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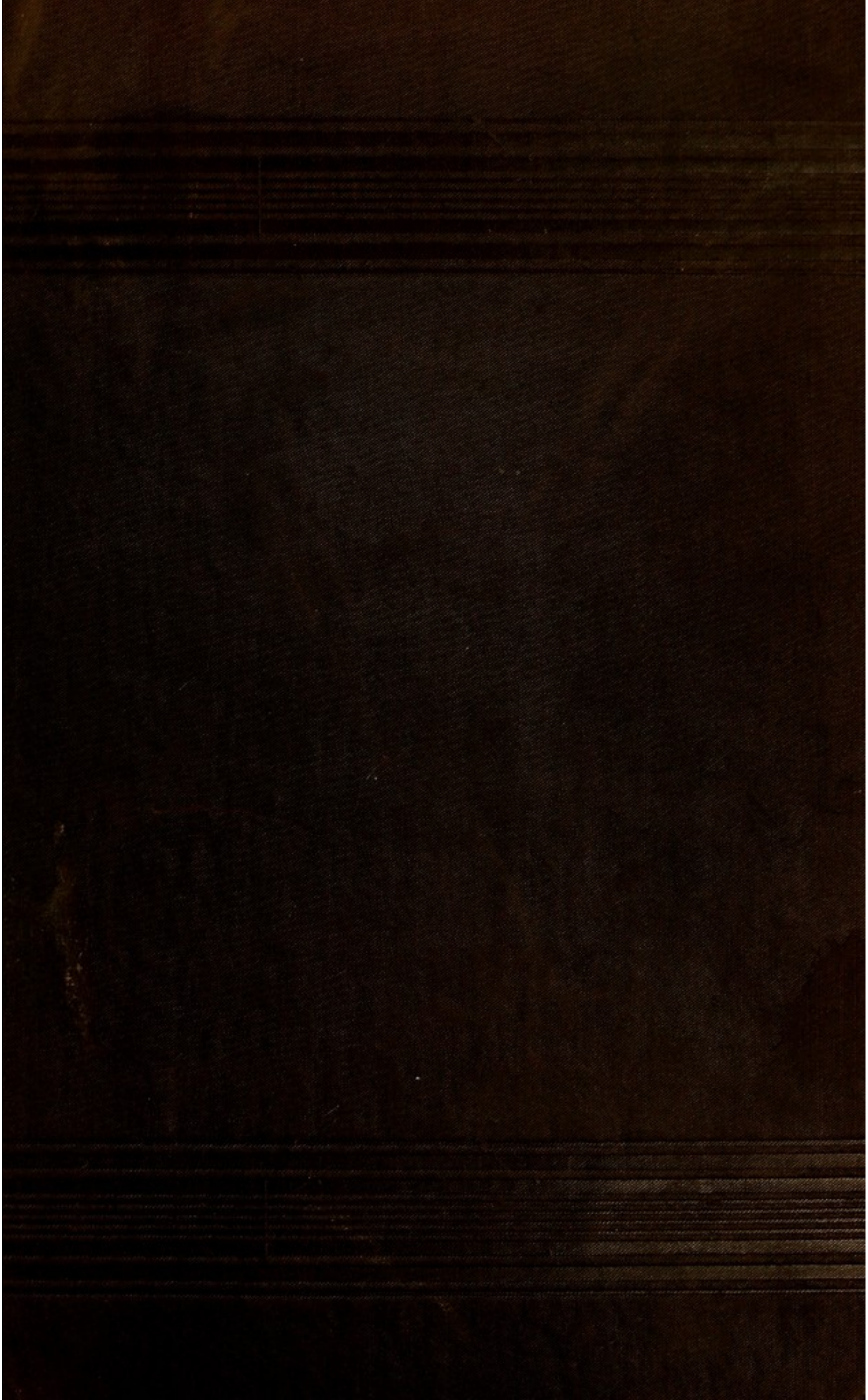
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Francis Minot

CLINICAL THERAPEUTICS.

LECTURES IN PRACTICAL MEDICINE, DELIVERED IN THE HOSPITAL ST. ANTOINE, PARIS, FRANCE.

BY

PROFESSOR DUJARDIN-BEAUMETZ,

PHYSICIAN TO THE COCHIN HOSPITAL, MEMBER OF THE ACADEMY OF MEDICINE AND OF THE COUNCIL OF HYGIENE AND SALUBRITY OF THE SEINE.

THE TREATMENT OF NERVOUS DISEASES; OF GENERAL DISEASES; AND OF FEVERS.

TRANSLATED BY E. P. HURD, M. D.,

Member of the Massachusetts Medical Society, Vice-President of the Essex North Medical Society; one of the Physicians to the Anna Jaques Hospital, Newburyport, Mass.

DETROIT, MICH.
GEORGE S. DAVIS.
1885.

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AUTHOR'S PREFACE.

This work, which my friend, Dr. Hurd, has so satisfactorily translated, and which Mr. George S. Davis (who has done much—in my estimation—to advance the cause of progressive therapeutics) now publishes, will, I hope, be found useful to American practitioners.

The success which has attended the publication of these lectures in France, where the work, before its completion, had gone through four editions, and in foreign countries, where it has been successively translated into Spanish, by Dr. Reboles y Campos, of Madrid; into Italian, by Dr. Cozzolino, of Naples; into Greek, by Dr. Kyriazides—a translation into Russian is also in progress—shows the great interest which physicians of all lands are to-day manifesting in therapeutic advance.

It has been my object to furnish a ready help to the busy practitioner, and especially, to young physicians commencing practice, by showing them how best to treat diseases, and by removing obstacles from their way.

To attain this end, I have drawn largely from the published labors of all countries, for science is cosmopolitan, having no boundary lines.

In order to judge of the value of the various medications in usage, one should always ask first, what are the clinical results? It is to this test that I have endeavored, impartially, to make appeal. My hospital opportunities have been great, and I have sought to obtain from them the utmost possible returns.

Therapeutics, which, as a branch of medicine, has been so much neglected, I may almost say despised, since the commencement of this century, is to-day claiming its rights and its pre-eminent position being first in the hierarchy of medical sciences, and all the other studies being subservient to it. On all sides we now see tokens of splendid promise. Yesterday the leading interest was in resorcin, kairine, antipyrine, and other new antithermic medicaments, which enable us to be masters of the temperature; to-day it is in cocaine, with its marvellous local anæsthetizing properties; to-morrow, or in the near future, it will be in the vegetal world, better known and applied to therapeutics, or in chemistry, by synthesis discovering new medicines, or in the protective benefits of attenuated virus creating media refractory to infectious diseases.

The United States has not been behind in beneficent medical work; we owe already to this country of enterprise and of progress, the greatest therapeutical discovery of our age, and of ages to come: surgical anæsthesia.

Therefore, it is with extreme satisfaction that I have accepted the proposition of Dr. Hurd, and I take this occasion to thank him for the assiduity, pains-taking, and accuracy with which he has translated these lectures, which I hope will receive a favorable reception from my American confréres, with whom the entire body of French physicians has such hearty sympathy—sympathy created by the bonds of affection which have so long united France to the great Republic of the United States.

PARIS, August, 1885. DUJARDIN-BEAUMETZ.

TRANSLATOR'S PREFACE.

Doctor Dujardin-Beaumetz, the author of this work, was born at Barcellona, in Spain, on the twenty-eighth day of November, 1833. He is the son of a farmer who is now living on an estate near Vendome, in the department of Loir and Cher. His father's family, by name *Dujardin*, was originally from a town of the north of France, which bore the name *Beaumetz;* for a long time the surname of the family was written: Dujardin de Beaumetz; the prefix, *de*, was eventually dropped, and the cognomen was henceforth written as at present.

Dr. Dujardin-Beaumetz's classical studies were performed at the College (Lycée) St. Louis, and the College Soutane, Paris. His first intention was to devote himself to agriculture, but he soon abandoned this purpose, and took up the study of medicine. In this he soon became remarkably proficient, and graduated at the Ecole de Medecine, in 1862. With a strong and growing passion for hospital work, he was successively, externe, then interne, under Velpeau, and *chef de clinique* under Behier. He has been three times Laureat of the Faculty, then Laureat of the Hospitals, and finally, Laureat of the Institute, obtaining the prize Montyon, for his Researches on the Alcohols.

For his gallant conduct during the siege of Paris, in caring for the wounded soldiers under the fire of the enemy, at the battle of Montretout, he was honored with the title of Chevalier of the Legion of Honor. He has been physician in chief to two large hospitals, the hôpital Saint Antoine, and the hôpital Cochin; he is at present connected with this latter hospital, in which, besides having the general medical supervision of that vast eleemosynary institution, he has charge of a fine laboratory for chemical and physiological experimentation. Dr. Beaumetz has also a large private practice, is member of numerous learned societies (Academy of Medicine, Societé des Hôpitaux, Societé de Therapeutique, etc.), which demand much of his time; he is also editor-in-chief (secretaire de la redaction) of the *Bulletin general de therapeutique*, one of the oldest and most influential of the French medical journals, an office which he has held since 1874.

Dr. Dujardin-Beaumetz has been already a voluminous writer. Among his published works we cite the following:

1. *On Locomotor Ataxia.*—An inaugural thesis of 75 pages. It comprises reports of ten cases which came under the observation of the writer.

2. *Etude sur le Cholera.*—This is a study of the cholera epidemic of 1865 and 1866.

3. *Ocular Troubles in Diseases of the Spinal Cord.*—In this memoir are contained the greater number of facts which have been observed of eye troubles in the course of diseases of the spine, and an attempt is made to point out the ties which unite these visual disorders with the medullary alterations.

4. *On Acute Myelitis.*—This is the author's *these d' agregation*, and is a volume of 162 pages. It is a complete history of acute myelitis. This is an exhaustive treatise of the subject, and in France, has become classical.

5. *Researches on Gelsemium*, 1878.—In this thesis the author studies the physiological and therapeutical properties of gelsemium, showing, first of all, the toxic effects of this substance on animals, then its therapeutic effects in neuralgia, and especially in facial neuralgia. (Written in collaboration with Dr. Emery.)

6. *Researches on Nutritive Lavements*, 1879.—In this memoir the author combats the opinion that alimentary lavements have a real nutritive value. He shows that the rectum, being destitute of villosities, can absorb only liquids, and that the penetration of peptonized substances thereby is difficult, if not impossible. In the case of lavements of milk or

broth, only the water and the salts are absorbed, while the fatty and albuminoid matters can not enter the economy through this channel, and even in employing the method of Leube, the peptones cannot be utilized by the rectum. He has supported this view by personal clinical researches, which showed that in persons affected with stenosis of the œsophagus or pylorus, alimentary lavements failed utterly to increase the weight and temperature, or the quantity of urea excreted in twenty-four hours.

7. *On the Treatment of Aneurisms of the Aorta by Electro-puncture*, 1878.—In this treatise the writer sums up the cases of acute aneurism occurring in his hospital service, which he has treated by electro-puncture, and shows that this method, applied to the treatment of aneurisms, is a simple and relatively safe operation, and one of the most efficacious and rational means of cure.

8. *Researches on Pelletierine*, 1878.—This is a communication published in the Bulletins et Memoires de la Societé de therapeutique, in which the results of the author's trials in the hôpital St. Antoine, with this new tænicide, were recorded. He shows it to be one of the best, if not the best remedy for tape-worm in possession of the medical profession.

9. *Experimental Researches on the Toxic Power of the Alcohols*, Paris, 1879.—This work, which is a stout octavo volume of over 300 pages, fills a lacuna previously existing in our knowledge respecting the physiological and toxic effects of the divers alcohols. Over three hundred experiments were made to ascertain the relative toxicity of ethyl, methyl, amyl, and other spirits which, more or less, impregnate the various intoxicants in common use, being naturally found there, or artificially added, and which are the cause of certain well-known excitant effects on the animal or human organism.

The animals on which these experiments were performed were dogs and swine. Dujardin-Beaumetz was assisted in these experiments by Dr. Audigé. They employed chiefly the hypodermic method, and called minimum toxic dose that quantity of pure alcohol which by kilogramme of the weight of the body of the animal, is necessary to cause death in the space of twenty-four to thirty-six hours, with gradual and permanent fall of the temperature. By pure alcohol is understood alcohol of 100° in the scale of Guy Lussac.

The following conclusions result from these researches:

The least toxic of the alcohols is the ethyl alcohol from vinous fermentation. The most toxic is the amyl alcohol (potato spirit, fusel oil).

As for the toxic phenomena determined by the alcohols, they may be divided into three periods: A period of ebriety, or excitation, a period of resolution, and a period of collapse. These periods undergo modifications depending on (1) the nature of the alcohol employed; (2) the dose administered; (3) the resistance of the subject.

With the alcohols obtained by fermentation, the three periods of acute intoxication succeed each other in a regular order, but in proportion as you depart from the ethyl series, their character is more accentuated, their evolution more rapid, and you see certain convulsive phenomena appear.

With methyl alcohol (wood spirits) the period of excitation is more intense, resolution, collapsus, and the toxic symptoms which accompany them arrive more rapidly at their maximum, but, in case the dose is not sufficient to kill, the phenomena disappear more promptly.

With œnanthylic and caprylic alcohols the periods of intoxication do not present the same regularity, and convulsions occur. Glycerine causes an increase, rather than a fall of temperature.

In the case of all animals which have died from acute poisoning by alcohol the necropsy discloses lesions of the respiratory and circulatory apparatus, of the nervous system and of the kidneys. As for the digestive apparatus, the lesions on the part of the gastric mucous membrane are inconspicuous when the alcohol is introduced by the hypodermic method, but when the poison is administered by mouth, the mucous membrane of the stomach is invariably found softened, and the more concentrated the alcohol, the greater the softening. The intestine undergoes the same alteration; it is found softened, and of a reddish black color; punctiform hæmorrhages are produced, even when the alcohol is injected under the skin (elimination of alcohol by the intestinal glands).

The liver is more profoundly altered than any other gland. It is congested, softened and friable. The spleen is engorged with blood and softened. As for the respiratory and circulatory lesions, they are characterized by a profound alteration of the blood, which becomes dark, and forms in the heart clots in considerable quantity. The lungs are congested and contain apoplectic foci. The kidneys are injected and present hæmorrhagic extravasations, especially when fusel oil (potato spirit) is used.

Acute alcoholic poisoning in the human subject, is attended with similar symptoms, and presents similar post mortem lesions.

10. *Chronic Alcohol Poisoning.*—Since the publication of the treatise above referred to, a little brochure has appeared, giving the results of a series of experiments by Dr. Dujardin-Beaumetz and his colleague, on chronic alcohol poisoning.* The subjects of these experiments were hogs, twenty of which were, during the space of two years, daily dosed with small quantities of the various alcohols in order to determine the symptomatological and pathological results.

It was in 1879 that Dujardin-Beaumetz and Audigé commenced in the abattoirs of Grenelle their researches on slow intoxication by the alcohols. They used, as before stated, hogs as the subjects of their experiments, giving these animals daily quantities of the different commercial alcohols, which varied from one gramme to three grammes by kilogramme of weight. When the quantity was exceeded of five grammes to the kilogramme, the animal emaciated rapidly, refused to eat, and soon died.

Among the post mortem changes, the lesions of chronic gastritis were noted; also fatty changes in the kidneys. In the case of two of these animals, the necropsy revealed atheromatous degeneration of the aorta. In no instance was cirrhosis of the liver observed, or any of the chronic interstitial diseases. Beaumetz explains the absence of hepatic cirrhosis by the fact that the fibrous web-work of the hog's liver is thicker and more resisting than that of man, and that in consequence it is more difficult to choke out the glandular elements.

The most marked manifestation of chronic intoxication in these animals was a profound prolonged somnolence without any period of excitation. There was also a trembling and a weakness in the limbs. It is worthy of special note that the symptoms of intoxication were much less pronounced when ethyl alcohol was used, and that swine will support for a long time, apparently with impunity, moderate quantities, administered regularly every day, of pure spirits (wine, beer, rum, whiskey, etc.), containing only ethyl alcohol.

In experiments undertaken to prove the combustion or noncombustion of alcohol in the economy, these physiologists were positive in having found aldehyde in the viscera of men and animals poisoned by ethyl alcohol, and had even obtained in one of their experimentations, the reduction on a mirror of silver nitrate which is one of the best tests of ethyl-aldehyde, but a more attentive examination of the facts has shown them that the aldehyde which they found may have come from its presence in the normal state in a great number of alcoholic liquors. Therefore, nothing definite has been determined by these experiments as to the formation of aldehyde out of alcohol in the economy.

The conclusions which Dr. Dujardin-Beaumetz deduces from this interesting experimentation (see the entire treatise as reproduced by me in the *Therapeutic Gazette* for July and August, 1884), are as follows:

"In fine, to complete the detail of experiments which have cost us so much in money, and about three years of careful observation, we observe:

1. That the alcohols, administered in a slow and continuous manner, determine in the hog, at the end of a certain time, anatomical lesions, which consist in congestions and inflammations of the digestive tube, and of the liver, without at the same time attaining to that degree of interstitial hepatitis which is noted in hard drinkers in human kind; in congestion of the pulmonary parenchyma, which may end in apoplectic extravasations; in

* Experimental Researches on Chronic Alcoholism, Paris, 1884. pp. 60.

atheromatous degeneration of the large vessels, and especially the aorta, and finally, in sanguineous effusions into the substance of the muscles, and in the cellular tissue.

2. That these lesions, inappreciable at the end of thirty months in cases where ethyl alcohol was given, and alcohols having other origin than vinous fermentation, but which had been thoroughly rectified, are very conspicuous in subjects to which have been administered crude spirits, whether from beets, grain, or potatoes.

3. That preparations of absinthe are especially baneful in their effects on the nervous system:

These results, considering the time and pains we spent, may seem inconsiderable. We think, nevertheless, that they deserve to go on record, for they strikingly confirm our first experiments, and enable us to affirm that the disorders observed in man as the sequel of alcoholism, are really due to the slow and progressive absorption of the poison to which he surrenders himself every day. We hope, therefore, that these new experiments will find a welcome with all who are interested in this social question of the times."

11. *Dictionnaire de Therapeutique.*—In 1882 Dr. Beaumetz planned a very extensive work, which is now about half completed. I refer to his Therapeutical Dictionary, which is being published in four large volumes, each volume comprising about a thousand pages. Here everything which is of recognized utility in the treatment of disease—medicines, hydrotherapy, electricity, ærotherapy, balneation, etc., comes up for exhaustive consideration. As an indication of the thoroughness of this work, I may mention that the one article *Electricity* covers 130 quarto pages, the article on *Waters* (*eaux*) 95 pages, that of *Bacteria* 35, that of *Ergot* 25 pages, etc. Dr. Beaumetz is assisted in this work by Drs. Debierre, Egasse, Hetel, Jaillet, Macquarie, and Bardet.

12. *Researches on phosphorus medication, 1868.*—In these researches the author studies the phosphorus preparations, shows the inconveniences of the officinal preparations in common use, and advises the solution of phosphorus in chloroform or ether; one of the best forms of administration is the phosphorated oil of Mehu's formula, which may be advantageously given in capsules, each capsule containing one milligramme of phosphorus. In the second part of this work he shows the advantages which may be derived from the internal administration of phosphorus in the medullary scleroses.

13. *Researches on carbazotate of ammonia*, 1872.—The above is a valuable contribution to the study of a new antiperiodic medicament.

14. *Researches on subcutaneous injections*, 1872.
15. *Researches on the action of iodine solutions on caoutchouc tubes*, 1872.
16. *On the treatment of hydated cysts*, 1872.
17. *Studies on the physiological and therapeutical action of the ammonia compounds*, 1873.
18. *On the external applications of chloral and metachloral*, 1873.
19. *On intravenous injections of water in the treatment of cholera*, 1873.
20. *On the use of oatmeal in the alimentation of infancy*, 1873.
21. *On the treatment of hepatic colic*, 1873.
22. *A study of boldo*, 1874.
23. *Researches on the action of ailantus gladulosa*, 1874.
24. *A study of the therapeutical actions of apomorphia*, 1874.
25. *A study of the action of the phosphates of lime*, 1875.
26. *On the indications of the treatment of cerebral rheumatism by cold baths*, 1875.
27. *On expectancy as a method of treatment in acute rheumatism*, 1875.
28. *A study of the ferruginous medication*, 1876.
29. *A study of the physiological and therapeutical action of the salts of cicutine*, 1876.

The foregoing sixteen treatises, which are merely mentioned by title, are communications from the pen of Dr. Dujardin-Beaumetz which have appeared among the publications of the various hospital, therapeutical and other learned societies prior to 1877. They are all based on original research, contain new facts, and constitute a valuable addition to medical literature.

30. *On the preparations and uses of meat powder*,* 1882.

31. *On lavage and gavage of the stomach*,† 1883.

In these articles the various methods now in use for the treatment of chronic disorders of the nutrition are described. Especial emphasis is laid on the utility of washing out the stomach and forced feeding in certain morbid states of the stomach. The author gives a minute account, illustrated by figures, of the operative procedure, with the flexible syphon, employed by him, and the improvements which he has introduced into the new methods of "lavage" and "gavage."

Those who are familiar with the medical literature of the last six or seven years know that great progress has been realized in this department of therapeutics. No one perhaps, has contributed more toward this advance than Dr. Dujardin-Beaumetz.

32. *Leçons de Clinique Therapeutique*, Paris, 1879-85.—This work, of which the present translation is the third and final volume, will probably for many years to come be considered as Dr. Dujardin-Beaumetz's most important work.

The first volume comprises the therapeutics of diseases of the heart and digestive tube; the second, the treatment of diseases of the liver, kidneys and lungs.

The first and second volumes have now gone through four editions, and the favor with which the work in its entirety has been received in France is something almost unprecedented.

Dr. Lucien Deniau, a former pupil of the professor, now a practising physician in Paris, thus writes me with regard to these lectures on Clinical Therapeutics.

"I learn with pleasure your intention to publish a translation of Dr. Dujardin-Beaumetz's work on Therapeutics. Ardent disciple of the celebrated professor, I had the good fortune to take part almost in the inception of this great undertaking, than which I have known none ever to be received with greater approbation by the Parisian medical public, not generally over prodigal with its favors. While a student, I was constantly in attendance on those public teachings, many of which you are about to incorporate in the book which Mr. Davis will have the honor to publish. The great amphitheatre of the St. Antoine hôpital was ever crowded with an appreciative audience of under-graduates and practitioners of medicine, who came here to learn from the lips of a master what arms they might most successfully wield in the great warfare against disease and death. The favor with which students and physicians welcomed these first lessons on clinical therapeutics has gone on increasing, and I may truly say to-day that in the amphitheatre of the Hôpital Cochin, which the administration has built expressly for the clinical teaching of the professor, every 'conference' constitutes a veritable scientific festival."

The lectures as originally delivered were oral (as I have been informed by the professor); they were afterwards written out, and the notes appended. The text is, in fact, largely the fruit of the notes, which have cost the writer infinite labor. The works consulted in their preparation comprehend, as may be seen from the bibliographical indications, a wide range of medical literature. Possessed of a prodigious memory, Dr. Dujardin-Beaumetz has a happy faculty of gleaning from extensive fields the choicest wheat, and the substance of entire volumes is often comprised in a single lecture. The work is eminently practical and is designed to assist the physician in his daily duties; diseases are described as he is likely to meet them; and from the data furnished by etiology and pathology, therapeutical indications are derived. Clinical Therapeutics is really a treatise on practice in which everything is subordinated to therapeutics. Much that in ordinary text-books on materia medica and practice is rather embarrassing to the practitioner than helpful is here omitted, while the important data, set forth in strong light and grouped in a few masterly generalizations, indicate to him where he can be truly useful, where his intervention is demanded, as well as the limits of that intervention. It has been objected that Dr. Dujardin-Beaumetz, is too zealous for new remedies and new methods of treatment, but in reality he is eminently conservative as well as progressive.

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*Bull. Gen. de therapeutique, 1882.

†Ibid. 1884.

While his motto is to "prove all things," he is equally characterized by a disposition to "hold fast to that which is good." As an illustration, I may only refer to his attitude toward certain new remedies, such as convallaria, antipyrine, glonoine, salicylic acid and salicylate of soda, etc. He was among the first thoroughly to test these medicaments in his hospital service where he has ever ample opportunities, and the judgment which he pronounced is the judgment which is sanctioned by the consensus of medical experience the world over.

It may be said (and it has, in fact, often been said) that we have already too many medicaments, and that it would be well to learn more about, and make a better use of those really good medicines which our fathers used, and whose action in combating morbid phenomena is incontestable. This, to a certain extent is true; there is one extreme which should be avoided—the forsaking of the old paths where there is more or less of certainty for new paths which have hardly yet been traversed, and which may lead into pitfalls. There is also another extreme which is equally reprehensible: overweening confidence in the traditions and methods of the past, and satisfaction with things as they are; it is a spirit which is inimical to all progress. Better by far for the physician to have some high ideal before him, an ideal which constantly demands more light on diseases, and improvements in methods and medicinal agents; there is little in the present state of medicine which should inspire satisfaction, and everything to stimulate to advancement. That progress has been made, especially during the last decade, no well informed man can deny; few have contributed more toward these useful gains in the department of healing than the author of this work; that we are at the dawn of a more glorious era of scientific achievement in which the uncertainties of therapeutics shall no longer be the reproach of our noble profession, we may fervently hope.

In the translation of this work I have had the constant co-operation and sympathy of the Paris author, for whose friendly services I shall ever be deeply grateful.

TRANSLATOR.

NEWBURYPORT, Mass., June 6th, 1885.

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INTRODUCTORY LECTURE.

ON

CLINICAL THERAPEUTICS.

SUMMARY: What is Meant by the Term Clinical Therapeutics?—Clinical Medicine and Clinical Therapeutics—Utility of Therapeutics—Scepticism and Enthusiasm in Therapeutics—Illusions in Therapeutics—Is Medicine an Art, or a Science?—Empirical and Experimental Therapeutics—Polypharmacy in Therapeutics—The Treatment of Symptoms—Constancy in Therapeutics—Necessity of Cool Judgment in Therapeutics—Accumulation of Doses—The Art of Prescribing—The Part of Hygiene in Therapeutics—The Part of Etiology in Therapeutics.

Gentlemen:—I owe you an explanation of the words "Clinical Therapeutics" placed at the head of these lectures. What is meant by Clinical Therapeutics? What are its limits? What has it to do with clinical study, what with the treatment of disease? This is what I will endeavor to explain.

When you study therapeutics so-called, you pass in review the different medicaments which constitute the Materia Medica; you learn their natural history, their physiological properties, their dosage, and their various remedial applications.

This method of studying is altogether theoretical. It is like commencing clinical medicine by learning about diseases, their march and their symptoms in treatises on pathology and practice. But in order that therapeutics, like pathology, may become practical, useful, productive, the theoretical notions which you have learned must be applied to the sick person. Moreover, as Clinical Medicine is the study of the modifications which different organisms impose on the course of morbid affections, so clinical therapeutics will enable you to appreciate in the living being the constantly occurring deviations from the precise laws formulated by therapeutics properly so-called.

To examine and survey the effects of the different remedial agents administered to the patient, and to study their indications, will then constitute, for us, clinical therapeutics. In pursuit of this knowledge you will learn not only how to *handle* medicines, but also how to associate them so as to constitute what has been described under the name of medication. No study is more practical, none more necessary.

In this place, to insist on the necessity of therapeutics, would be absurd; medicine without therapeutics does not exist. All that you learn about medicine properly so-called, and the sciences accessory to it, has but one end and aim—to relieve and cure the patient.

When you are called to visit a sick person, after having taxed all the knowledge you possess to enable you to arrive at an exact diagnosis, and after having carefully considered the prognosis, you are inevitably and fatally brought to face the question which your own conscience, your patient and those

around him force upon you. What must be done? You will have to look to therapeutics for an answer, and the world will form its opinion of you much more from the skill with which you combat disease, than from the knowledge, however pretentious, which enables you to recognize and diagnosticate the disease.

Far from our thought the intimation that one can be a good practitioner without a thorough understanding of clinical medicine and pathology; in order to institute a treatment and determine the indications, it is absolutely necessary to know accurately (as far as possible) the symptoms and natural tendencies of the malady which is before you. In fact everything in therapeutics will be hesitating, mismanaged, incoherent, unless you begin by establishing the treatment on a solid basis, which is an exact knowledge of the morbid affection.

When occupied with therapeutics there are two dangerous rocks to shun: skepticism on the one hand, exaggerated enthusiasm on the other. To believe too much and not to believe at all are two opposite terms, but they are not so far apart as one might suppose. The one engenders the other, and extreme credulity gives rise to incredulity.

Beware especially of skepticism. A physician who lacks faith in medicine has no more reason for existence than a priest who does not believe the religion he teaches, or a soldier who is destitute of love of his country and his flag. It is repugnant to reason and to conscience that he can be a good physician who judges of no utility all the remedial agents that have the sanction of tradition and custom.

But, on the other hand, it often happens that he who has the reputation at the hospital of being a sceptic in therapeutics becomes an over-zealous prescriber when at the bedside of his private patient. Believe then in your art, but that this belief may be judicious, reasonable, let it not suffer you to be too easily carried away by what you may deem the results of your medication; in therapeutics, illusions are indeed very frequent. This arises from numerous causes, especially from the propensity of the human mind to attribute all that eventuates favorably in the course of the disease to the medicine given, when very often it is only the natural evolution of the disease which the physician has observed.

It is particularly in epidemic complaints that great prudence and extreme reserve should be exercised before drawing conclusions. The type of epidemics is variable, and according as this is mild or severe, therapeutical results are different. This explains to you why it has happened that certain remedies, exhibited with success in some epidemic and contagious diseases, in other seasons have failed to give as good results. This is an example of those therapeutic illusions which have encumbered the Materia Medica with so many drugs that have obtained a certain brief reputation in their day, soon to fall into forgetfulness and neglect until another experimenter repeating the trials of a bygone time, restores them to passing notoriety.

This celebrity, then this decadence of remedial agents, are unfortunately facts of too great frequence in therapeutics. So, after having pruned away all the useless and superfluous substances of the Materia Medica, if you retain

only those which medical practice has consecrated by long usage, you will find that the really useful medicaments are much less numerous than one would suppose, and your daily practice will include but a few drugs.

For a long time the question has been discussed: "Is medicine an art or a science?" It is both.

Medicine is a science by the many kinds of knowledge which it includes as a necessary part; it is an art by its application to the patient, and above all by its therapeutics. It is in this art that all the talent of the physician finds its proper exercise; it is by the form given to his preparations, by a happy choice of remedial agents, by their favorable combination, that the physician is a veritable artist. And when Trousseau pronounced these words he was himself the living personification of the fact, for no one ever carried farther than he the art of therapeutics.

Follow no exclusive method; draw from all sources. Be not too solicitous for physiological explanations; do not demand for each drug an absolute experimentation which may explain its therapeutical action. Because you do not know the mode of action of quinine, do you any the less believe in its efficacy in intermittent fever? Because you are ignorant how mercury acts, does it cure syphilis any the less?

I am aware that by so speaking, I lay myself open to the charge of crass empiricism. It will be said, too, that I am diverting therapeutical practice from the new and scientific road, which it ought to pursue. But this road is scarcely marked out; only here and there a few stakes have been set, and unhappily these stakes are not very firmly placed.

Experimental therapeutics, in fact, may be said to exist only in name. Being unable to induce in animals artificial disease, we cannot study on them the therapeutical action of drugs. We have scarcely been able to arrive at a knowledge of their physiological action; for we are too often obliged in order to obtain appreciable effects, to produce grave disorders, and to administer the drug in the state of poison rather than in the state of medicine. By this method, then, of studying the action of drugs, we have cultivated an experimental toxicology, rather than experimental therapeutics. Do not think, however, that I would discourage these researches. You know, on the contrary, how much I prize them. You have often seen me in our laboratory, study the effects of medicines on animals; you have seen me examine attentively the symptoms produced. It is indeed an excellent study which has furnished valuable data, but do not forget that it is only a complementary study.

It enables us to give a tolerably plausible explanation of the action of the medicament, and especially to know the limits beyond which it is not safe to go, and at what moment the drug ceases to become medicinal and becomes a poison. But it is not physiological experimentation that decides the destination of the medicament, or of medication; it is the effect of the remedy on the sick man, and on the march of the disease which determines its therapeutical value.

The history of therapeutics these last few years shows that it is by this mode of procedure that progress in this science has been made. Do you believe

that it was as a sequence of experimentation on animals that chloral, bromide of potassium, alcohol, etc., were introduced into therapeutics? No, the clinician first noted with care the favorable results obtained in the treatment of certain affections, then the facts reported were confirmed by the experience of others, and the experimenter applying the drug in his turn to animals studied the intimate mechanism and physiological action.

It is, then, always to observation that you should have recourse; it is to the attentive examination of the patient that you should always return. Careful observation will enable you to study the action of the drug, to lessen or modify the dose according to the indications, and to decide the proper form for administration.

Do not employ too many remedies at the same time; do not in your busy endeavors to serve your patient, inflict upon him medicines and medications widely differing in their action. Study with care the disease which is before you; go back to the origin of the morbid affection; formulate the leading indications resulting therefrom; decide concerning the diatheses which have influenced the course of the malady, institute a plan of treatment and endeavor to carry it out with a very moderate exhibition of drugs.

During the years just passed, we have seen it gravely urged that we should treat diseases by meeting particular symptoms; that is to say, by combating each of the morbid phenomena by a specific medication. This is, I believe (in very many cases at least), a pernicious course to pursue, and one for which there is little scientific justification. Instead of dispensing your medicines in this way, instead of introducing into the economy numerous substances differing in nature, differing often in their action, adopt an opposite method, that is to say, endeavor to find the point of departure of all the manifold symptoms, and to this, as the real cause, direct your medication.

Be not too changeable, do not allow yourself to drift about at the caprice of your patient, who would fain experience immediately the benefit of the medication; learn to be patient and wait until the medicine has had time to produce all its effects. Husband well your therapeutical forces, do not expend all your efforts at once, follow the tactics of the army general, and to decide the victory, keep always strong reserves.

Unhappily the physician in certain cases, called cases of urgency, often yields to the importunities of the family, who are frightened at the progress of the disease, and administers with lavish hand medicines that are heterogeneous and even incompatible.

In the midst of the general disorder be calm and cool; be not precipitate in the administration of remedies; act rapidly, and with energy, but go right to the end you have in view, without stopping to meet secondary symptoms.

Do not forget, especially if you institute a course of treatment which must be continued for some time, that a great many remedial substances, when given for a good while, either loose their effect, or produce cumulative effects in the economy. You must in these cases know how to suspend and interrupt the administration of the drug at the proper time, you must know also how to vary its administration, in order that the patient may not be disgusted with the

remedy from long taking it. Remember also that the effects of the same medicines differ according as they are taken in massive or fractional doses.

This is not all ; it is desirable that the physician should use the utmost care in prescribing his medicines. The hospital practice does not, unfortunately, favor this special study; we find ourselves in a particular situation which obliges us to formulate too rapidly and incompletely, so that after having followed for several years our hospital services, the most of you are almost entirely ignorant of the art of prescribing.

This ignorance has more serious consequences than you think of, and if we see, in our day, pharmaceutical specialties having a constantly increasing importance, it is in some measure due to the fact that physicians do not acquire that expertness in the preparation of their medicines which they ought to possess, and prefer lazily to rely on the combinations of the manufacturing chemist, trade-mark preparations, or even the nostrums of the charlatan.

But if by pursuing this course the practitioner often promotes the fortune of the pharmacist, he despoils himself in the end, for the patron, beguiled by the advertisements which accompany his nostrum, is almost certain to apply in the future, not to his physician, but to the vender of the trumpeted drug.

Learn, then, skilfully to prescribe, and not only to write in an orderly and judicious manner the substances which compose your prescription, but also to render the combination as pleasant to the taste as possible. Repudiate, therefore, in a general way, all the specialties which inundate the therapeutics of to-day. Exercise the greatest care in the directions which you give to the patient or his nurses ; do not fear to enter into the minutest details ; indicate how the external applications should be made, and the times for giving the internal remedy; regulate carefully the little incidents of the day, and be particular about the diet. For you must ever remember that pharmaceutical measures go but a little ways in the cure of your patient, and that you can often accomplish more by hygiene than you can accomplish by medicine.

Hygiene is, in fact, called upon to play a preponderating part in the treatment of diseases, and especially of chronic affections. To establish with care and in a scientific manner the bases of dietetics, ought to be one of the most serious occupations of the practitioner, and you will see in the course of these lectures the prominence which I give to hygiene in the treatment of diseases.

By the side of hygienic therapeutics, it is also necessary to bring to light the importance of a study of the causes of the disease, for the old adage : *Sublata causa tollitur effectus*, is always true. Therefore, Professor Bouchardat was right in insisting that etiology is as indispensable to therapeutics as is hygiene, or the administration of medicines.

Pardon me, gentlemen, for these remarks, but in undertaking the responsibilities of private practice, you will soon learn how all these details contribute toward the reputation which the physician enjoys. The patient cannot, in fact, judge of your technical knowledge, he appreciates simply the care which you give him, the devotion and skill which you display in such cases ; he forms his opinion of you and values you by the little details of our art. Do not think

lightly then of these details, to which you will see me again and again return in the treatment of our patients.

I hope I have shown you the utility of Clinical Therapeutics, and the farther we shall penetrate into the study which we begin to-day, the more will you be able to appreciate at their just value the results which I expect to obtain from this fruitful journey which we now undertake together.

PART FIRST.

TREATMENT OF DISEASES OF THE NERVOUS SYSTEM.

ON THE TREATMENT OF DISEASES OF THE NERVOUS SYSTEM.

THE NERVOUS SYSTEM FROM A THERAPEUTIC STANDPOINT.

SUMMARY: Difficulty of the Study of the Therapeutics of Diseases of the Nervous System—Moral Therapeutics—Structure of the Nervous System—The Nerve Cell—The Nerve Tube—Chemical Composition of the Nervous System—Phosphorus in the Nervous System—Action of Medicines on the Nervous System—Anæsthetics—The direct Action of Anæsthetics on the Nervous Elements—The Action of Alcohol—Effect of two Medicinal Substances on the Nervous Elements—Resistance to the Action of certain Medicaments—Action of the Nervous System on Nutrition—Action of Medicaments on the Vaso-motors—Vaso constrictor and Vaso-dilator Medicines—Action of Ergot—Action of Morphia—Spasmodic and Anti-spasmodic Medicaments—Rôle of the Nervous System on the Secretions—Secretory Medicaments—Antagonism of Jaborandi and Atropine.

Gentlemen:—I do not make light of, or conceal, the difficulties of the task which I enter upon to-day. The study of the treatment of nervous diseases is, in fact, one of the most delicate and most difficult, for, to the hygienic and medicinal measures with which we have thus far been occupied, we must add a certain influence of a moral kind, exerted by the physician, an influence altogether personal, which plays often a preponderating part, and which constitutes a veritable moral therapeutic agency, respecting which it is not at all easy to furnish precise and exact data. That obscurity and that hesitation which attend us at every step in the treatment of nervous diseases, result from a number of circumstances. Although, during the last twenty years, the study of affections of the cerebro-spinal axis has made immense progress, and this especially in our own country, under the powerful and sage impulsion which Prof. Charcot has given to the School of the Salpêtriére, there exists still, unhappily, numerous lacunæ in this study. Physiology itself, which has accumulated, for a great many years past, an innumerable number of works on this special subject, is far from having solved all the problems of the vital and physiological functions of the nervous system. As for therapeutics, it must be confessed that this department of medicine is still less advanced; not being able to base itself on positive physiological and pathological data, it has drifted about, having no guide but empiricism and tradition.

I believe it my duty, however, to show you in these lectures the office of the physician in diseases of the nervous system, and what he can accomplish in certain cases by sage and reasonable therapeutic measures. But that you may well understand the difficulty of the subject of which I am going to treat, and how fragile the physiological and therapeutical basis is on which

rests the treatment of nervous diseases, I am going to devote this first lecture to the study of the nervous system from a therapeutic standpoint.

The nervous system,* reduced to its simplest expression, may be represented by two elements, a nerve-cell and a conducting tube.

The nerve-cell, as you are aware, is composed of three parts: a nucleus, enclosing a nucleolus in its centre, a peripheral, homogeneous substance, and an excessively fine envelope. These cells present prolongations, more or less numerous, and their volume offers variable dimensions.

As for the nerve tube, it possesses an investing membrane—the neurilemma. This neurilemma surrounds the nerve-fibrils, which are themselves constituted of three parts: an axis cylinder, continuation or prolongation of the cell; a transparent membrane, constituted by the myeline; and an external tunic.

* The nervous system may be reduced to two elements, a nerve cell and a nerve tube; it is the association of these two elements which constitutes nerve centres and nerves.

Each nerve cell is composed essentially of three parts: a nucleus, protoplasm, and an envelope. The central nucleus, sometimes vesicular in appearance, contains a nucleolus. The peripheral substance is homogeneous, and presents different tints. Heckel, of Montpellier, has shown that lead and certain mineral substances color certain parts of this protoplasm black. In fine, the utricular tunic which invests it is sometimes so thin as to be scarcely visible.

These cells may present prolongations or be deprived of them, whence the names, apolar cells, monopolar, bipolar, multipolar. According to certain authorities, and in particular Stilling, this first group of apolar cells does not exist, and results from a fault in the preparation, or from the alteration of the cell. The filiform prolongations of the cells may be ranged in two classes: intrinsic prolongations and extrinsic prolongations. The first go from one cell to another cell or group of cells; the extrinsic fibres pass to motor or sensory organs, and constitute the principal part of nerve cords.

The nerve cord is constituted by an envelope of connective tissue, known as neurilemnea, and by the juxtaposition of a series of primitive nerve fibres, more or less numerous. The nerve fibrillæ are composed of three parts: a central axis cylinder, an external tunic or sheath, and an intermediate substance described under the name of medullary cortical substance, or myeline. These tubes have a variable diameter. Kolliker has classed them in the following manner: Very fine tubes, whose dia. does not exceed 2 *m.* (2-1000 of a millimetre); somewhat larger tubes, with a dia. of 2 to 4 *m.*; middling sized tubes of 4 to 9 *m.*; and large tubes with a dia. of 9 to 20 *m.*

The medullary substance which is situated between the sheath and the filiform axis cylinder, is transparent and viscous, and gives to nerves their white and pearly appearance. This laver is the most alterable, and in coagulating it gives to nerves a variable appearance.

The axis cylinder is the essential part of the nerve tube; it has a very complex structure, as Stilling has shown. It is striated longitudinally and transversely, and this last appearance has led Grandry to think that it is composed of a series of alternating disks. Roudanowsky has stated the opinion that the axis cylinder may give origin to lateral offshoots which cause inter-communication between the different tubes of a nerve cord. In fine, the axis cylinder is a direct continuation of the extrinsic prolongations of the cells (*a*).

(*a*) Heckel—De quelques phenomènes de localisation de matiere minérale et organique chez les mollusques (Comp. rend. de l'Acad des Sc., 1874, t. CXXIX, page 614). Stilling—On the Structure of the Nerve Cell (Comp. rend. de l'Acad. des Sc., 1865, t. XII., p 899). Kolliker—Elements of Histology, p. 314. Grandry—Jour. de Anatom., 1869, t. V., p. 289. Roudanowski—Observations on the Structure of Nerve Tissue (Jour. de l'Anat. de Robin., 1865, t. II., p. 231). Milne Edwards—Lessons in Physiology, t. xi., p. 152.

As for the chemical composition of these substances, it has for its basis certain phosphorized oils, whose essential principle, according to Liebreich, is a neutral phosphorized body, which he has described under the name of *protagon.**

These cells and these nervous tubes, associated in divers ways, constitute the nervous system in its entirety. I do not propose to enter into details of this structure; this is a point quite outside of my subject, and which would demand for its complete exposition, numerous lectures. But I desire, before going further, to draw a first conclusion from the several particulars which I have just stated respecting the constitution of the nervous system. I refer to the application of phosphorized substances, and of phosphorus, to the treatment of diseases of the cerebro-spinal axis.

From the fact that nervous substance contains a large proportion of phosphorus, it is by no means demonstrated that the diseases of the nervous system, and in particular temporary perturbations of this system, such as those which constitute hysteria, for instance, are accompanied by a diminution of the phosphorus contained in the protagon. And even were this fact demonstrated, it would be necessary to prove that phosphorus, or phosphorized substances introduced by way of the stomach, are utilized for the nutrition of the nervous system; which is very doubtful. We encounter here (and shrouded in even greater obscurity) the same therapeutical problem which met us in the past, and which meets us to-day, respecting the action of ferruginous medicines. From the fact that iron is a constituent of the blood, we do not the better understand the *modus operandi* of chalybeate preparations. So we ought not to conclude, because phosphorus is an integral part of the nervous system, that therefore, *à priori*, the preparations of phosphorus are indicated in diseases of the system.

Seat of intelligence, sensibility, and movement, the nervous system plays a still more important part when we study its influence on nutrition throughout the entire animal series. The celebrated experimentation of Claude Bernard,

*The nervous substance is composed of water, albuminous matters, salts and phosphorized fats, besides fats that do not contain phosphorus. Among the latter are oleine, stearine and cholesterine. The former, first described by Vaquelin in 1812, constitute, according to Bibra, 14 per cent. of the weight of the cerebrum, and have from 1 to 1.5 and even 1.9 per cent. of phosphorus. Frémy has described among these phosphorized fats two acids which he calls cerebric and oleo-phosphoric acids.

According to Liebreich these substances come from the decomposition of an azotized neutral body containing phosphorus which is found in the brain and is described under the name of *protagon*. When this protagon is subjected to ebullition in presence of baryta water, certain acids are obtained, stearic and phosphoglyceric acids, an acid non-azotized, and a base which Liebreich has described under the name of *neurine*.

Coeurbe has also described as of cerebral origin certain fatty substances, under the name of *cerebrales* and *stearoconotes*, but these seem to be artificial conpounds—(*a*)

(*a*) Milne Edwards—Cours. de Phys. (Comp., t. XI. p. 153). Vauquelin—Analysis of Cerebral Matter in Man and in Certain Animals (Ann. de Chimie , 1812, t. LXXXI.). Bibra—Vergleicherde Untersuchungen uber das Gehirn. Frémy—Researches on the Brain of Man (Comptes rend de l'Acad. des Sc., 1840, t. XI. p. 163). Liebreich Ueber die Beschaf. der Gehirnsubstanz (Arch. de Chem. and Pharm., 1865, t. 134, p. 29). Coeurbe—The Brain Considered from a Chemical and Physiological Point of View (Jour. de Chem. Med., 1834, t. X).

in 1851, opened new and unlooked for horizons respecting the *rôle* of the nervous system in the organism; and leaving one side all the discoveries which have flowed from this experimentation, I will consider only those which have a bearing on therapeutics.

Heretofore, in the study of medicinal substances, their action on the blood, and on the parenchyma of the viscera, was alone taken into account; it was thought that medicaments introduced into the economy modified the constitution of the blood, and even the tissue elements themselves, and from this double action their therapeutic and toxic effect was derived. The discovery of the vaso-motors, in showing us that the circulation, secretion, intimate nutrition of the tissues are under the dependence of special nerves—vaso-constrictors, vaso-dilators, trophic nerves—has considerably modified this experimental study, and even suggested the thought that henceforth the key to the great problem of the physiological and therapeutical action of the greater part of medicinal substances is to be found in the influence of these substances on the nervous system—on nerve-tubes and nerve cells.

My duty now is to point out to you what are the positive facts pertaining to this subject, and what, unfortunately, are the too numerous points of uncertainty and obscurity.

I cannot examine all the medicinal substances and acquaint you, for each one of them, with the positive and negative facts which are furnished us by experimental therapeutics, concerning their action on the elements of the nervous system.

This task would be immense, and would embrace therapeutics in its entirety. I have time only to consider briefly certain medicaments in their action on the cerebro-spinal or vaso-motor apparatus, and whose effects have been the most studied and are the best known.

Those medicaments which act on the cerebro-spinal axis, and whose effects are best known, are certainly the anæsthetics, which modify and alter, at a given moment, the functions of the nervous system. I propose here to examine, with reference to their modifying action on the nervous system two substances—chloroform and alcohol.

Claude Bernard has given us a series of experimental researches on the action of chloroform, which are a model of their kind. In one fundamental experiment he shows us first of all, that chloroform cannot act unless it be absorbed by the blood and carried to the cerebro-spinal axis. I spoke of this last year when treating of the penetration of medicaments by the air passages, and will not return to it now. By repeated experiments he sought and obtained a solution of the second part of the problem which he set before himself, namely, what is the *rôle* respectively of the cerebrum and the spinal cord in this anæsthesia? Both are affected independently by anæsthetics; but the cerebrum, as Claude Bernard says, is the centre of centres; that is to say, when it is under the influence of chloroform, the anæsthesia generalizes itself over the whole economy, while, on the other hand, when the spinal cord alone is affected, the anæsthesia extends over only a limited zone of the organism.

By an attentive study of the phenomena which characterize the action of

anæsthetics, the illustrious physiologist shows that the cerebro-spinal axis is not affected in all its parts at the same instant, and that, on the contrary, each one of them successively submits to the influence of the medicament. This order of succession is the following: The brain is first taken, and the consciousness of the ego is at once lost, but the spinal cord remains intact, and the reflex movements of the whole body persist. In a more intense degree of anæsthesia the spinal cord in its turn is overcome, but the medulla oblongata remains unharmed, presiding over the movements of circulation and respiration, which continue their function in a veritable cadaver, where every other sign of life has disappeared; the reflexes are abolished, anæsthesia is general, muscular collapse is absolute. But if you keep on increasing the dose of chloroform, the rachidian bulb is taken in its turn, and the animal succumbs; and in the interesting communication which he has lately made to the Academy of Medicine, Vulpian has shown us that if the rachidian bulb seems to be intact, it is nevertheless affected, and that in a chloroformed animal, it is only necessary to induce a slight nervous shock to suspend the functions of the medulla oblongata in its turn.[1]

By these experiments we see clearly set forth the part which pertains respectively to the circulation and to the nervous system in the action of the medicinal or toxic substance; the circulation bringing from the periphery to the nerve-centres the medicinal substance, and these, when affected by the medicament, generalizing the effect from the centre to the periphery. But this does not suffice; it is necessary to penetrate further into the subject, and demand what is the intimate action of chloroform on the nerve elements themselves. Claude Bernard has shown us by experiments of rigorous precision, that in the case of sensory nerves this momentary loss of their functions is absolutely analagous to what takes place when the sensory nerves succumb to abstraction of blood; or, if you prefer this statement, that troubles of sensibility manifest themselves at the periphery, while the action of the medicine is exerted on the centre (*i. e.*, the nerve-cells), in accordance with the law laid down by M. Bernard: "the nervous element loses its properties by the extremity opposite to that where it is affected."

But what is the alteration of the nerve-cell produced by the contact of chloroform conveyed to it by the blood? Here we can only make hypotheses.

[1] The respiratory centre in the medulla oblongata possesses a considerable resistance to the action of chloroform, but it is paralyzed in part, as the following experiment, performed by Vulpian, shows: In an animal not chloroformed, in which the pneumogastric nerve has been cut, if you electrize the central end of the nerve you determine complete arrest of the respiration; this lasts half or three-quarters of a minute. If you continue the electrization, the respiration resumes its course, and in order to obtain a new arrest of the respiratory movements, you must suspend for a time the electrization, to return to it again. In an animal plunged in the sleep of anæsthesia, electrization of the central end of the pneumogastric arrests respiration more readily than in the first case, and after this suspension the respiratory movements do not, of their own accord, come back again, and the animal, abandoned to itself, dies of respiratory syncope. This shows that the rachidian bulb is not in its normal state, and that the respiratory centre is weakened.—*Vide* Dictionnaire de Thérapeutique, D. Beaumetz, 1882, page 237. TRANS.

The most probable is that which Claude Bernard has offered, viz., that chloroform causes an incomplete coagulation of the protoplasmic substance surrounding the cell-nucleus, that this coagulation is temporary, but that, under certain circumstances, it may be final.

The solution of the problem in therapeutics, which I have stated, is not yet complete, for there is another element of the nervous system which is to be taken into account, viz., the great sympathetic, which modifies, in its turn, the circulation, and especially that of the brain, and produces there that anæmia which is such a factor in the anæsthetic sleep, as well as in natural sleep, as Hammond and Durham were the first to show us. The effects, then, of anæsthetics may be partially explained by the action of the chloroform or other medicament on the ganglionic centres of the vaso-motor system.

What I have just said of chloroform, I may almost repeat, word for word, of alcohol. It also is carried by the circulation to the nerve-centres. Like chloroform, it disturbs, more or less, the action of the cerebro-spinal axis, determining at first phenomena of intoxication, then collapsus. Like the former, too, it modifies locally the circulation. So, then, certain substances penetrate, by the circulation, to the nerve-centres, and fix themselves there; as for alcohol, this fact is undeniable, and by direct researches on animals, and even on man, I have determined the presence of alcohol in the brain tissue itself. Other medicinal substances also localize themselves in the brain, and I cannot furnish you a better example than lead; in fact, saturnine encephalopathy is produced by the presence of this metal in the cerebral tissue, as has been proved by chemical analysis. Heckel has even shown that in animals submitted to lead-poisoning, this element, in fixing itself in the cerebral substance, alters the color of it.

So it is now known that certain medicaments, which produce modifications in the functions of the cerebro-spinal axis, act directly on the nerve-cells, and by their presence determine transient or permanent results, which modify the property of those cells; here, then, is a first fact which seems to be sufficiently established.

I must add that it is essential that the nervous elements be intact, and this is a point to which I desire to call your attention, for it is of capital importance from a therapeutic point of view. We know, in fact, that under the influence of modifications, such as are determined by alcohol or by cerebral derangements, patients acquire a certain immunity from the therapeutic, and even from the toxic action of a great number of medicaments. We can, for instance, give to alcoholic patients, when affected with delirium tremens, or to maniacal patients, immense doses of morphia, atropia, or digitalis, without producing any symptoms of poisoning, although the same doses, in the same individuals, when in health, would speedily produce dangerous, if not fatal, symptoms.[1]

[1] I have seen teaspoonful doses of tincture of digitalis given in delirium tremens and in mania without any very perceptible effect. There is the same tolerance of chloral. I have given as much as three drachms (℥ iij) in one night to a patient in delirium tremens, without producing any profound sleep; have seen five grains of morphia by mouth prove futile.—TRANS.

How shall we explain these facts? We can give a physiological explanation, based on a curious experiment of Claude Bernard and Paul Thernard. They etherized hares, then injected anhydrous prussic acid under the skin. Whenever the animal was plunged in the anæsthetic sleep, they could give him quite large doses of prussic acid without producing poisoning, but toxic symptoms appeared as soon as the animal recovered consciousness and sensibility.

This experiment is fundamental, and brings out with great clearness the capital fact, that when a nervous element is influenced or modified by a medicinal agent previously taken, it cannot be easily impressed by any other medicament. This explains the variable susceptibility to toxic drugs which some persons manifest—the tolerance of the nerve cells for one modifier of function when influenced by another—the cases of mania above referred to, also those of alcoholic poisoning, where morphia in very large doses is borne with impunity. But as the action of the cerebro-spinal axis is in relation with the activity—greater or less—of the circulation, it is apparent that it is quite possible to modify the functions of the nervous system by modifying the circulation through the agency of medicinal substances. This it is that leads me to speak of the action of medicines on the vaso-motors.

Since the discovery of Pourfour du Petit,[2] since more especially the curious experimentation of Claude Bernard, we know that the capillary circulation is dependent on the nervous system. This discovery immediately threw light on the actions of a great number of medicaments, and an attempt was made to divide them into two distinct groups, the one consisting of medicines that act on the vaso-dilators, the other of such as act on the vaso-constrictors.[3]

In the first group (the vaso-dilators) were placed curare, opium and its

[2]According to Vulpian, medicines which act on the vaso-motors are divisible into two groups, as given in the text (*vide supra.*) These vaso-motor effects may be produced in various ways. Toxic substances may act on the unstriped muscular fibres directly, or primarily on the nerves, or vaso-motor nerve-centers. The effect of medicinal substances on the circulation has been studied, by direct examination, *i. e.*, by the sight, by the hæmadynamometer, and by the sphygmograph (Bordier's method); then by successive destruction of the vaso-motor nerve filaments, or vaso-motor centres, it has been attempted to limit the action of the substance under experimentation. Nevertheless, despite all the scientific rigor brought into these investigations, only confused and uncertain results have been obtained.—(Vulpian, "Leçons sur l'Appareil Vaso-moteur," t. ii. p. 724, 1875).

[3]The discovery of the vaso-motors goes back to 1851, when Claude Bernard made the experiments referred to. At the same time the contractility of the vascular system had long been known. Senac, Ens and many others had affirmed this contractility. Poufour du Petit, in 1727, had pointed out the redness of the conjunctiva which follows section of the cervical sympathetic cord, and Cruikshanks and Arnemann, repeating the experiments, had obtained the same effects. But it is Dupuy of Alfort, who, with Bréchet, in the presence of Dupuytren, in 1816, made the most decisive experiments concerning the action of the great sympathetic on the circulation.

The first contribution of Claude Bernard bears date 1851, and consists in a short note to the Society of Biology. He showed that on removing the superior cervical ganglion in the hare, there is produced an augmentation of heat and a congestion of the ear on the same side. Then appeared a work of Brown-Sequard, which showed that on irritating the upper end of the nerve you obtain contraction of the dilated vessels.

alkaloids, eserine, and nitrite of amyl. In the second (or group of the vaso-constrictors)[1] a place was assigned to strychnia, ergot, belladonna, atropia, and the greater part of the poisons of the heart.

Unfortunately it must be admitted that this division of medicines is based rather on hypothesis than on any rigorous scientific demonstration of their action; and in order to show you how difficult is the subject, I will take from the two groups two substances, and will tell you what we know that is positive concerning their vaso-motor action. As representing vaso-constrictive medicaments, I will select ergot; as a vaso-dilator medicament, morphia.

It was in 1849 that a Belgian physiologist, Savet, affirmed for the first time that ergot of rye, whose ecbolic action was well-known, causes the arteries to contract. John Simon, in England, in 1850, taught the same doctrine, and both maintained that this constrictive action on the arteries was concerned in all the pharmaceutical and toxic properties of the drug.[2] But before these statements could be accepted as fact, they must be demonstrated by experiment, and Holmes, Wernich, Schuller, Vogt, showed in frogs, as well as in higher animals,

[1] In frogs poisoned by nicotine, Claude Bernard has seen arrest of the circulation in the interdigital membrane, and contraction of the arterioles. Hence he affirmed that nicotine has a vaso-constrictive action. In Vulpian's opinion, this arrest of the circulation is due to disturbance of the functions of the heart. It has been asserted that in animals poisoned by this drug ("nicotinized") the intra-arterial blood pressure is raised. Vulpian maintains, on the contrary, that if you will take the precaution to prevent all convulsive action by curarizing the animal, you will always find the blood pressure lowered, and there will be a marked congestion of the digestive tube, and especially the stomach. Sever the pneumogastrics in the neck, and there is no longer fall of the blood pressure. Heidenhain has shown that nicotine prevents the secretion of the submaxillary gland, without acting on the vaso-motors. From all this, it appears difficult to affirm that nicotine acts specially either on the vaso-motors or muscular fibres, and its action seems to be more complex than has been supposed. —Claude Bernard, "Leçons sur les substances toxiques et médicamenteuses," 1857, p. 402, *et seq.* Heidenhain, Pflüger's Arch., t. v. p. 40-45. Vulpian, *loc. cit.*, t. ii. p. 139.

[2] Savet, of Belgium, in 1849, and Simon, in 1850, first expressed the opinion that ergot caused the arterioles to contract. Savet attributed to contraction of the arteries all the phenomena which ergot determines (contraction of the uterus, of the bladder, etc.) Simon, on the other hand, affirmed a specific direct action on the unstriped muscular fiber everywhere. Holmes (Thèse de Paris, 1870), has studied experimentally the action of ergot on the circulation. Injecting ergotine into the tongues of frogs, he has noted arterial constriction lasting twenty-five to thirty-five minutes. This effect was also noticed in the interdigital membrane after section of the sciatic nerve. He concludes that ergot has a direct action on the muscular fibre of the arterial walls.

Wernich, in experiments on hares and cats, has seen certain arterioles of the ear and pia mater contract, and this contraction takes place even after section of the sympathetic, which innervates these vessels. Schuller has obtained the same effect in the vessels of the pia mater, after section of the cervical sympathetic.

Vogt, on the other hand, affirms that the active principles of ergot of rye act on the vaso-motor centres.

Vulpian is of opinion that these experiments are not demonstrative, and that the direct action of ergot on the smooth muscular fibre has not yet been substantiated.—Holmes (*loc. cit.*), Vulpian (*loc. cit.*), Wernich (*Virchow's Arch.*, 1872, t. 56, p. 19), Schuller (*Centralblatt*, 1871, No. 51), Vogt (*Berlin, klin. Wochenschrift*, 1872, No. 10), Labadie Lagrave, L'Ergot de Seigle en France, et en Angleterre (*Gaz. Hebdom.*, 1873, p. 249).

cats and hares, the constrictive action on the arteries of these animals of ergot of rye and of ergotine.

But how is this action on the unstriped muscle of these arteries effected? Is it a direct effect, or is it brought about by an influence on the constrictor nerves? Here experiments are contradictory. Wernich and Schuller affirm that the contraction takes place when the vessel is deprived of all the nerves which it receives from the great sympathetic; Vogt, on the contrary, affirms that the vaso-constrictive action of ergot results from modifications wrought in the vaso-motor centres. As you perceive, physiology has not given a clear answer to the question, and, as Vulpian well says, we have as yet no decisive test-experiment on either side.

We find the same difficulty, *àpropos*, of the study of morphia. Doubtless, morphia brings about a congestion of the face, causes constriction of the pupil, and seems to produce a relaxation of the unstriped muscular fibres. But how is this action effected? This is a problem not yet solved.

Whatever may be the *modus operandi*, one may nevertheless say, taking his stand on data already acquired, that the group of spasmodic and anti-spasmodic medicaments owes its therapeutic action solely to the effect which these substances produce on the smooth muscular fibres, and that this effect is more likely indirect, being primarily exerted on the vaso-motors. It is, in fact, very difficult to affirm, with all the care that one may take in conducting the experiment, that one has destroyed all the nervous elements which innervate a group of muscles, or the walls of a bloodvessel. Moreover, in sectioning the nerves, the terminal extremities of the nerves still exist, and it is probable, I affirm, that it is by acting on these extremities that the contraction or relaxation of the muscular elements is produced.

But this is not all; medicaments act also on the secretions, and we must recognize the fact that this is one of the most important results that we look for in the administration of remedies; whether it be the kidneys, the salivary glands, or the skin with which we are concerned, we acknowledge the remedial efficacy, in morbid conditions of these organs, of diuretics, sialagogues, and sudorifics.

Till quite recently, it was supposed that certain principles contained in these medicaments, by a direct action on the glandular element itself, promote secretion; to-day, since the discovery of secretory nerves, this theory ought to be abandoned, and the admission made that these medicines act either directly on those nerves, or on the unifying substance which binds them to the secretory elements.

But in order to show you, gentlemen, on what experimental data is based this new method of regarding secretory medicaments, I shall finish this lecture by briefly reviewing the curious experiments which have been made concerning the action of jaborandi and atropine on certain salivary glands.

Among these glands is one which lends itself readily to experiment, as far as the nerves which innervate it are concerned—the submaxillary. This gland receives two sets of nerves; one set comes from the lingual branch of the inferior maxillary, and from the chorda tympani; another set comes from the

superior cervical ganglion. By destroying the latter, or cutting the former, one may study the influence of these two sets of nerves—whose origin is so different—on the secretion of this gland, for a tube introduced into Wharton's duct enables you justly to estimate the flow of saliva in the curarized animal.

When the chorda tympani is irritated, the circulation in the gland and the glandular secretion are augmented.[1] Heidenhain was the first to show that when an animal is poisoned by atropine, irritation of the chorda tympani produces augmentation of the circulation, but does not provoke the secretion of saliva; the atropine then has acted on the secretory nerves, but it has respected the vaso-motors. And if any one should say that the atropine has directed and limited its action to the secreting cell, whose effect it has destroyed, the reply is that we can restore the secretion of saliva by exciting the branch of the great sympathetic, which fact proves that the glandular parenchyma is not altered in its functions.

In another animal submitted to similar experiments, but treated by subcutaneous injections of pilocarpine, instead of atropine, an increase in the secretion of saliva was noted. When, moreover, both these alkaloids were introduced, the one after the other, in the same animal, the phenomenon of exaggerated secretion was no longer seen, these two substances being in therapeutic antagonism. What does this experimentation show? It is this—that jaborandi does not determine the salivary secretion, as Gubler thought, by the presence of certain of its principles in the secreting cell itself, for we have seen by the first experiment that atropine does not destroy the properties of the cells, but that there is a special action on certain elements, which it remains for us to designate. What is the anatomical element on which atropine, on which jaborandi acts? Is it the nervous element itself? First of all, we must exclude all action on the nerve centers or nerve tubes. We have seen the action of atropine and jaborandi manifested in animals in which had been extirpated both the chorda tympani and the nerves from which it is derived, and the ganglia of the sympathetic; the effect then of these two medicaments must be exerted, if at all, on the peripheral portion of these nerves. But between the extremities of the terminal filaments of the branches of the sympathetic and those of the chorda tympani, from an anatomical point of view, no difference exists, and it is difficult to admit that a medicinal or toxic substance, introduced by the circulation, can leave intact the structure of one set of fibres, while altering the structure of the other.

It is probable, then, that it is not on the extremities of the nerve-fibres[2]

[1] When, after cutting the chorda tympani, you excite the peripheral end of that nerve, all the bloodvessels are seen to dilate, and the salivary secretion augments. Nevertheless, these two effects, the vaso-motor and the secretory, are distinct, for woorari, given in a certain dose, paralyzes the secretory action, without at all modifying the vaso-motor action. The same result is obtained with atropine or cicutine. The experiments of Vulpian, of Heidenhain, and of Joliet, are, in this respect, absolutely demonstrative. There are, then, medicaments which act on the nerves of secretion, without acting on the vaso-constrictors, or vaso-dilators.—Vulpian, "Leçons sur les Substances Toxiques et Médicamenteuses."

[2] Coyne has studied the terminations of the nerves in glands. He has found, under the

that such toxic substances as jaborandi and atropine act, but rather on the "unifying substance," which is interposed between the nerve terminations of the chorda tympani, or sympathetic, on the one hand, and the secreting elements on the other.

What is this "unifying substance?" Here is a great anatomical and physiological problem which is not yet solved, and it is for the future to define it, and to assign to it its part in the process of secretion.

But I ought to assure you, that if the difficulties of these physiological problems augment in proportion as experimental analysis becomes more rigorous, it is none the less true that such researches give scientific precision to the study of the actions of medicines, and that it is in this way only that experimental therapeutics can progress.

Such are the general considerations that I desired to present to you relative to the nervous system considered from a therapeutic standpoint; they show you the difficulties of the problem and how these researches should be conducted in the future.

limiting membrane of the parenchyma, triangular or elongated cells, with multiple prolongations, having all the characters of nerve cells. He has been able to follow the nerve fibres through to the cells, but has not succeeded in finding the connecting substance which binds the cells to the epithelial elements. Pflüger has described very fine nervous filaments terminating in the epithelium itself, but he is the only one who has yet traced these terminations in the epithelium of glands. Rouget disputes Pflüger's assertion that the fibres discovered by him were nervous filaments, for they keep their sheath of myeline to their termination in the gland substance—an exception to the general rule.

Hermann, in observations of sweat glands, has seen fine nerve filaments in the limiting membrane of the glands. Cadiat explains the presence of these nerve filaments in this situation by the fact of the existence of a great number of muscular fibres in the parietes of the glands; he thinks that Hermann's nerve filaments are destined to innervate these muscular elements. (Coyne, "De la terminaison des nerfs dans les glandes," Comptes Rendus de l'Académié des Sciences, 1878). Cadiat, "Traité d'Anatomie Générale," t. ii. p. 153.)

ON HYDROTHERAPEUTICS.

SUMMARY.—History of Hydrotherapy—Priessnitz—Physiological Action of Cold—Reaction—Action of Hydrotherapy—Action on the Nervous System—Action on the Circulation—Action on Nutrition—Mode of Application of Cold Water—Douches—Pressure of the Water—Temperature of the Water—Alternating Douches—Duration of the Douche—Sudation before the Douche—Immersions—Affusions—Applications of Ice—Pulverizations of Ether.

Gentlemen:—Applied from the earliest antiquity to the treatment of certain affections, cold water did not take its proper place among the resources of our profession till almost the very epoch in which we live. It was as a result of the efforts of a simple peasant, a kind of country quack, and not till after his empirical employment of the remedy, that scientific labors were undertaken to explain the effects, and to determine the indications of cold water applications.[1]

At Graefenburg, a village of Austrian Silesia, lived, at the commencement of this century, a certain Priessnitz, a very observing and intelligent man, who had noted the beneficial effects of cold water treatment on sick animals confided to his care.

Imagining that diseases impregnate a man as liquids do when they penetrate a sponge, he maintained that in order to cure them it sufficed to remove morbid impurities from the cutaneous surface by repeated bathings and the promotion of the excretory function of the skin. He therefore applied cold water to the treatment of the greater part of diseases, and modified successively the divers procedures of hydrotherapy which he put in practice. At first he

[1] Hippocrates, in his treatise on "Air, Waters and Places," insists on the use of cold water in the treatment of diseases. The Romans made great account of hydrotherapy, and a certain Charmis maintained that all diseases were curable by cold water alone. Celsus, Aretæus, Cœlius Aurelianus, all pronounced in favor of cold water medication, and recommended treating fevers by this means. Then it fell into desuetude till the seventeenth century.

In 1638 Louis Septala recommended cold douches; then a Belgian, Hermann Van der Heyden, employed them in all diseases, and Foyes, an Englishman, advocated hydrotherapy with great enthusiasm.

In 1712 appeared a dissertation by Frederic Hoffman, having for title, *De aqua medicina universali*, and showing the marvelous success which attends the therapeutic use of cold water; the system of treatment advocated spread rapidly in Germany.

In Great Britain, Wright, Gregory (of Edinburgh), and especially Currie, all of whom attempted a physiological explanation of the action of cold water, gave a powerful impulse toward the employment of this method.

In Italy, Giannini, Vallisnieri, Cocchi became partisans of hydrotherapy. [This was about the middle of the last century.] Pomme, who wrote in 1765, was about the only French exponent of the new method. Then comes the era of Priessnitz, who, early in this century, gave so great an impetus to the water treatment, and stimulated scientific inquiry, the results of which are seen in the numerous and able physiological treatises whose authors are mentioned in the text.

employed sweatings followed by cold affusions, then advised wrapping the patient in a wet sheet, and, finally, cold baths. He obtained by this mode of treatment marvelous cures, which spread his fame far and wide.

Soon were seen flocking from all parts of Europe sick people seeking remedial aid from the healer of Graefenburg, and the village hovels disappeared to make way for numerous hotels, which soon became insufficient, so great was the number of patients, which kept increasing every day. Moved by this success, the Austrian government shortly appointed a commission which gave officially to Priessnitz the direction of the "hydropathic" establishment, which he had founded, and a few years after the institutor of hydrotherapeutics died crowned with fortune and with glory.

Such is the curious beginning of modern hydrotherapy, which, it will be seen, owed its popularity to the most gross empiricism. More recently the labors of Scoutteten, of Schedel, of Fleury, of Beni Barde, in France; of Chiapponi, in Italy; of Johnson, and of Manby Gully, in England; of Bell and Nicanor Rojas, in America; of Roser, of Lersch, of Pleniger, in Germany, have given a strictly scientific and medical character to the study of hydrotherapeutics, and it is from their contributions that I shall draw material for the several considerations into which I now enter.

PHYSIOLOGICAL ACTION OF COLD.

Numerous investigations have been made the last few years into the physiological action of cold, and of cold water in particular. I shall refer more especially to the valuable study of Winternitz.[1]

Whenever you apply a cold substance, such as ice or cold water, to any part of the body you determine perturbations in the nervous system, affecting the cerebro-spinal axis, and especially the great sympathetic. These phenomena are variable as the application of the refrigerant is of greater or less duration; if the chilling be of short duration, the tactile sensibility is at first augmented; if it be prolonged, all the modes of cutaneous sensibility disappear; a fact which has been utilized in the production of local anæsthesia for minor surgical operations. If, finally, you cease the refrigeration, the sensibility appears anew with a certain degree of hyperæsthesia.[2]

[1] Winternitz, Die Hydrotherapie auf Physiologischer und klinische Grundlage, Vienna, 1877.

[2] Cold raises, lowers, or abolishes the excitability of the sensory nerves, and Richardson has shown the modifications, varying according to the duration of the refrigeration. When the temperature of the skin is a little below 35° C. vascularization becomes more active, and sensibility more exquisite. When the integument is cooled still more, sensibility undergoes diminution, and at eight degrees below zero it is abolished altogether, to reappear as the temperature returns to the normal.

These modifications of temperature have been noted by Winternitz, and with the æsthesiometer of Sieveking by Helmholtz, by the determination of the quickness of our sensory impressions. From 36° C. to 38° C. this velocity is seventy-two meters a second; with lowering of the temperature it becomes ten times less.

These same modifications of sensibility are produced when the cooling body is applied to the trunk of a nerve of sensation, and these applications produce first hyperæsthesia, then

But the most profound modification, and that which effects the most happy results, from the stand-point of therapeutics, is the perturbation occasioned in the vaso-motors. Under the influence of reflex action,[3] following cold water applications, the capillaries are seen to become constricted, the peripheral heat to diminish, the cutaneous secretion to cease, the skin to become pale, the muscular elements to contract, giving rise to the phenomenon known as *goose skin;*[4] at the same time the heart's pulsations diminish, the arterial tension augments, as Delmas, of Bordeaux, has shown, and the patient experiences a general chill.

All these symptoms disappear with a rapidity proportioned to the duration of the exposure to the action of the cold. To this period succeeds another assemblage of symptoms to which has been given the name of reaction, a reaction which is characterized by manifestations of an opposite kind. The skin becomes red, animal heat is raised, the secretions augment, the muscular functions acquire a new energy, and a quite special sensation of *bien être* is experienced. It is in this double action of the nervous system that we must seek an explanation of the effects of hydrotherapy, whether considered as an antipyretic, a nerve tonic, or simply as a means of hygiene.

I will leave at one side for the present the antipyretic effects of cold water, to which I shall return when I shall speak of the treatment of fever by cold baths, and I shall at the present time limit myself to the effort to set clearly before you the results which may be obtained in nervous diseases from the double physiological action above mentioned.

ACTION ON THE NERVOUS SYSTEM.

In order that the functions of the nervous system may be accomplished in a regular manner, there must be not only complete integrity of all the constituent parts of that system, but it must receive a uniform and sufficient supply of normal arterial blood. When one of these conditions is at fault immediately

a period of complete anæsthesia. The experiments of Waller, of Rosenthal, of Eulenburg, of Weir Mitchell, etc., are very instructive and convincing. (Richardson, "Action of Extreme Cold on the Nervous System," Medical Times, vol ii., 1825. Winternitz, op. cit. Waller, On the Symptoms produced by the Application of Cold to the Sciatic Nerve. (Arch. Gén. de Méd., 5th series, vol. xx., p. 346, 1862.) Eulenburg, Lehrbruch der Functionnellen Nervenkrankheiten, Berlin, 1871. Weir Mitchell, Injuries of Nerves and their Consequences, Philadelphia, 1872.)

[3] Edwards, Brown-Séquard and Tholozan, and Vulpian have shown that when the hand is plunged into cold water the temperature of the other hand is lowered or elevated. Brown-Séquard has, moreover, remarked that the reflex phenomena determined by the local application of cold to the skin are produced in a point symmetrical to that where the local application was made. Dumontpallier has quite recently insisted upon the study of the localization of the æsthesiogenous points of the skin. (Edwards, De l'influence des agents physiques sur la vie, Paris, 1824. Brown-Séquard and Tholozan, Recherches experimentales sur quelques uns des effets du froid; Arch. Gén. de Méd., 5th series, vol. xii., p. 683, 1858. Dumontpallier, Leçons sur les actions reflexes; Un. Med., 1880.)

[4] Samkowy has noted the following effects on the unstriped muscles of frogs subjected to intense cold. During life these muscles contract, but after death they are not influenced by cold; a contrary result has, however, been observed in mammals.

modifications, more or less profound, in the nervous system result. This first fact being posited, we may immediately deduce consequences of the most positive kind from the stand-point of hydrotherapy, which acts on the nervous system, on the circulation, and on the nutrition.

On the nervous system by the sudden perturbation which it causes in the functioning of the sensory and motor nerve apparatus, hydrotherapy reëstablishes the regular operation of the cerebro-spinal axis; it, moreover, brings into exercise the vaso-motor centres, and thus produces an equilibrium between the functions of the brain and cord on the one hand, and the great sympathetic on the other. Moreover, it attenuates the exclusive action of certain local affections, which, by reason of reflex influences, become the point of departure of important secondary perturbations of the brain and spinal cord.

By its action on the circulation, which it regulates and renders active, hydrotherapy still further modifies in a happy manner the functions of the nervous system. Finally, by its general effects on nutrition,[1] by its direct or indirect action on the vaso-constrictors and vaso-dilators, on the secretory nerves, and lastly on the trophic nerves, cold water stimulates nutrition, promotes the regular play of the different organs, and becomes one of the most active agents of tonic and reconstituent medication. Under its influence the globules become richer in hæmoglobin, the oxygenation of the blood more active, and we ought to make a capital point of this fact in the treatment of nervous diseases.

Such is the veritable effect of hydrotherapeutics in nervous affections. I know that there has been much discussion as to whether the action of cold water were sedative, excitant, or perturbing. Some, with Trousseau, have pretended that cold water is the best of sedatives; others, as Fleury, have affirmed its excitant action; others, with Bloch, its perturbing action. These are, I opine, trivial questions, for according as you consider the effects of cold water during its application, or after its application, you observe opposite symptoms, and that it may be at one time perturbing, at another exciting or sedative.

MODES OF APPLICATION.

It is not enough to know the physiological or therapeutical effects of cold water, you must understand the conditions to be fulfilled in order to obtain the most favorable effects. I am, then, going to enter somewhat into details which I believe are of importance, for I have seen physicians prescribe hydrotherapy without insisting either on the mode of application, or on the duration of the douche, or on the temperature of the water. It is necessary, on the contrary, that you should carefully determine all these points in your directions, and that you should not leave, as is often done, to persons who are strangers to the healing art the management of the hydrotherapeutic treatment.

[1] Kund has experimented on the influence of cold in cases of poisoning by strychnia. Frogs poisoned by this medicament, he placed, some in water at 34° C., others in very cold water. The muscles of the former very speedily returned to their state of physiological relaxation, those of the latter, exposed to a low temperature, kept their tetanoid state a long time. The same experiments have been repeated in cats with like results. (Kund, Gaz. Med., 1857.)

The means of application of cold water are numerous; these may be arranged in three distinct groups: In the one the water is delivered under high pressure, in the second there is no pressure, in the third the applications are made to the naked body by means of cloths or sponges. I shall then speak of three modes of application—douches, baths, and lotions.

DOUCHES.

Douches are by far the most employed. They are divided into a number of varieties, which depend on the apparatus by which they are administered. Thus we have the *douche en pluie*, or shower bath; the *douche à colonne*, in which a column of water is let fall upon the body; the *douche à lame concentrique*, in which three or more concentric streams are directed on some portion of the body surface; the *douche en nappe*, in which the water comes in sheets; the *douche en cercle*, in which a circle of jets plays upon the patient; the *douche en jet mobile*, in which a varying direction is given to the jets. I need not occupy much of your time with a consideration of these douches; you are familiar with them all. In the shower bath the douche is applied by means of a large globe sprinkler (*pomme d'arrosoir*); in the *douche à colonne* the water descends with some force by a circular opening; in the third variety the globe sprinkler, instead of being pierced with a multitude of holes, has several circular chinks through which the water pours; in the *douche en nappe* the watering globe has the form of a bell; in the *jet mobile* a tube of leather or caoutchouc enables one to give a varying direction to the stream. The most used of these douches are the *douche en pluie* and the *mobile jet* douche.

In general, the stronger the pressure of the water, the less painful the sensation of cold. At the same time care is needed in the management of the pressure, which, when too violent, produces painful traumatisms. In the shower bath the douche strikes more especially the upper part of the body, and you ought to avoid, save in exceptional cases, douching the head. As for the *douches en jet* (the jet sprays), you can make use of different attachments which modify the form of the jet, and give the full jet or the broken jet, which may be directed, according to circumstances, on different parts of the body.

It remains for me to say what should be the temperature of the water, what ought to be the duration of the douche, what preparation the patient should make before, what he should do after, the douche.

As far as the temperature is concerned, the douche may be cold, it may be tempered, or it may be alternately cold and warm. The colder the douche the more intense the reaction, the more painful, too, the application of the douche. So in very susceptible subjects, and those who experience under the influence of cold a painful sensation of cardiac constriction and of suffocation, it is better to have recourse to tempered douches. In administering these douches a jet of cold water and a jet of hot water are turned by means of stop-cocks into the douche apparatus, and you can at your pleasure vary the temperature of the douche. Ordinarily at the commencement of the douche the water is tempered to 25° C. (77° F.), and is lowered during the douche so that finally it is not more than 10° C., or 15° C. (50° F. to 59° F.).

In the douches alternately hot and cold a much more active physiological reaction is obtained. In the so-called "Scotch douche" you begin with a douche of the temperature of 30° C. (86° F.), and gradually rise the temperature to 50° C. (122° F., which is about as hot as can be borne), then you give immediately a douche about as cold as ice. There is another kind of alternating douche in which a succession of warm and cold douches is given to the patient.

DURATION OF THE DOUCHE.

The douche ought always to be exceedingly short. You have just been told that the favorable results of hydrotherapeutics are due to the double action on the nervous system; to obtain this double action the impression of cold must be of short duration. As a general rule its duration should not exceed thirty seconds, and the first application of cold douches ought not to exceed ten or fifteen seconds.

PREPARATION FOR THE DOUCHE.

There are certain rules which should govern the patient before, during, and after, the douche. The greater the difference between the temperature of the body before the douche and that of the water, the more active the reaction will be. It has therefore been advised to cause the patient to take vigorous muscular exercise before the douche, in order to induce some degree of sweating. In our great gymnastic establishments, where the happy idea of douche compartments for the public benefit finds realization, it is at the moment of greatest muscular activity that the douche is taken.

This important condition, to have the skin in a state of prespiration, in order to derive from cold douches all their desirable effects, is little known, not only to the public, but also to physicians. Does not everybody in fact maintain that a cold bath taken when one is sweating is a bad thing, and that it is to this cause that are due the evil effects which sometimes follow the free external use of cold water? I believe this to be a complete mistake; and if we occasionally see congestions of the lungs follow a cold plunge, it is more probable that the individual was chilled before the bath was taken, than that the pulmonary congestion resulted from the bath.

Elsewhere we see, as a medicinal measure, a disposition manifested to favor as much as possible this state of sudation by exercise and artificial means. As artificial means, in Germany they make great use of the *dry blanket*, the patient being enveloped in several blankets thoroughly tucked around him, and kept in the hot, dry, sweating room, or subjected to a powerful vapor bath till a state of free perspiration is induced; then the wrappings are removed and a cold douche is administered, or he is immersed is a bath of cold water. The Russian bath, so much in use among a great many nations, and of which we possess in Paris a very complete establishment, the Hamman, is based entirely on this double action of heat and of cold water.

During the douche the patient ought, as Beni Barde recommends, to suppress, as much as possible, strong contractions of the muscles, and keep a firm hold of the bar for support. The respiratory distress is mitigated by freedom

in outcries. In the event of congestive tendencies to the head or to the uterus, it is well to take a warm foot-bath, or douche the lower extremities with warm water, after the cold douche.

IMMERSIONS.

When remedial effects are sought from immersions, the patient either takes a single plunge into cold water, which should be of sufficient depth that the whole body may be immersed, then immediately rubs himself dry till the skin glows, or he remains several minutes in the bath; the latter course is recommended when an antipyretic effect is desired.

Partial baths are often beneficial, such as foot-baths, sitz-baths; those with running water, furnished with implements for local douching, are preferable.

AFFUSIONS AND PACKING IN THE WET SHEET.

Affusions consist in pouring cold water on the naked body of the patient, or in what is called the wet pack. Wrapping the patient in wet blankets is a very active hydrotherapeutic method. It has this advantage, that it may be employed in all places, and without having recourse to the quite complex apparatuses just described. It is, however, a painful application, and is by no means free from danger. The mode of procedure is simple enough: You wrap the patient in a sheet that has been wrung out of icy-cold water,—you may apply the wet sheet with the patient standing or lying, and keep him thus enveloped ten to fifteen seconds,—then with brisk rubbing with dry cloths you try to promote vigorous reaction. This envelopment may be partial; in this case it has been advised to leave the wrappings on during the entire period of reaction.

Such are in general the methods of application of cold water. There are other modes of using cold from a therapeutic point of view, and I shall now speak of applications of ice and pulverizations of ether.

It has been advised to treat certain neuroses by the application of ice along the vertebral column, and in England chorea is much treated by this method, and so is hysteria. Charcot has even attempted this method at the Salpêtriére, the ice being placed for the space of a half hour, then an hour, over the ovarian region in hysterical patients. By this means he has observed a diminution in the number and intensity of the attacks.[1]

[1]Experiments have been made by Weir Mitchell, and by Richardson, to determine the direct action of cold on the spinal cord, the brain, and the cerebellum.

Cold destroys the vital properties of the cerebro-spinal axis when it is too long applied. The first effect of chilling the cerebrum is a brief sedative action. Then phenomena of motor excitation are developed, sensibility is lessened, and if the application of cold is continued, the animal falls into a profound stupor, and surgical operations may be performed on him without the least movement. This state resembles the hibernal sleep.

When refrigerant applications are made over the cerebellum of birds, backward movements are produced of a very marked character, the explanation of which has not yet been satisfactorily given. According to some they are due to the cerebellum serving as counterpoise to the opto-striate bodies which contain the centres for backward movements. Ac-

A physician of Varsovie, Lublesky, has advised another means of producing refrigeration—the application of ether spray over the spinal column. He has thus treated chorea.

Such, gentlemen, are the divers applications of cold in the treatment of nervous diseases. In the next lecture I shall treat of electricity in the same affections; a subject much more complicated, and which will require much more persevering study to master.

cording to Richardson, the cerebellum is the seat of instigation of forward movements, and when its action is suppressed, backward movements take place.

When cold is applied to the medulla oblongata, the respiratory movements are first tumultuous, then they are slowed, and finally cease altogether. (Bourneville, De l'emploi de la glace; Progrèss Médical, 1876. Weir Mitchell, Injuries of Nerves and their Consequences, Philadelphia, 1872. Sur les movements de recul produits chez les oiseaux par l'application du froid, etc.; Arch. de physiol. norm. et path., t. i., p. 477, 1868. Richardson, On the Application of Cold to the Cervical Region, for the Reduction of Pyrexia; Medical Times and Gazette, March 21, 1874, pp. 312, 313.)

ON MEDICAL ELECTRICITY.

SUMMARY.—History—New Theory of Electricity—Intensity of the Current—Static and Dynamic Electrical Apparatuses—Physical Phenomena of the Electric Current—Chemical Phenomena of the Electric Current—Physiological Action of Electricity—Action on the Muscular System—Electro-Capillary Phenomena—Action on the Nervous System—Action on the Circulation—Action on Nutrition—Technics.

Gentlemen:—I shall devote this lecture to the study of electricity, considered as a therapeutic agent.

You are already aware of the use which is made of electricity in the treatment of nervous diseases, and I desire to acquaint you with the physiological facts which are the basis of the therapeutic employment of this remedy. But in order that you may the better understand so difficult a subject, I shall refresh your memories with certain details of elementary physics. It is not indeed necessary that the physician should be a profound *physicist* (despite the common derivation of the words); he ought nevertheless to know the general principles of physics if he would be successful as an electro-therapeutist.

From the beginning of the seventeenth century,[1] when Gilbert, physician to Queen Elizabeth, first applied the terms *electrics* to such substances as amber and sealing wax, which, when rubbed, attract light objects, this department of physics

[1] It was in 1743 that Kruger, professor at Helmstædt, first applied to therapeutic purposes, the precious experiment of Nollet, who, having suspended Du Fay by silken cords, and put him in communication with an electric machine, drew sparks from his body.

In 1744, Kratzenstein, of Halle, published a memoir entitled, "Letter from a physicist on the use of electricity in medicine," and enumerated the results obtainable in paralysis.

In 1748, Jallabert published a work of considerable size on electricity in its applications to medicine.

In 1749, Abbe Nollet employed electricity in other affections besides paralysis. The same year, Francois de Sauvage de la Croix, also gave to the world a monograph on the curative action of electricity.

In 1775, Antoine Van Hæn, first physician to Marie Theresa, showed that not only paralysis, but chorea was amendable to treatment by electricity.

In 1779 appeared the work of Mauduit of Varennes, which reported eighty-two cases of diseases treated by electricity.

In 1780, Mazars, of Cazelles, gave one hundred and nine observations of patients treated by static electricity. The same year, Bertholon appeared as author of a treatise on electricity, in two volumes.

In 1783, Marat published a memoir on electricity and its advantages in medicine.(*a*)

(*a*) Kratzenstein, *Letter of a Physicist on the Use of Electricity in Medicine*, Hall, 1746. Jallabert, Experiments with Electricity, and Some Conjectures as to its Causes and Effects; Geneva, 1748. Nollet, *Researches on the Particular Causes of Electrical Phenomena*, Paris, 1749. Francois de Sauvage de la Croix, *On the Treatment by Electricity of Hemiplegia.* Mauduit de la Varennes, *Memoirs on Electrical Treatment as applied to Eighty-two patients*, 1779. Mazars de Cazelles, *Memoir on Medical Electricity, and the History of 109 Cases Treated, and the Most of Them Cured by Static Electricity*, 1780. Bertholon, *Treatise on Electricity of the Human Body in Health and Disease*; two volumes, 1780. Marat, *Physical Researches on Electricity*, 1782; *Memoir on Electricity*, 1783.

has undergone a progressive evolution. Gilbert's crude discovery was improved upon by succeeding physicists, but it was not till the middle of the eighteenth century that the first applications of electricity to therapeutics were made.

In 1743, Kruger, professor at Helmstaedt, utilized, for the first time, in the treatment of disease the curious experiment of Nollet, who suspended Du Fay by silk cords, put him in communication with a plate electric machine, and drew sparks from his body. The year following, Kratzenstein, a physician of Halle, cured, by electricity, a woman paralyzed in her little finger. Jallabert, of Geneva, in 1748, obtained a much more signal success with a patient affected for fourteen years with paralysis of the right arm; the cure was accomplished in two months by electrical treatment. Some years later (in 1775), Antoine Van Haen, physician extraordinary to Maria Theresa, not only cured paralysis, but also treated chorea by electricity.

From this date works on medical electricity follow with rapidity, and multitudes of cases are reported where this agent was used therapeutically. Mauduit, of Varennes, published in 1779 a report of twenty-four observations. Mazars, of Cazelles, relates the history of one hundred and nine patients treated by electricity, and among the names of physicians who gave attention to this subject at this time, I mention one who obtained a great celebrity in our revolutionary records, namely, Marat. Thus far frictional electricity alone was employed, but toward the end of the eighteenth century Galvani, and especially Volta, made new discoveries in the laws, properties, and methods of employment of this agent.

It was the 20th of September, 1781, that Galvani made his curious experiment with the frog, an experiment with which you are all familiar; and then arose that discussion between him and Volta, which resulted in the discovery of the electric pile.

Galvani maintained that the frog was a veritable electrical apparatus, and that all that was necessary was a metallic arc to bring into play this electricity. Volta took another view, pretending that the electricity manifested was generated in the metallic arc, and the invention of the pile seemed to justify his view. At the same time Galvani, in support of his opinion, made some remarkable experiments, showing that the simple contact of the frog's muscle with the sciatic nerve, without the intermediation of a metallic arc, was sufficient to excite contractions. Modern experimental research has confirmed the doctrine of Galvani, while at the same time doing justice to Volta. The discoveries of these two celebrated physicists were soon utilized in medicine; frictional electricity was abandoned, and voltaic piles everywhere came into use. In 1832 Faraday, by the discovery of induction currents, modified yet even more the applications of medical electricity, and the voltaic gave place to the faradic battery.

Till quite recently specialists in electro-therapeutics have been known to devote themselves exclusively to some one form of electricity, ignoring all others. Thus Duchenne, of Boulogne, looked for remedial efficiency in all cases to the faradic current, while Remak, then Legros, and Onimus, recommended only the voltaic current. A few, meanwhile, went back to static electricity; thus

Reynolds, in England, and more recently Arthuis, in France. Of late static electricity has been brought prominently into notice by Charcot, and his pupil Vigouroux.

At the present day, owing to a better acquaintance with the subject, we have abandoned this exclusiveness in methods, and employ, as best suits our purpose, faradic electricity, voltaic electricity, or frictional electricity.

Moreover it would be a strange mistake to suppose that these electricities, of different sources, have different properties, comparable, for example, to the properties of three different medicines.

Electricity, from whatever source we obtain it, is one and the same, and the differences which we observe in the various apparatuses, voltaic, faradic, and frictional, are resolvable into a *plus* or *minus* of quantity and of tension.

NEW THEORY OF ELECTRICITY.

Whenever you modify the molecular equilibrium of a body, whether by mechanical or chemical action, electricity is set free.[1] Electricity, then, is a part of the molecular state of bodies, and is a mode of motion. We have now completely abandoned the ancient hypothesis of the existence in all bodies of two electricities, called positive and negative electricity, which were regarded as fluids, capable of neutralizing each other, and which could be separated by chemical action or by friction. It has been experimentally rendered certain that electricity is one of the ever-varying modes of force, and the new theory of electricity, like that of light, is based on the existence of ether, an imponderable fluid, which surrounds and penetrates all bodies; an elastic medium, so to speak, in which the atoms are enswathed. By chemical or mechanical action we break the molecular equilibrium of a compound chemical substance; certain atoms are put in a condition in which there is more ether around them than surrounds

[1] The electric fluid is set free whenever by mechanical or chemical action you produce a rupture of equilibrium in the molecular state of bodies. Of late years there has been a general abandonment of the old hypothesis that every body is charged with two electric fluids, positive and negative, neutralizing each other, but separable by mechanical and chemical means.

Electricity is to-day considered as one of the transformations of force, and like light, there is assumed, as the condition of its existence, an impenetrable ether which bathes the atoms of all bodies.

When you put in contact two bodies whose atoms are surrounded by definite quantity of ether, and when you act mechanically or chemically on these two bodies, you break the molecular equilibrium, and the atoms of one of the bodies have much more ether associated with them than those of the other body.

Whenever a body is in this condition it is said to be electrized positively, while the body that has the least ether is electrized negatively. Hence this definition of electricity: Electricity is the difference which exists between the actual quantity of ether which impregnates the molecules of a body and the normal quantity which it should possess.

There is only this difference between static and dynamic electricity; the one is the electric fluid considered in the state of repose, the other is electricity considered in activity. (*a*)

(*a*) Mascart, Traite d. électricite statique. Ganot, Physics, Bardet. De l. exposition d'electricite an point de vue medical et therapeutique. (Bull, de therap, 1880 t. CI p. 289.)

other atoms (the conditions of equilibrium being effected by the ether); those atoms which possess most ether are electrified positively, those which contain a minus quantity of ether are electrified negatively. The new definition then reads: Electricity is the difference which exists between the actual quantity of ether which impregnates the molecules of a body and the normal quantity which it should contain.

This electricity may be relatively in a state of repose, or in a state of activity; hence the division into static and dynamic. But whether static or dynamic, electricity has qualities of tension, and manifests resistance which you must learn.

INTENSITY OF THE CURRENT.

There is a well-known formula which enables us to determine the intensity of an electrical current. This formula is represented by the following equation: $I = \frac{E}{R}$. Here I represents the intensity of the current; E the electro-motive force, which, so to speak, separates the electricities, or drives them apart to recombine through the circuit; R the resistance which results from the length and narrowness of the conducting wire, etc.

For these algebraic signs the Electric Congress, held in 1881, substituted names which it behooves you to learn, for these names now form part of the nomenclature of medical electricity.

The name *Volt* is given to the unit of electro-motive force, represented in our formula by E. To the unit of *resistance* (R) the name *Ohm* is given. The name *ampère* is applied to the unit of intensity (I). A current of *Volt* passing in an *Ohm* (that is, the unit of electro-motive force acting on the unit of resistance) gives a unit of intensity, that is, an *ampère*. If the *ampère* is produced in a unit of time (that is, a second), you have the unit of electrical quantity, that is, a *coulon*.

Practically, the *Volt* or unit of electro-motive force is represented approximately by a Daniell's constant cell. As for the unit of intensity, that is, the *ampère*, it is not employed in medicine, being too powerful; it has therefore been divided into thousandths, to which division the name of *milliampère* has been applied. On this basis is effected the graduation of certain batteries, and in particular those of Gaiffe.

STATIC AND DYNAMIC ELECTRICAL APPARATUSES.

The difference which exists between static and dynamic apparatuses results from the tension and from the quantity of electricity which they produce. In the frictional apparatus you get but little electricity, but electricity of enormous tension; the dynamic machines, on the other hand, such as the electric piles, produce a great quantity of electricity, but of feeble tension; place these batteries, however, in special conditions, and you will obtain analogous effects. Observe this spark from an induction machine, compare it with that given by this static apparatus of Carré, and you will see that they are of equal intensity.

Tension plays the same part in reference to electric currents as pressure does in liquids. You will often see a river with a considerable mass of water

which is incapable of turning the water-wheel of a mill, so feeble is the current, while, on the other hand, a mighty rushing brook from the mountains shall furnish water-power for an entire factory; this illustrates what I have said about pressure in liquids. It is the same with electricity, and while static machines give us violent effects, but excessively short, the electric piles give us prolonged effects, but of very feeble intensity. The faradic batteries are intermediate between these two extremes, but before entering upon the therapeutic applications of these different currents, I will glance at their action on the economy.

PHYSICAL PHENOMENA OF THE ELECTRIC CURRENT.

Electric currents produce first of all physical phenomena of heat and light. which are utilized in medicine. The heat action is especially employed in surgery (for example, the galvano-cautery, which enables us easily and safely to perform grave operations). As for the phenomena of light, we have various apparatuses which enable us to illuminate by electricity internal cavities of the body, and thus diagnosticate morbid conditions. The polyscope of Trouvé is an example.

CHEMICAL PHENOMENA OF THE ELECTRIC CURRENT.

Besides the light and heat, determined by the passage of the electric current, medicine has utilized the chemical phenomena which result. You know that when you pass a current into a saline solution a decomposition of the solution is affected, and while the acid seeks the positive pole the base seeks the negative pole; the first is called the *acid* pole, the second the *alkaline*. Analogous modifications take place in the living tissues, and on these is based the interesting phenomenon of electrolysis. Already in speaking of the treatment of aneurisms, I have alluded to the beneficial effects of electrolysis in these cases. I shall not revert to this subject now, and shall only refer you to the important observations of Professor Le Fort, which go to show how numerous and how remedial are the modifications determined in the tissues by constant currents.

PHYSIOLOGICAL ACTION OF ELECTRICITY.

I come now to the study of the physiological action of electric currents, as this plays the most important rôle in the treatment of diseases of the nervous system. We will examine successively the action of electricity on the muscular system, on the nervous system, on the circulation, and finally on nutrition.

ACTION ON THE MUSCULAR SYSTEM.

As far as the muscular system is concerned, we know, since the experiments of Galvani,[1] experiments reproduced by Matteuci, Marianini, and especially by Du Bois Reymond, that there exists a proper muscular current, not only in the

[1] Since the experiment of Galvani, other experiments by Nobili, Matteuci, and Du Bois Reymond, have demonstrated the existence of the frog current which is found in the muscles of all animals and of man, but which becomes more and more feeble as you ascend the

muscles of the frog, but of the whole animal series. This current, which has been described under the name of frog current, has been explained in different ways. Some, as, for instance, Hermann, have invoked (to explain the phenomenon) the chemical actions which are all the time taking place in the muscles, and in particular those going on in a substance not yet isolated, which he has described under the name of *inogene;* others, on the contrary, like Du Bois Reymond, have supported the hypothesis of the electro-motive molecular state of the muscular substance, each molecule of the muscle representing an element of the electric pile acting upon the neighboring molecules.

ELECTRO-CAPILLARY PHENOMENA.[2]

All these theories and all these hypotheses which have been in vogue the past fifteen years are to-day abandoned, for the question is much more complicated than was formerly supposed, and the discovery of electro-capillary

animal scale. In the same individual the muscle gives a current which is the stronger, the more important the function of the muscle is destined to be.

These experiments have, moreover, shown that every point of the longitudinal surface of a muscle is positive with relation to every point of the transverse surface.

Two hypotheses have been made to explain these electric currents in the tissues. Hermann and others have contended that it was necessary to invoke the chemical reactions which take place in the muscle. Each muscle in its normal state contains a substance called *inogene*, which breaks up into C O^2, and an albuminoid body *myosin*, and it is the decomposition of this body which sets free the electric current. Others, as Du Bois Reymond, have advanced another hypothesis, based on the electro-motive molecular state of the muscles. These electro-motive molecules are little centres of chemical action, turning their homologous sides in the same direction and acting electrically the one on the other.(*a*)

[2]Becquerel has investigated certain phenomena which he has described under the name electro-capillary. He has demonstrated that two solutions of different nature, conductors of electricity, separated by an organic membrane or by a capillary space, constitute an electro-chemical circuit capable of giving rise to chemical and mechanical effects. This fact, applied to the human organism, goes to show that the greater part of the anatomical elements present all the conditions of an electro-capillary couple. There exist, then, in our bodies, an innumerable number of these electro-capillary couples, giving rise to currents which act without interruption during life, and for some time after death.

Becquerel has studied the current formed by the bones, the muscles, and the nerves; and he has described the electro-capillary currents which pass between the blood and the muscular fluids. He has shown that the side of the capillaries in contact with the arterial blood is the negative pole, and that in contact with the serosity and the tissues the positive pole of an electro-capillary couple. In the nervous substance Becquerel has shown that the current is directed from the white substance to the gray substance. He has, moreover, pointed out that under the influence of electro-capillary chemical effects there is produced a phenomenon which he has described under the name of *cementation*, which consists in the introduction into and the departure from the body of certain elements, without the body losing thereby in any manner its form.(*b*)

(*a*) Hermann, Untersuchungen uber den Stoffwechsel der Muskel Berlin, 1867. Du Bois Reymond, Conference at the Royal Institution of Great Britain (Revue des Cours Sc. No. 3, 1867. Onimus et Légros, Traité d Electricite, p. 100.

(*b*) Becquerel, Phenomène électro-capillaire (Acad. des Sc. de 1867 a 1870).—Legros et Onimus.—Traitè d' electricité medicale, p. 117.

phenomena and currents of polarization has shown us how difficult is the explanation of the muscular current. As for the electro-capillary phenomena, it was Becquerel who first demonstrated their reality, showing us that when two solutions of different nature are separated by an organic membrane or a capillary space electricity is evolved. Our organisms reproduce, in quantity innumerable, the conditions of these electro-capillary phenomena, and it is easy to understand the part they play in the living being. As for currents of polarization, it has of late been shown that when you pass for a certain length of time a current through a muscle, if you arrest the current you cause to be produced in the muscle a current passing in the opposite direction, and of greater intensity; this current has been called the current of polarization.

These are facts which show us how manifold are the sources of electricity in the human body. Moreover, it is a matter of common experience that when you electrically excite a muscle (and for this purpose the induced current is the best) you determine energetic contractions, and you utilize this action in the treatment of muscular paralyses.

ACTION ON THE NERVOUS SYSTEM.

The remarks which I have made *apropos* of the muscular system are applicable also to the nervous system, The nerves, as well as the muscles, possess a current of their own; the nerve fibrils as well as the muscular are the seat of electro-capillary currents; the nervous mass as well as the muscular undergoes polarizations. The nerve current has been compared to electricity; to-day this comparison is given up; there can be no identity between currents of which one (the nerve vibration or "current") is so slow (ten times slower than sound), while the other is so rapid. What we now know is that under the influence of certain currents, as the faradic, the properties of the sensory or motor nerve reappear, and give rise to contractions of the muscular groups to which the nerve is distributed. We also know that by the influence of the electric current we modify the electric state of the nerve, and thus cause to disappear certain neuralgias of the most obstinate kind.

ACTION ON THE CIRCULATION.

Electric currents have a marked action on the circulation. Sometimes the current acts directly on the blood-vessel, whose contraction it causes; sometimes it acts on the vaso-motor centres, directly or indirectly, and in this way static electricity may produce effects analogous to those of hydrotherapy. When we place the patient on the insulated stool, and after having put him in communication with the static machine, draw sparks from certain parts of his body, we effect a revulsive action on the skin resembling that produced by cold; there is first of all vaso-constriction, succeeded by vaso-dilatation, and reddening of the tissues.

ACTION ON NUTRITION.

There is a physiological effect of electricity still more pronounced than the other effects above mentioned. I refer to the effect of this agent on nutrition. Under the influence of constant currents nutrition is seen to im-

prove, and the vitality of the tissues is restored with new energy. Although we have not any absolutely scientific explanation of this effect on nutrition, it results probably from a double action,—direct action on the trophic nerves, and on the tissue molecules of the organism, whose vital energy is raised.

Such are, in brief, the effects which are obtained from electricity, whether from a chemical, physical, or physiological standpoint, and to accomplish our end we make use of the different kinds of apparatus which I now place before you, static, voltaic, and faradic.

When we desire to modify the cutaneous sensibility and nutrition in general we make use of static electricity; when we wish to limit electricity to a group of muscles, or when we wish to restore contractility to certain muscles, we use the faradic machine; when, finally, we wish to modify the molecular state of certain nerves, or give a new activity to certain tissues, we employ galvanism.[1]

[1] [Here, in the original, follows an exposition by Dr. Bardet, an electrician of Paris, of the *technique* of the various electrical apparatus, static, voltaic, faradic. This part of the work is unsuited to American practitioners, and is omitted from the translation. We give, in its place, a chapter on the technics of American electric machines, kindly prepared for this work by Dr. C. L. Dana, of New York.]

ELECTRICAL BATTERIES AND THEIR USE.

Gentlemen :—Despite much that has been said against the value of electricity, it is becoming more and more the custom of physicians to equip themselves with electrical batteries when starting out in practice. The number of manufacturers of these batteries has lately increased, and I am informed that all of them make and sell many more instruments each year.

You wish to know where to get the best batteries, what kinds to get, and how to take care of them and use them. I will try to say something upon these points as briefly as I can.

Electricity and magnetism are forms of the same force, but they show themselves in different conditions and have correspondingly different physiological and therapeutical effects.

The three forms in which the therapeutist uses electricity are the static, the induced and the galvanic. We have accordingly static electrical batteries, batteries generating faradic or induced electricity, and galvanic electrical batteries.

In order to understand the differences in the effects of these batteries, you will allow me first to say a word regarding the physical nature of the force, electricity.

We suppose electricity, like light and chemism, to be a mode of molecular motion. That hypothesis is not of much use, however, in explaining the ordinary electrical phenomena: Therefore it is assumed that every substance is permeated with two imponderable fluids. Under ordinary conditions these fluids are united and in equilibrium; but by certain agencies, such as friction, heat, chemism, etc., they can be separated. Then we have electrical phenomena, which we recognize as due to these two fluids, positive and negative electricity, that have been separated and are trying to get together again. We assume that the condition of electrical equilibrium is that of zero, and that the earth's electricity is at zero. Positive electricity is raised above, negative electricity pulled below this zero point. All electricity phenomena, I repeat, result from attempts of the fluids to become equalized or stable again at the zero point, just as all the phenomena of heat result from differences of temperature, and those of gravity from differences of pressure. The distance to which the electrical fluids are separated from the zero point is spoken of as the difference in "potential." This *potential* corresponds to the term degrees in measuring heat. Now, the greater the difference in potential the greater the effort of the fluids to return to zero. High and low potentials correspond to high or low intensity of heat. *Tension* is the result of the widely separated fluids striving to return to the zero point. Electrical tension is an important characteristic to understand, as it has much to do with electro-physiological and therapeutic results. When the two fluids, at different potentials, attempt to become equalized, they pass along certain paths and form *electrical currents*. Electricity will

pass along any substance, but some substances conduct it more easily than others, and these are known as *conductors*. I have here a table showing the relative value of different conductors. They have the following resistance, that of mercury being taken as 1.:

Mercury	1.	Sulphuric acid	47,000
Silver	0.017	Commercial nitric acid	18,000
Copper	0.018	Sol. sulphate of zinc	288,000
Zinc	0.057	Sol. sulphate of copper	306,000
Platinum	0.092	Dilute acids or salts	from 10,000 to 300,000
Iron	0.099	Human body	about same as dilute saline sol.
Gas carbon	43.	Pure water	12,000,000

The tissues of the human body are tolerably good conductors except only the skin. This offers a great deal of resistance, if it is dry, and it is, indeed, the main difficulty to be overcome in passing electrical currents through the body.

Those substances along which electricity passes with great difficulty are known as non-conductors or insulators. Of these, too, I show you here a list, the substances being arranged in accordance with their relative value as insulators:

Caoutchouc.
Silk.
Glass.
Wax.
Sulphur.
Resins. Shellac. Dry air.

The electrical fluids may be kept by insulators at different potentials, the insulators preventing them from becoming equalized, or reduced to the same potential. Electricity in this condition is called static, and it is always at a high tension.

Static electricity has the power of inducing another disassociation of the electrical fluids, in other bodies separated from it by intervening bodies. These intervening bodies are called *dialectrics*. The dialectrical bodies are analogous in function to the conductors of electrical currents. They are such substances as glass, dry air, gutta-percha, etc.

There are certain electrical terms which I wish to explain to you:

The *quantity* of electricity is the amount of electricity in a given body or on a given surface. The *electro-motive force* is the force which disassociates the two fluids, putting them at different potentials; electrical current results.

The *working-power* or *current strength* is the term used to express the capacity of the separated fluids to overcome resistance in their attempts to reach equilibrium or equalization again.

This working-power or current strength naturally is in proportion to the strength of the electro-motive power which is constantly disassociating the fluids and generating the current. If, however, as is always the case, the electrical fluid meets resistance in seeking equilibrium, the resistance diminishes its

working-power or current strength. Hence we have a common formula known as Ohm's law.

$$\text{Current Strength} = \frac{\text{Electro-motive Force.}}{\text{Resistance.}}$$

As I have said, all bodies offer some resistance to electrical currents, and it is important to have some standard unit of resistance for the sake of comparison. Such standard unit has been adopted, and is called an *ohm.* It is the resistance offered to a current by a certain piece of wire of definite size and length.

A *volt* is the unit of electro-motive force, *i. e.*, it represents the force which will generate a certain amount of electricity in a second of time. A Daniell-cell is of about one volt strength.

A *weber* (or ampere, as it has been lately called) is the unit of working-power or current-strength. It is the current-strength produced by one volt of electro-motive force working against one ohm of resistance.

The *coulomb* is the unit of quantity and is the quantity of electricity given by one weber in a second of time.

I have gone over the foregoing points very briefly, and have left out much in the way of explanation. Sufficient has been said, however, I trust, to render somewhat clear the discussion of the therapeutical and physiological effects of electricity which we take up now. The main things to be remembered in connection with the practical properties of electricity are that it shows itself in different quantities and at a different tension. You can, if you wish, forget all the other things about electricity, and certainly I want you to forget many of the ancient terms which have confused the subject. The terms density and intensity, for example, can be ignored.

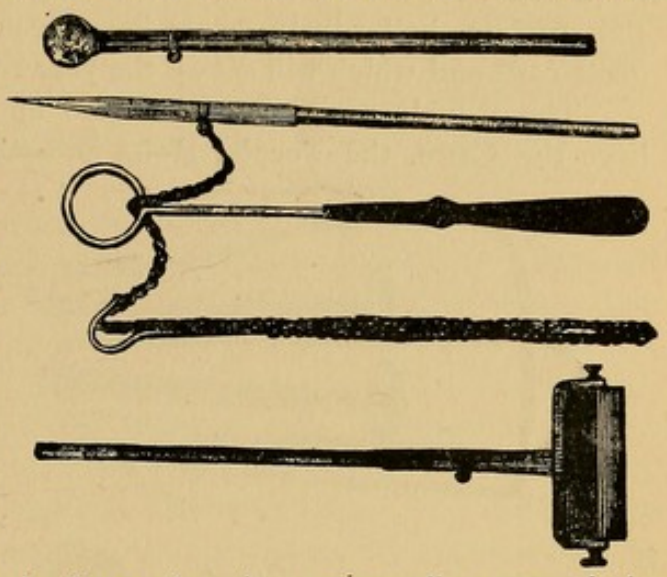
All medical batteries depend for their efforts upon the quantity of electricity generated, the tension or difference of potential of the electrical force generated, and the variations in the duration or strength of the currents.

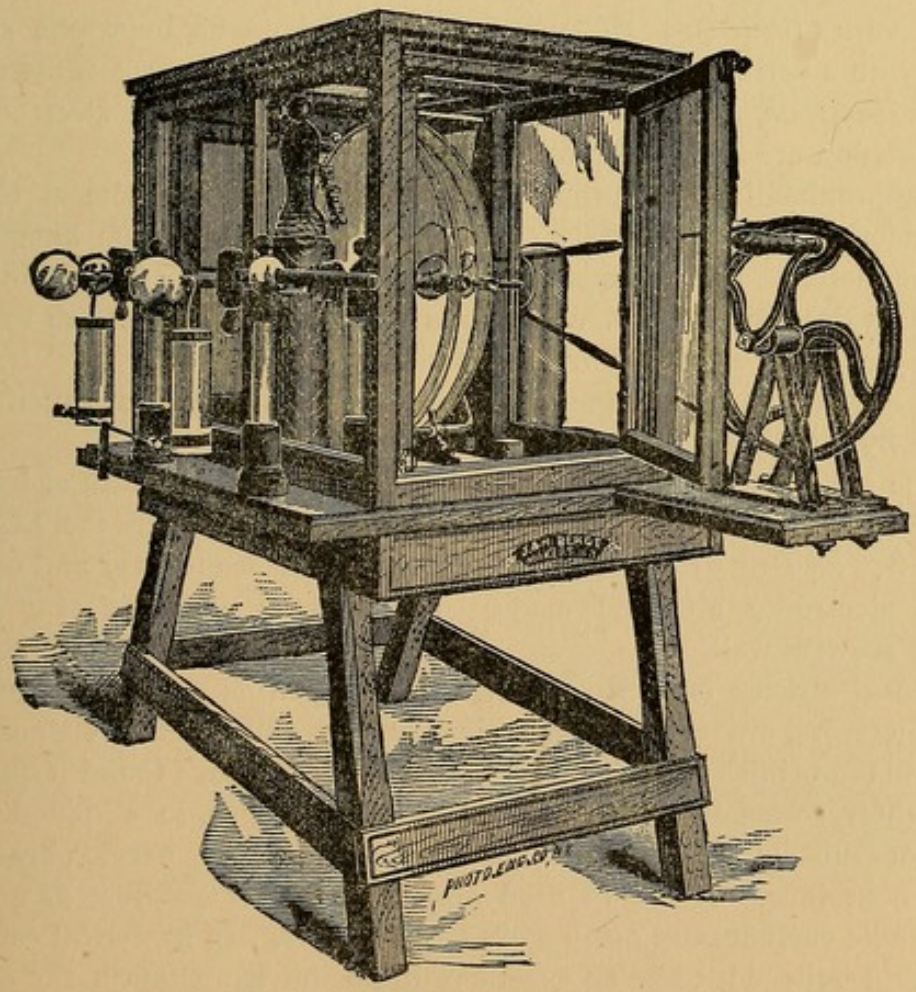
We come now to the practical subject of the different medical batteries.

There are three kinds: The *static*, the *faradic* or induced, and the *galvanic.* Recollect, if you please, that the phenomena in all depend upon the difference of potential in the same hypothetical electrical fluids.

The *Static Electrical Batteries*, used for medical purposes, are all modifications of the Holtz electrical machine. They consist of two (or more) circular discs of glass, one revolving, the other stationary, the latter being perforated with windows. The electricity is generated first by friction. The electrical plate then induces electricity upon its neighboring plate, from which lattter it is conducted off and collected in Leyden jars that hang upon the two prime conductors, the negative to the other. For medical purposes the battery is supplied with an insulated platform upon which the patient sits. The electricity, as it is generated, is conducted from one prime conductor to the platform and dispersed over whatever is upon it. The patient becomes covered, as it were, with a layer of electricity which is at a very high tension, and is constantly trying to escape and find its equilibrium. If the patient sits quiet and is

not touched, he is kept in a kind of electrical bath, the electricity passing off at every point in his body and being continually renewed as long as the machine continues its work. It does not penetrate the body and exercises only a superficial effect upon the cutaneous nerves. If now you connect the other prime conductor with the earth or a gas-pipe, by a chain and then make connection between the earth or another gas-pipe by a second chain, then finally suddenly connect with the patient by touching him with a brass electrode, you complete the circuit. The tense electricity bounds to its zero point with such force that it carries off some of the metallic parts of the electrode, causing a spark.

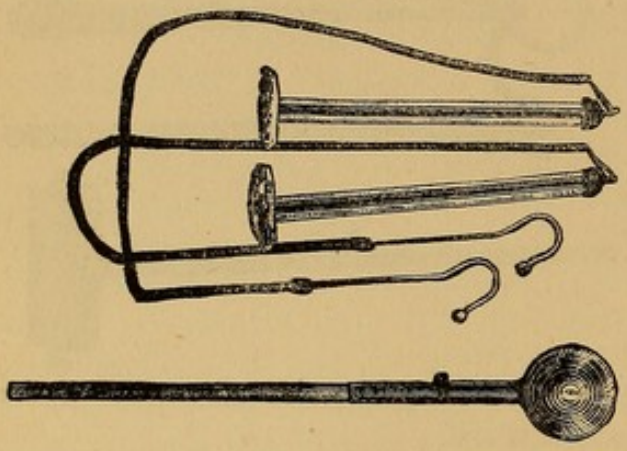




In this way by continually charging the patient and making connections upon him, you can draw off sparks from all parts of the body.

The trouble has always been with static batteries that they could not be made to work in warm weather on account of the moisture of the air. But, of late, better instruments have been made, which are covered with a glass case and which will act all the year round.

The machines are improved also upon the original Holtz model. We have the Carre, the Toepler-Holtz and other forms.



Excellent machines are now made in this country and it is not necessary to import them. J. & H. Berge, of New York City, make machines, one of which I have used for two years and a half, and it has never failed me. Queen, of Philadelphia, also makes a good machine, and McIntosh, of Chicago, advertises them. They are of various sizes. I believe that those with the twenty-two inch plates are large enough, but I would not advise the use of smaller sizes. The cost varies from $150 to $400. The physician who buys one should be supplied with a certain number of electrodes: a medium-sized brass electrode, a wooden electrode, a brass-roller electrode, a sharp-pointed electrode with a ring and chains, are about all that are really needed.

By approximating the prime conductors so that they almost touch, and then connecting the outer surface of the two Leyden jars which hang from the prime conductors, with sponge electrodes, you can get the static induced current, first described by Dr. Wm. J. Morton, who has done much to popularize the use of static electricity in medicine.

This induced current has no special peculiarities and is not superior to that furnished by faradic batteries.

If you get a static machine, see that it will generate a spark at least seven or eight inches long between the two prime conductors when the Leyden jars are on. See also that the connections of the prime conductor and of the discharging electrodes are well made. Connections with different gas-pipes generally answers well.

Static electricity is at a very high tension, but is small in quantity. Its effects, therefore, are chiefly mechanical and—owing to the violence of the shocks and the brilliancy of the sparks—psychical. I have found it quite useful in the lighter forms of rheumatic and neuralgic pains, in stiffened joints of chronic or subacute rheumatism, in sciatica, lumbago, cervico-brachial and occipital neuralgiæ. It may be used also in paralyses with just as good effect as the faradic currents and often more conveniently. In hysterical cases it also acts well. I believe it to be an excellent tonic and can confirm the opinion of French electro-therapeutists, who regard it as producing similar effects with hydrotherapy. It is claimed to have a sedative effect in spasmodic conditions, but of this I have seen no illustration. It is a good cutaneous and muscular

stimulant and counter irritant, and produces effects by acting on the imagination, which are just as good as if they were produced in any other way.

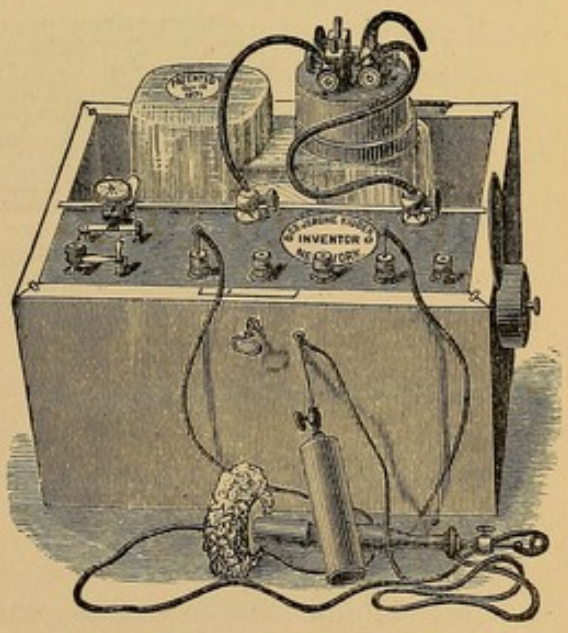
You should treat the patient for from fifteen to thirty minutes at each seance, and repeat the seances daily at first. If you wish to lessen the strength of the sparks, put one foot on the platform or use a wooden electrode.

In warm weather have a piece of dry flannel and lay it over the part from which you are drawing the sparks.

In *Faradic Medical Batteries*, the electricity is produced by induction. The chief elements are a cell, and two coils of insulated copper wire. One coil is placed around the other, and the outer coil is longer and of finer wire. The cell which generates the original current does not generate the electricity which is received by the patient. This fact is not generally understood. This original current is so arranged that it is being constantly broken and closed again. At both break and make, a current is induced in the coiled wire. In the first coil, the current of "making" is sent through the battery-cell itself, and not through the patient. The current of breaking is, however, sent through the conducting cords of the electrodes and thus through the patient. This is called the primary induced current, and it is, as you see, made up of a succession of very short induced currents, all flowing in the same way; thus the current is always felt more strongly at the negative pole than at the positive. Hence by taking hold of the electrodes you can at once distinguish between the two.

Apart from the greater strength of the negative pole, however, we cannot say that it has any different physiological effects.

Every time that a current in the primary coil is induced, it induces a secondary current in the outer coil, of an opposite direction. As a result there is produced in the outer coil a constant succession of to-and-fro-currents, which can be conducted through the patient. The current of the outer coil is a to-and-fro one therefore, and has no positive and negative pole. It is stronger and has more tension than that of the primary coil. It is said by the French electro-therapeutists, to have less quantity and to be different in its physiological and other effects. This is not the case, however. Aside from its greater tension, or strength it has no therapeutical properties different from those of the primary coil. Some electrical instrument-makers have other coils which have a third, and even a fourth, induced current.



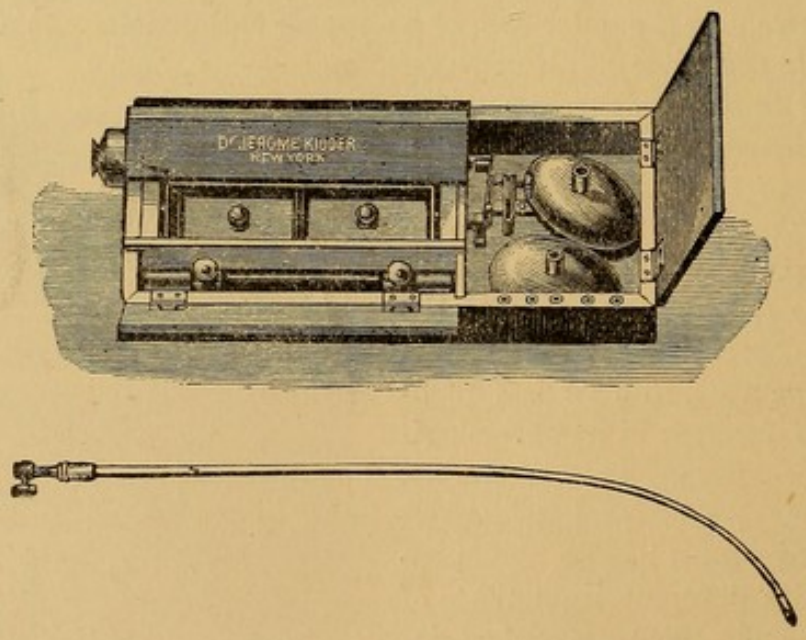
I know of no advantage in these, however. All that you want in a faradic battery is a primary and secondary current, and finally a union of the two, which is stronger than either separate. The strength of the different currents

is modified by metal tubes which slip over the coils, and which, by interfering with induction, weaken the currents. You will observe that the faradic coils have in their centre a bar of soft iron, which becomes magnetized and demagnetized, and this strengthens the induced currents in the coils. All the batteries have, also, a hammer, or spring lever for automatically breaking and making the current.



Good faradic batteries are now made by a great many firms. Kidder, the Galvano-faradic company, Waite & Bartlett, Stammers, in New York; Fleming, in Philadelphia; McIntosh, in Chicago, are some of the better known firms. The batteries are very much alike. Most of them are run by the Grenet-cell of zinc and carbon, with an acidulated solution of bi-chromate of potash as a fluid.

Kidder uses the Smee-cell. I have recently devised and shown you a coil which is made so that it can be run by a single open-circuit cell, devised by Haid and sold by Bergmann & Haid, and by Stammers, of this city. The cell is a modification of the Leclanché, and is known as an open-circuit cell. The coil is small, portable, and can be carried separate from the cell. The advantages of this form of battery are that it requires less attention,a very rare renewal of zincs, and is cleaner and more portable. It is also very cheap, costing from $7 to $10. The main things to be looked out for in selecting a faradic battery are to have the interruptions by the automatic lever smooth and even, and to

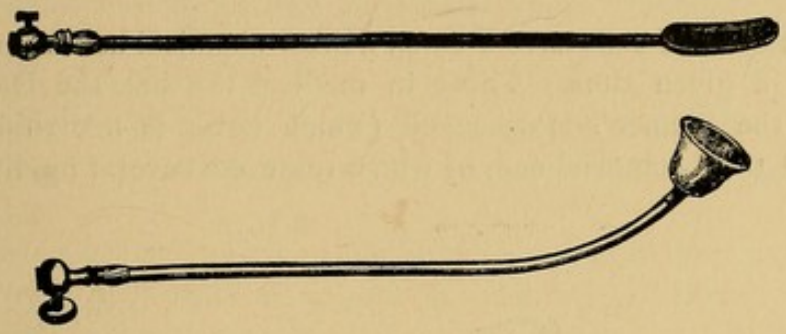


have the cell one which does not easily get out of order. Some batteries are made so that you can have slow or rapid interruptions as you wish, and it has even been claimed that in certain forms of paralysis you should only use the slow interruptions. I have never been able to find cases where slow interruptions were of any perceptible advantage, and there are no theoretical grounds for supposing that they would be so. If you get a smooth rapidly interrupted

current, it will, I believe, answer all the purposes for which a faradic battery is intended.

The small pocket batteries, made on the model of the Gaiffe batteries, are convenient for occasional use. But they are not very strong and do not last very long if frequently used.

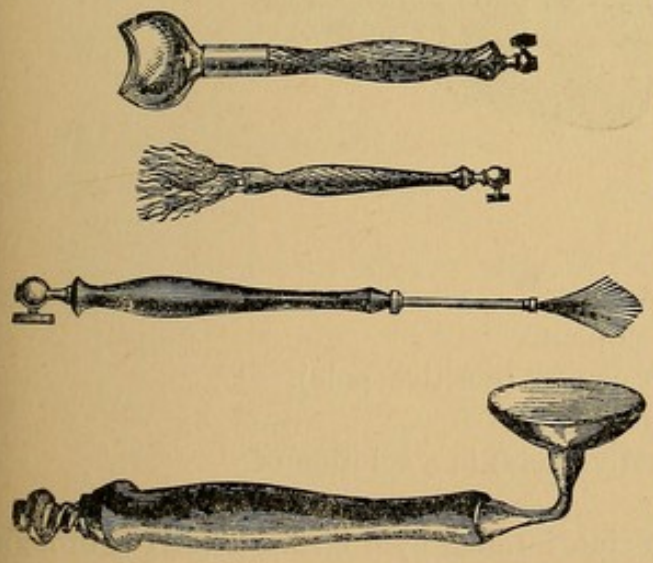
Electro-magnetic batteries, in which the currents are generated by revolving magnets, are not used now, as they are harsh and disagreeable.



The magnetic battery with roller electrode, devised by Dr. John Butler, is, however, quite a useful thing for general faradization.

The French chloride of silver batteries are apt to get out of order, and I have not met any one in this country who recommends them.

As regards accessories, you should get two carbon-pointed, sponge-covered electrodes of moderate size; also one very small carbon electrode, and one very large one made of annealed brass, covered with sponge, backed with rubber and measuring six inches by four. You need also a metallic brush, and one of the handles to the electrodes should have an interrupter. In using the battery be sure that the electrodes are well moistened with warm water. You may add a little vinegar or salt to the water if you wish, but it is not often necessary. If you are very anxious to get contractions, or deep effects, lay a cloth moistened in the salt water on the skin, and let it stay there for twenty minutes. Let the current pass for some time also, for the skin becomes a better conductor the longer the current runs through it.

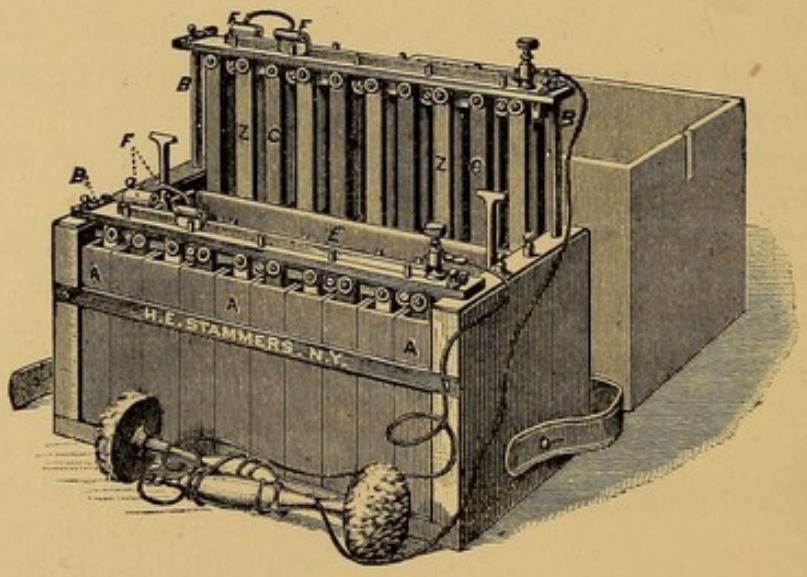


You must remember in seeking for therapeutical effects with the faradic battery, that induced electricity is one of high tension and small quantity, like static electricity. Consequently its effects are primarily mechanical and counter-irritant. You can contract muscles, arouse nerve impulses, effect circulatory changes, and produce important reflex effects.

Galvanism. Much labor and ingenuity have been spent in devising cells for

the generation of electricity. The number in use is large, and I cannot attempt to enumerate them all, or discuss their various merits. For medical purposes we have now two kinds. The one includes the cells which act constantly when the current is closed. The other includes those which act whenever the elements composing the battery (*e. g.*, zinc, carbon, platinum, copper, etc.,) are both in the common fluid. The former class (known as two-fluid cells) are not touched except to renew water or add some chemical. In the latter (the single-fluid cells) one of the elements is always taken from the fluid when the current is in use.

The first class of cells have a much weaker chemical action, and evolve less electricity in a given time. Those in medical use are the Daniell cell, the Gravity cell, the Siemen's-Halske cell (which latter is a modification of the Daniell), and the Leclanché cell, of which there are several modifications.



The Daniell cell consists of

(1) A glass vessel containing,
(2) A sat. solution of cupr. sulphat.
(3) A perforated cylinder of copper (positive pole).
(4) A porous clay vessel containing,
(5) Amalgamated zinc (negative pole) in a solution of
(6) Dilute sulphur. acid.

The sulphuric acid acts on the zinc, forming hydrogen. The H is brought over to the copper pole, where it unites with the copper sulphate to form copper and sulphuric acid. Hence in Daniell's battery the sulphuric acid and copper plate are not used up. Only the zinc and sulphate of copper are used.

Other batteries on the same principle are:

Grove's, which has nitric acid and platinum, instead of sulphuric acid and copper.

Bunsen's, which is like Grove's, but has carbon instead of platinum.

The Gravity cell; it is constructed in various ways, one of which is as follows: A cylindrical glass jar is about three-quarters filled with a solution of zinc sulphate. In the bottom is placed a piece of copper, to which is fastened the end of a piece of insulated wire, and this wire is led up above the edge of the jar. Some lumps of copper sulphate are thrown on the copper plate, and then a piece of zinc is suspended in the jar, so that its under surface is about half way from the bottom of the jar. It is found that the difference in the specific gravities of the copper and zinc solutions is sufficient to keep them apart, and it is from its being so constructed as to take advantage of this fact that the cell has its name.

The Siemens-Halske cell is similar to the Gravity battery, except that a diaphragm of paper-maché is used to still further ensure the separation of the two solutions.

In the Leclanché battery manganic dioxide replaces the nitric acid in a Bunsen's battery, and chloride of ammonium solution the dilute sulphuric acid.

These batteries have a different electro-motive force and different internal resistance.

They may be classed as follows, according to Mr. Delafield (Archives of Medicine):

Low Resistance.	High Electro-motive force.	Constancy.	Little trouble for short use.	Little trouble for long use.
Gravity (very large).	Leclanché.	Gravity. Daniell.	Dipping, Grove, Bunsen.	Leclanché, Gravity, Daniell.

The Siemens-Halske has about the same properties as the Gravity. When ordering your cells get large jars, and have them covered so as to prevent evaporation.

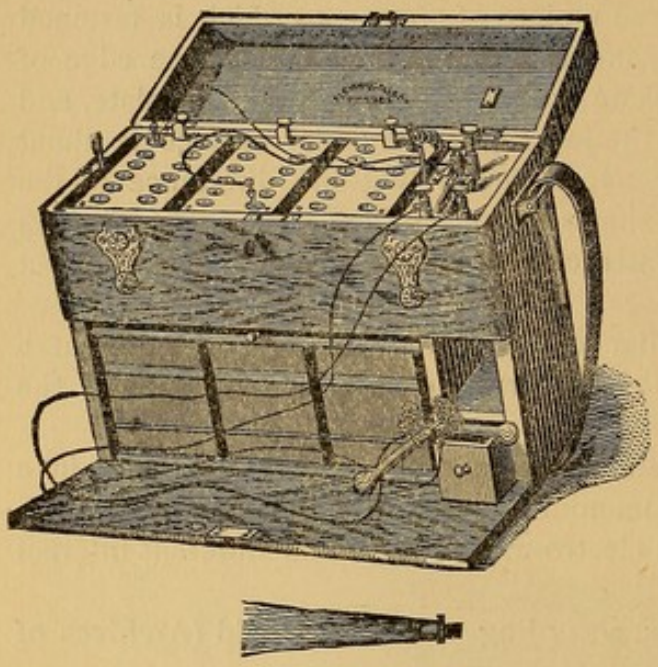
The electro-motive force of some of the different cells is about as follows:

Grove	1.80 volts.
Bunsen	2. "
Dipping	2. "
Leclanché	1.50 "
Gravity	1. "
Siemen's-Halske	1. "

Among the second class or single-fluid cells, the zinc-carbon cell, known as the Grenet or Stohrer's cell, already referred to, is most used. The Sinee cell is also a popular one for generating induction currents.

If you intend to purchase a galvanic battery, the first question is whether you shall get a stationary battery of two fluid cells, of the first class above de-

scribed, or a portable battery of the single-fluid or zinc-carbon cells. My advice always is to get a portable battery first, because it will supply a larger range of needs; then get a stationary or office battery later, if possible, because they are more convenient to use, are more powerful, and probably will furnish better therapeutical effects.



If you decide to get a portable galvanic battery, any of the manufacturers whose names I have referred to, will supply one. In selecting a battery do not get one with less than thirty or thirty-six cells. It is a mistake to buy the cheaper and smaller batteries. For although twenty cells will answer for most purposes, you may at any time find that thirty-six cells will do what nothing else will.

All the portable galvanic batteries made in this country, so far as I know, that are of any value, have the zinc-carbon cell. In some the cell is larger, in some smaller. The smaller cells do not last quite so long, but the difference in current strength is imperceptible. Be sure only that you get a battery which is simply made and has good connections, and that there is an apparatus for reversing the current. An apparatus for causing rapid interruptions is also a useful thing. Hydrostats to prevent the fluid from spilling are not absolutely essential.

I do not advise you to get a combined galvanic and faradic battery, because these make the faradic apparatus less portable and you can buy the two batteries separately for nearly the same amount of money. McIntosh, Waite, and Bartlett, and the Galvano-Faradic Company and Kidder all make these combined batteries.

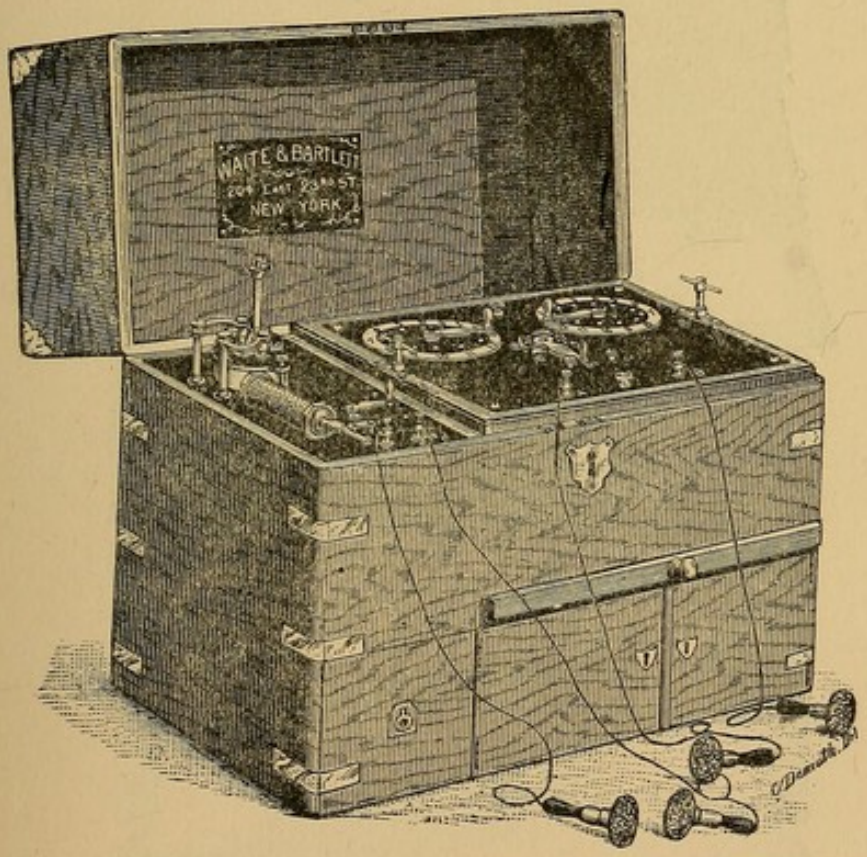
If you decide to have an office or stationary battery, your choice will be between the Daniell or Siemens-Halske's cell, the gravity cell and the Leclanché, or its modification, Bergmann & Haid's. The gravity-cell is the cheapest, costing only about sixty cents, the Siemens-Halske cell is perhaps a little more durable. The Leclanché has a greater electro-motor force, and fewer cells are needed, but it is more expensive. It cannot be used more than twenty minutes at a time without becoming polarized and injured. In my own office I have used the gravity cell, and with satisfaction. One does not often need more than forty Leclanché cells, or more than eighty gravity cells.

The accessory apparatus for galvanic batteries consists of the same electrodes above mentioned. This is really all that is generally needed. You can, however, supply yourself with special electrodes for the eye, ear, tongue,

throat, and urethra, etc. You can also, with advantage, use a very large long electrode for the spine. Electrodes with an apparatus in the handles for reversing the current are also sometimes very useful.

No galvanometers are yet made in this country which are of very much value.* They indicate the presence and direction of the current, but that is all. If you wish a cheap galvanometer, buy a compass for a dollar. Get a dozen yards of fine insulated copper wire, wind it over a flat spool, and connect each end of the wire with your battery; place the compass upon the coil and pass the current through it and observe the deviations of the needle.

For practical purposes, the best way to test the presence and strength of galvanic currents is to hold one electrode in the hand and touch the other to the forehead. This should always be done before galvanism is applied to a patient's head.



Other accessories to the galvanic battery are a rheotome, which is an instrument for breaking, and if need be, reversing the current, and the rheostat, an instrument for interposing resistances in the circuit and gradually changing the current strength. These things are always recommended by electrotherapeutists.

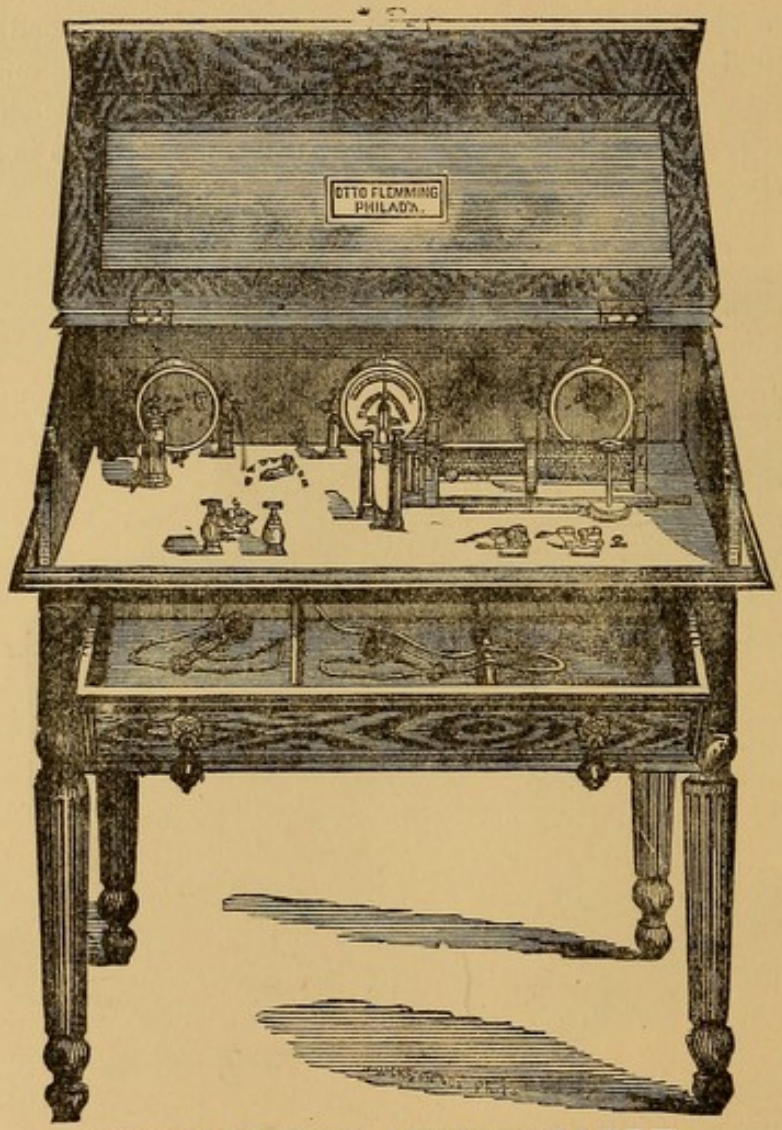
In using galvanic batteries, care must be taken of them to see that the

* Endelmann now claims to make an absolute galvanometer measuring in milleamperes, which is spoken highly of. (R. Lewandowski, Electro-Technick, Wein, 1884.)

Gaiffe, of Paris, makes a galvanometer which measures in milliwebers and is not much commended. (Op. cit. and R. H. Pierson, Electrotherapie.)

fluids are not spilled, or too far evaporated, and connections are not destroyed. With ordinary use the zinc-carbon cells last several months, then the fluid has to be renewed. With care the zincs will last very much longer. Occasionally the elements should be taken out and washed in hot water.

In using the galvanic current, remember that it is a current of low tension and great quantity, and that its effects are much deeper and more potent than those of the faradic current. There is a marked difference between faradic and



PERMANENT OFFICE TABLE,

For Physicians' Offices, Colleges, Hospitals, &c.

galvanic currents, despite the contrary opinion of Dr. H. C. Wood in his classical work on materia medica and therapeutics. If you do not believe it, apply the two to the head, rapidly intermitting the galvanic current if you wish. The one hurts, but the other knocks you down. Galvanic currents have more than a simple mechanical and excito-reflex effect. They produce more profound changes in tissue irritability, excite chemical action and induce other electrical currents, besides stimulating nerves, muscles and glands. Galvanism is especi-

ally valuable, as you know, in treating diseases of the internal viscera which it alone appears to reach effectively.

In using galvanism do not forget that the direction of current has probably nothing to do with physiological or therapeutical effects. It is the peculiar action of the poles, not the current direction that you are to utilize. Therefore, always use your large electrode upon some indifferent place, and apply the other electrode to the affected part, using the positive pole, with gradually increasing and decreasing currents, for sedative effects; the negative pole, or alternating poles, with interrupted currents for stimulant effects.

For deep-lying organs use two large electrodes. The little electrodes ordinarily furnished are often very nearly useless. Large electrodes, if needed, the polar method, frequent repetition of short or long seances, cautious use of current strength, these are the things you should bear in mind in using galvanic batteries.

Galvanism and faradism should be given from two to seven times a week. The seances should last, if you wish to give tonic effects, fifteen to thirty minutes. When applied to special organs or viscera, three to eight minutes is long enough. In chronic cases you should continue treatment for six to eight weeks, then wait for a few weeks and begin again.

ON THE TREATMENT OF NEURALGIA.

SUMMARY.—Definition—Pathogeny and Causes of Neuralgia—Influence of the Nervous System—Influence of the Circulation—Influence of Diseases of the Blood—Treatment of the Neuralgias—Symptom Treatment—Nervous Medicaments—Morphia—Atropin—Chloral—Chloroform—Injections of Chloroform—Aconite and Aconitine—Gelsemium and Gelsemine—Electricity—Hydrotherapy—Surgical Treatment—Neurotomy—Neurectomy—Nerve Stretching—Revulsive Medication—Cutaneous frictions—Vesicatories—Cauterization—Injections for Local Effect—Acupuncture—*Reveilleur de la Vie*—Aquapuncture—Galvano-Puncture—Empirical Medication—Phosphorus—Guarana—Sulphate of Copper—Pathogenic Medication—Essential Neuralgias—Bromide of Potassium—Neurites—Revulsion—Congestive Neuralgias—Aconite—Neuralgias by Anæmia—Morphia—Dyscrasic Neuralgias—Chlorosis—Arsenic—Intermittent Neuralgia—Quinine—Syphilitic Neuralgia—Arthritic, Dartrous Neuralgia—Treatment of Certain Varieties of Neuralgia—Neuralgia of the Foot—Sciatica—Uterine and Vesical Neuralgia—Ileo—Lumbar Neuralgia—Intercostal Neuralgia—Trifacial Neuralgia—Odontalgia—Tic Douloureux—Migraine.

GENTLEMEN: I propose devoting this lecture to that very common affection which you will often have occasion to treat, and the therapeutics of which you ought well to understand—neuralgia.[1]

Despite the recent extensive researches into the functions of the nervous system, we have not yet precise and certain data concerning neuralgia, and we are compelled to define this affection by the principal characters[2] which it

[1] It is to Cotugno, in 1765, that we owe the first description of neuralgia. He describes sciatic neuralgia, and attributes it to an acrid liquid, which, issuing from the spinal canal, descends along the nerve.

Nevertheless long before the appearance of this work the ancients had certain notions concerning neuralgia; Hippocrates, Aretæus, Celsus described the symptoms; Aretæus in particular knew facial neuralgia; in 1756 André gave a good description of this neurosis.

We must come down to the commencement of this century before we obtain certain data respecting the neuralgias. In 1821 Chaussier published his work in which he gives an excellent account of neuralgia; then comes the important treatise of Valleix, who has rightly insisted on the *points douloureux*, which are in his estimation characteristic of this neurosis. Since then works have multiplied, and we may cite especially, in Germany, those of Nothnagel, Erb, Eulenburg, Rosenthal; in England, the treatise of Anstie; in Belgium, that of Vanlair; and in France, those of Vulpian, Charcot, Lasegue, Fernet and Landouzy, Rigal, Hallopeau and Martinet. (*a*)

[2] There have been several definitions given of neuralgia (*neuron*, a nerve; *algos*, pain) The best known are the following: "Neuralgia consists in a pain, more or less violent, having its seat on the tract of a nerve, and disseminated by circumscribed points, veritable

(*a*) Dominicus Cotugno, De ischiade de nervosa Commentarius, Naples, 1764; Chaussier, Tableau Synoptique des Nevralgies, Paris, 1822; Valleix, Traité des Nevralgies, Paris, 1842; Martinet, Essais sur les Nevralgies, (th. de Paris, 1878, No. 70;) Rosenthal, Beobacht, über Neuralgien, 1874; Erb, Galvano therap., Mittheilungen (Arch. f. Klin. Med., III, 1867); Northnagel, Storungen bei Neuralgien (Arch. für Psych., II. 1869;) Eulenberg, Functionelle Nervenkrankh., 1871; Anstie, Treatise on Neuralgia, London and New York, 1871; Lardouzy and Vulpian, Lecons sur l. Appareil Vaso-Moteur, second vol.; 1876; Hallopeau, Art Neuralgia in Diction, de Med. Prac.; Rigal, Causes and Pathogeny of Neuralgia, 1870, Vanlair; Les Nevralgies, leurs formes et leur traitement, Bruxelles, 1882.

presents, and neuralgia is still a symptom rather than a pathological unity. Without entering here into a discussion respecting the relations of the structural diseases of nerves, and the neuralgias, which are veritable neuroses, I believe that the symptom known as pain is produced whenever there is molecular alteration or modification of sensory nerves. I do not believe in "essential" neuralgias, and I am persuaded that when we come to understand better the physiology and pathology of the nervous system, that word *essential*, which only conceals our ignorance and uncertainty, will disappear from the nosological category.

What is of importance for us to know from its bearing on the treatment of the neuralgias, is the pathogeny and etiology[3] of this affection; on this point

painful foci, from which stream forth at variable intervals lancinating pangs or other like sensations of distress, and on which points, a certain amount of pressure is more or less painful."—Valleix.

The following is from Fleury and Monneret: "Neuralgia is a neurosis of sensibility, or, in other words, a painful neurosis; an apyretic disease, intermittent or remittent, irregular or periodical, fixed or readily shifting, having its seat in some point of the sensory nervous system, cerebro-spinal or tri-splanchnic; principally characterized by a very severe pain, which follows the course of the superficial nerve branches, or makes itself felt in the deep viscera; is accompanied by functional troubles which vary according to the organ affected, and cannot be explained by any appreciable lesion of the nervous tissue."

Spring thinks that in order that the word *neuralgia* should be applicable to any particular case, there should exist two conditions: (1) "the pain should be paroxysmal in character; (2) there should be no peripheral or central lesions present."

As Lereboullet has remarked, neuralgia can only be defined by its symptoms, and then we are forced to include under the same definition several distinct affections.

Axenfeld has given the following definition: "Neuralgia is an affection of the cerebro spinal nerves with this peculiarity, that generally the suffering is, or appears to be, limited to the tract of their trunks, branches or ramuscles."

Anstie thus defines neuralgia: "A disease of the nervous system, manifesting itself by pains which, in the majority of instances are unilateral, and which appear to follow the course of certain nerves, ramify sometimes into a few, sometimes into all the terminal branches of those nerves."

Vanlair has given a different definition, and which is as follows: "An affection whose essential symptom consists in a paroxysmal pain, recognizing for its cause a special and still undetermined alteration of the elements proper of the cerebro-spinal or ganglionic nervous tissue." (*a*)

[3] Monneret and Fleury have divided the causes of neuralgia into (1) predisposing, (2 determining.

Jaccoud classes them into three groups: 1. Intrinsic and primitive modification of the excitability of the nerve, from its nucleus of origin to its terminal expansions: 2. extrinsic lesions which act directly or reflexly: 3. Constitutional condition which modifies the nervous excitability, generally by the intermediation of the alteration of the blood.

Rigal classes the causes as follows: 1. General causes (age, sex, heredity)· 2. Causes which act directly on the nerves (traumatism, compression): 3. Causes which act through

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(*a*) Monneret et Fleury, Art Nevralgie du Compendium. Spring, Symptomatologie, t II, p. 80. Lereboullet, Dict. des Sc. Med. Art Nevralgie. Axenfeld, Des Nevroses, Paris, 1864, p. 156. Anstie, Neuralgia and Diseases that Resemble it, London, 1871. Vanlair, Op. cit., 1882, p. 5. Axenfeld et Henri Huchard. Traité des Nevroses, p. 34, Paris, 1883.

I must dwell briefly. I have told you before that in order that the functions of the nervous system may be regularly and normally performed, three conditions must be fulfilled; there must be: 1. Integrity of the nervous system itself, cells and fibres; 2. Integrity of the circulation; 3. Integrity of the nutrient blood. The sensory system of nerves is no exception to this law, and every circumstance, whether connected with the state of the blood or the blood-vessels, which modifies these nerves or their centres, may give rise to pain. Let us consider each of these conditions separately.

From the standpoint of the nervous system, all alterations, from the profound modifications of neuritis to simple molecular disturbances, may be the point of departure of the clinical syndrome described under the name of neuralgia; wounds of nerves, irritation, compression of nerves, inflammation of the neurilemma, neuritis properly so-called, are all so many causes of persistent neuralgias. It has even been claimed that rebellious neuralgia is always neuritis. In my opinion, if inflammation of a nerve sometimes gives rise to a stubborn neuralgia, we are not to conclude from this that every persistent neuralgia is of inflammatory origin, for some quite obstinate facial neuralgias have a different origin.

As for circulatory troubles, they have a manifest influence on the production of neuralgic phenomena, and in this regard two sorts of neuralgia may be distinguished; those which result from want of blood—anæmic neuralgias, and those which result from excess of blood—congestive neuralgias, to which Gubler first called attention.

It is to these disturbances of the circulation that neuralgias due to the impression of cold have been referred, and which are so frequent. Some explain them as the result of anæmia of the cutaneous extremities of sensory nerves, others as the result of congestion of the nervous centres. The question is more complex than one would suppose, and it is impossible at the present day to decide in one way or the other. Lastly, in certain cases neuralgias originate in alterations of the blood. Thus chlorosis, malarial and other blood-poisoning conditions, and diatheses, such as gout, may give rise to veritable dyscrasic neuralgias. Whether the cause may be changes in the blood, circulatory disturbances, or some alteration in the nervous system itself, these divers modifications may affect the sensory nerve in three points of its course; its periphery, some part of the main trunk, or its central termination.

At the periphery, every cause which, through traumatism or atmospheric changes, modifies the terminal sensory fibre, may determine a neuralgia which shall spread to all the ramifications of the nerve. As an example, I refer you

the medium of the blood (diathetic and infectious diseases): 4. Causes which act by sympathy or reflexly: 5. Associated causes: 6. Unknown causes.

Hallopeau studies the causes under two heads, *predisposing* and *occasional*. The last are divided into three groups: 1. By direct lesions of the nerves or their roots: 2. By lesions more or less remote: 3. By general diseases. (*a*)

(*a*) Monneret et Fleury, Compendium de Med. pratique. Jaccoud, Traité de Pathologié Interne, t I, p. 451. Rigál, Causes et Pathogenie de la Neuralgie, p. 12, 1872. Hallopeau, Art, Nevralgie in Nouveau Dictionaire de med, et de chir.

to dental neuralgia. A carious tooth produces some alteration of the dental pulp, and an irritation spreads along the dental nerve, causing pain in all the branches of the trifacial. The annals of medicine are full of similar facts, where we see neuralgias persist for years, in consequence of the presence in the tissues of foreign bodies which irritate the peripheral extremities of sensory nerves, But in order that there may be a painful sensation, a sentient cell must be touched ; and this is a point on which Vulpian, Anstie, and especially Vanlair,[1] have insisted. It is then well understood that if theoretically there exist peripheral neuralgias, yet in order that there may be phenomena of pain the neuralgia must be central.

These preliminaries being settled, we will now enter on the treatment of the neuralgias; but in order to pass in review the numerous therapeutic measures recommended in these cases, I shall be obliged to establish a certain number of divisions. Therapeutic agencies applicable to neuralgia may be classed in two distinct groups—the one is addressed to the symptom pain which characterizes the neuralgia, this is symptom treatment ; the other is directed to the cause of the pain, this is pathogenic treatment.

Symptom treatment is subdivided into three groups. In the first are placed all medicaments which act by modifying more or less profoundly the functions of the nervous system, and which are described under the name of hypnotics, anæsthetics, analgesics, anti-neuralgics, etc., such as opium, chloral, chloroform, and aconite. The second group contains medicaments which act by substituting for the pain, another pain, and constitutes revulsive or substitutive medication; we place here vesicatories, cauterizations, etc. The third group contains substances which experience has shown to have powerful anti-neuralgic properties, but the mechanism of whose action is not known, such as turpentine, guarana, and sulphate of copper.

I shall first briefly examine the medicaments of the three divisions of the

[1] Vanlair has given a good physiological and clinical analysis of pain. It depends on alteration of the normal sensibility but is not itself this alteration. The latter is called *algesia* and pain is but the conscious expression of it. We must, he says, distinguish hyperesthesia from algesia; the one is exaltation of sensibility, the other is objective pain. In order that there may be pain, according to Vanlair, there must be molecular modification in the central ganglia. Neuralgia depends on a change in the state of the sensory cell. These aphorisms sum up his views concerning pain:

I. Notwithstanding the variety of its expressions, pain is one in its essence.

II. It takes place without the intervention of the terminal apparatus of the nerves.

III. Painful sensations have not special fibres subservient to their transmission.

IV. But there exist nerve cells exclusively charged with the exercise of algesic sensibility.

V. Moreover these cells, destined primitively for another function may become in certain conditions centers of pain.

According to Jewell neuralgia has always a central cause while its seat is in the sensorial tract. The nerve cells of the sensorial tract are modified in their nutrition, and this modification is the efficient cause of neuralgia. (*a*)

(*a*) Vanlair, Les Nevralgies, leurs Formes et leur Traitement, 1882, 2d ed.. p. 48. Jewell, Pathology of uralgia (Journal of Nervous and Mental Diseases, April, 1877.)

first group, then the bases of the pathogenic medication, and finally shall take up, in order, certain forms of neuralgia and their treatment.

In the first group stand prominently forth, opium and its derivatives, chloral, chloroform, aconitine and gelsemium, electricity and hydrotherapy.

Opium is undoubtedly one of the means the most employed in the treatment of pain in neuralgia, and since the introduction into medicine, by Wood, of hypodermic injections, it may be truly said, that it is on subcutaneous injections of morphia that we rely most to subdue pain, or at least to obtain temporary alleviation.

Is it necessary to make the subcutaneous injection *in loco dolenti?* Some, and Chouppe in particular, have answered this question affirmatively. I do not think so. If morphine relieves neuralgia, it is not by any local action on a nerve or nerves in a painful region, but by modifying the sensory nerve-centre; the anodyne must first enter the circulation and be carried to the heart, then sent to the cerebro-spinal axis, before it can have the effect sought. The injection then may be made with equal advantage on the thighs, hips, or the fleshy part of the arm, wherever it can be made the most easily.

You may use Magendie's solution made with cherry-laurel water, or any other good menstruum that will not ferment; the average dose being one or two centigrammes. Constantine Paul recommends water that has been boiled. If you use common water, mucedines will be sure to form in your solution after a few days. Bardet has shown that these aid in the transformation of morphia into apomorphia.

These sub-cutaneous injections, which have supplanted all other modes of administration of opiates in the treatment of neuralgias, have one great disadvantage, and only one—the patient easily becomes habituated to them, and resorts to the hypodermic syringe, not to obtain relief from pain, but an excitation which henceforth becomes a necessity. That will be a curious chapter of pathology, which shall describe the progress of morphomania in our times; it will show that it has almost always been the case that inveterate and deplorable habits of morphia-taking have had their origin in the use of hypodermic injections of that anodyne in the treatment of neuralgia.

When the hypodermic method was first introduced, Wood, in Great Britain, and Behier, in France, employed atropine, but this medicament was soon abandoned on account of the dangers which it presented, and the delirium which frequently followed its use. At the same time you may derive benefit from the association of the two medicaments, and I recall to your remembrance the formula which I habitually use:

℞.—Sulphate of atropine..... 0.01 (gr. $\frac{1}{6}$).
Hydrochlorate of morphia..... 0.10 (gr. iss),
Cherry-laurel water..... 20.00 (℥ vss).

M.—

A cubic centimetre (15 m.) or about a syringeful of this solution contains half a milligramme ($\frac{1}{120}$ gr.) of atropine, and a half a centigramme ($\frac{1}{12}$ gr.) of morphia.

It has been asserted that injections of plain water would relieve pain as effectually as injections of morphia, and Dieulafoy has given his support to this statement. I showed in 1872 that only injections of morphia can be relied upon to calm the pain, and that an occasional anodyne effect produced by injections of water, is due to distension or rupture of certain muscular fibrillæ.[1]

Chloral is one of the best anodynes we possess; it has only one inconvenience, that it cannot be administered a great while to the same individual without determining by its caustic and irritant action a chronic inflammation of the digestive tube. Therefore, I have recommended, in order to obviate this inconvenience, to give the chloral preferably by enema; the following combination administered *per rectum* will do good service. Take the yolk of one egg, beat it up in a gill of milk, and dissolve one or two grammes of chloral. Administered in this way, the chloral, however, in a few days irritates the rectal mucous membrane, and must be suspended.

Certain derivatives of chloral have been proposed as a substitute, and croton-chloral has been especially vaunted by Liebreich, Benson Baker, and others in Germany and France. Croton-chloral and butyl-chloral are given in the dose of thirty centigrammes to one gramme every three hours, till the paroxysm disappears; despite the advantages which this remedy possesses in-tic douleureux, it is little used in the treatment of neuralgia.[2]

[1] The fact that intense pain is sometimes relieved by a hypodermic injection of water, has been attested by a great many observers. Gubler, who has many times witnessed the phenomenon, explains it as the result of local infiltration, not only of the cellular tissue, but of the histological elements as well. There are degrees of hydration of the tissues, and there is a marked relation between this hydration and divers modes of sensibility; witness cases of anasarca, in which the infiltrated tissues are relatively insensible, as you will see by testing the sensibility over the œdematous parts, and over the surrounding region not invaded by the anasarca. The aqueous injections succeed the best, according to Gubler, in those neuralgias which are called congestive.—*Vide Cours de Therapeutique*, p. 238, Paris, 1880.

The whole subject is far from being clear.—TRANS.

[2] Croton-chloral is obtained by the action of chlorine on aldehyde. By constitution it is a chlorated aldehyde of crotonic acid. Liebreich has studied its physiological action; its hypnotic effects are due to decomposition in presence of alkalies into bichlorallyline, which acts on the brain and spinal cord.

Croton-chloral is little soluble; it has been employed in the treatment of neuralgias by Benson Baker and Skerrit. The latter administered it in the form of pills, in the dose of 30 centigrams (about 5 grs.) every three hours, and he has thus given five and even six grammes a day (75 to 90 grains). Croton-chloral often causes vomiting. Gray combines croton-chloral with bromide of potassium in the following formula:

℞. Croton-chlor... 1 gr. (gr. xv).
Bromide pot... 4 " (ʒ j).
Water..... 250 " (ℨ viij & gr. xv).
M.

M. Signa. A teaspoonful every two hours till the pain is relieved.

Worms employes the following formula:

℞. Croton-chloral.. 1 gr. (gr. xv).
Glycerine..... 60 " (ℨ ij).
Water..... 60 " (ℨ ij).
Essence menth. Pip. q. s. to fla.
Syr. simp..... 25 " (ʒ vi & gr. xv).
M.

M. Signa. A tablespoonful every two hours.

Chloroform is also in current use in the treatment of neuralgia; it is employed almost exclusively locally, occasionally, however, by inhalation in the case of neuralgias that are horribly painful. Locally it is used in the form of liniment, or injected subcutaneously. Aran, Dupuy, De Frenel, and others, advised a long time ago to treat neuralgias locally by compresses wet with chloroform, and recently Brown-Séquard has experimentally demonstrated the analgesic action of these local applications. But it is especially in hypodermic injections that this medicament gives good results.[3]

Introduced into therapeutics by Roberts Bartholow, of Philadelphia, then by Doe, of Boston, the usage of subcutaneous injections of chloroform did not become general in France till Ernest Besnier made his favorable report.

Weill counsels the use of the following preparations, potions and pills:

℞. Croton-chloral..... 2 grammes (ʒ ss).
Glycerine..... 6 " (ʒ jss).
Ext. licorice..... 4 " (ʒ i).
Syrup } ää..... 45 " (℥ iss).
Aquæ }
M. Sig. A tablespoonful as often as required.

℞. Croton-chloral, }
Licorice powder, } ää..... 1 gram (15 grains).
Conserve of roses. }
M. F. S. A. pill, No. xx.

Leoni's potion is as follows:

℞. Croton-chloral..... 1 gr. (15 grains).
Glycerine..... 16 "
Aquæ lauro-cerasi..... 16 " (a a ℥ ss).
M. Each teaspoonful contains ten centigrammes of croton-chloral. (*a*)

[3] Roberts Bartholow first employed in 1874 these subcutaneous injections of chloroform in neuralgia. Stedmann, in 1877, cites eight cases cured by this means. The same year Doe, of Boston, treated by this method a case of neuralgia consecutive to zona, but these injections did not become general in France till Ernest Besnier made his favorable report to the Societé de Therapeutique, November 14th, 1877.

Dujardin-Beaumetz has experimented with this method, and shown the advantages which may be derived from it, and has especially insisted on the general symptoms which follow injections of notable quantities of chloroform (from 4 to 10 grammes). Henry Fournier, his pupil, has embodied in his thesis a great number of observations relative to this subject. (*b*)

(*a*) Liébreich, On the Action and Use of Hydrate of Croton-Chloral (Brit. Med. Jour., Dec. 20th, 1873). Benson Baker, On the Employ of Croton Chloral in Neuralgia (Brit. Med. Jour., 1874). George Grey, On the Effect of Croton-Chloral as an Anæsthetic and Analgesic (Brit. Med. Jour., March 24th, 1874). Worms, Note on the Action of Croton Chloral (Bull. de Ther. 1874 t 86 p. 447). Martin Skerrit (Lancet, Dec. 2d and 9th, 1874). Bruennich, Croton Chloral and Prosopalgia, 1874. Weill on Croton Chloral Hydrate (Thése de Paris, Dec. 30, 1874). Leoni, Sur le Croton Chloral (Marseille Medicalé, April and May, 1877, page 129 and 259).

(*b*) Roberts Bartholow, On the Deep Injection of Chloroform, in the Practitioner for 1874. Ernest Besnier, On Subcutaneous Injections of Chloroform, in Bull. de Therap., t. xcii., p. 433. Stedmann, Eight Cases of Neuralgia Treated by Deep Injections of Chloroform (Boston Med. and Surg. Jour., May 24, 1877.) Dujardin-Beaumetz, Des injections hypodermique de chloroforme (Bull. et mem. de le Soc. de Therap., t. v. pp. 39, 40, 1878). H. Fournier (Thése de Paris, 1878). Duran, Des injections hypodermiques de chloroforme Thése de Paris, 1878).

I have myself made trial of this method in my hospital practice, and my pupil, Henry Fournier, has given the results in his thesis. In order that these injections of chloroform may do good, they must be made in the painful region, and they must be introduced deeply in the cellular tissue, or muscular interstices; neglect to follow this rule has resulted in accidents, and in failure. Plunge your needle, then, perpendicularly into the tissues, and carry it as far as the guard at the proximal extremity. This mode of treatment is hardly applicable to any form of neuralgia except sciatica.

By these subcutaneous injections of chloroform you may obtain two different results—either disappearance of local pain after small doses, or general effects, characterized by sleep, when you inject two, three, four, and even ten grammes of chloroform, without, however, at any time obtaining surgical anæsthesia. Why do you not obtain complete anæsthesia? It is because chloroform, when introduced beneath the skin, is absorbed by the veins and lymphatics, and carried to the lungs before entering the arterial system to be distributed to the brain and other nerve-centres, and in the lungs it is in large part eliminated. What remains uneliminated, and such portion of the vapor of the chloroform as, after being expired, returns to the lungs in the air of inspiration, passes into the blood of the aortic system, and is carried to the brain, where it has a more or less sedative effect, according to the quantity which has escaped the eliminating action of the lungs. In producing surgical anæsthesia by inhalations of chloroform, you practically suppress the principal source of elimination, and charge the arterial blood with the toxic agent.

By the side of these medicaments, and even at their head, we must place aconite and aconitia, which give marvelous results in certain varieties of neuralgia, and especially in facial neuralgia of the congestive form. Experiments have shown that aconitia has an action quite special on sensory innervation, and in particular on that of the trifacial, and it is this action which Oulmont, Séguin, Franceschini, and Laborde have utilized in the treatment of neuralgia. You can then make use of the crystallized nitrate of aconitia, and as there exist impure aconitais in commerce, you would do well to order the preparation of Duquesnel. The granules of Duquesnel contain each one-quarter of a milligramme of aconitia; you may give one of these granules every three hours till eight are taken in the course of twenty-four hours.[1]

[1] I have previously described these medicaments (see vol. II of this series), and shall here only treat of the physiological properties of aconitia.

According to Franceschini and Laborde, aconitine acts especially on the bulbous portion of the myelencephelon, then consecutively on the great sympathetic, and by their medium it exerts an influence, more or less profound, on the principal functions of the economy.

Gubler has dwelt on the phenomena that follows aconitia in moderate doses: A half-hour after the injection, there are formications over the whole body, a general numbness, with tingling, pricking, and smarting in the nose, and end of the tongue, and disorders of taste. The tactile sensibility is blunted, torpor supervenes, and the patients feel a sensation of a rubber band which tightly constricts their skin. This sensation of general anæsthesia is especially felt in the parts innervated by the trigeminal nerve. To sum up, the phenomena observed after the administration of the aconitia are as follows: 1. A

Crystallized aconitia is one of the most energetic poisons; and you ought rarely to exceed the dose of two milligrammes a day; there are some patients even, in whom, owing to their susceptibility to the drug, this dose cannot with safety be reached. You ought then to suspend the medicine when the patient complains of an uncomfortable sensation of constriction of the mouth and eyes, and tingling in the tongue, which are the first toxic manifestations. When you cannot obtain aconitia, you can employ the tincture of the root (the tincture of the leaves is not to be relied on). Of the common tincture of aconite root, you may give ten drops every three hours. [Fleming's tincture is much stronger, and should not be given in a larger dose than five drops, at least as a commencing dose.] The tincture is much inferior to aconitia, at least in the treatment of facial neuralgia. I cannot too highly commend the alkaloid in prosopalgia; since I have been in the habit of using it, I have obtained cures in a great many cases, and always an amelioration.

In my judgment gelsemium sempervirens[2] and gelsemium merit a place far below aconite and aconitia. In the rich, moist soils of Virginia and the Carolinas grows a climbing plant with yellow flowers, called the yellow or Carolina jasmine; it is the gelsemium sempervirens. From the root and stalk is obtained an alkaloid called gelsemin, discovered by Fredigke. A tincture is

special modification of sensory innervation, appreciable more particularly in the sphere of the fifth nerve. 2. Paralysis of the peripheral extremities of the motor nerves, by an action similar to that of curare. 3. Paralysis of the muscles of respiration, then depression of the vascular system, and arrest of the heart by a special action on the sympathetic system. (*a*)

[2] The gelsemium sempervirens, "eclectic febrifuge," botanic family still undecided (referred by some to apocynaceæ; by others to the scrofulariaceæ), has long been a popular medicine in America. The roots and stalks contain gelsemic acid, discovered by Wormby, and gelsemine discovered by Fredigke. The latter is crystallizable. Ringer and Murrell have studied the physiological action of the plant. It acts on the muscular system and on the heart; produces phenomena of paralysis like curare, and antagonizes strychnia. The tincture is powerfully toxic. Dujardin Beaumetz and Eymery have caused the death of hares in two hours, by injecting two cubic centimetres of the tincture. Death has followed its use in man. Freeman cites the case of three children poisoned by two grammes (3 ss) of tincture of Gelsemium. Drs. Marin and Courtright have noticed similar cases. In a patient of the author two cubic centimetres (about forty drops), administered by mouth, caused paralytic symptoms of extreme gravity:

Almost all authorities who have employed this tincture medicinally, have given it in quantities equivalent to twenty drops a day. Massini, however, has employed it in doses amounting to 60 drops in the 24 hours.(*b*)

(*a*) Franceschini, Sur l. aconitine (Thése de Paris, 1875). Laborde et Duquesnel, Physiological, Chemicál, Clinicál, and Toxicologicál Study of Aconitia (Tribune Med., 1881). Gubler, New Researches on the Therapeutic Action of Aconitia (Bull. de Ther. 1864, p. 348 t. 66, and Commentaires du Codex). Dujardin Beaumetz, Art. Aconitine, in Diction. de Therapeutique, 1882. Séguin, Report on Aconitia in Trigeminal Neuralgia (New York Med. Jour. Dec. 1877. Mary, Du nitrate de aconitine dans les Nevralgies faciales (Thése de Paris, 1880.)

(*b*) Isaac Ott, in Philadelphia Med. Times, March 31st, 1877. Cordes, of Geneva, in Jour. de Ther., No. 5, 1877. Hill in Philad. Med. and Surg. Reporter, Jan. 30th, 1875. Ringer and Murrell in Lancet, 1875, 1876. Spencer Thompson, Lancet, 1875. Eymery, Thése de Paris, No. 362, 1875. Suraszc, Centralb. July, 1875. Massini, On the Root of Gelsemium as an Anti-Neuralgic, 1878. Putreyse and Romée, Action physiologique de la Gelsemine.

made from the root, which is given in the dose of ten drops every two hours. This tincture has been made the subject of experimentation by Wickham Legg, Cordes, of Geneva, Hill of the United States, Spencer Thompson, Sidney Ringer and William Murrell, Massini, Suraszc, Roberts Bartholow, and others, who have obtained remarkable results in the treatment of facial neuralgia, and neuralgias especially of the paroxysmal or intermittent form.

I was the first in France to experiment with this tincture, and my pupil, Dr. Eymery-Heroguelle has reported the results in his thesis of graduation (August 1877). I obtained certain favorable results from the tincture, but I found it an uncertain medicament. Moreover the tinctures were of no definite and uniform strength, a fact due probably to the circumstance that in making the fluid preparations, all parts of the plant, as well as the roots, were used, or possibly because pains were not always taken to obtain the fresh, green root; as a consequence the same doses sometimes gave toxic effects, sometimes no effect at all. In one of our patients, symptoms of poisoning, of the utmost gravity, from the medicinal use of the tincture were noted. Such toxic phenomena have already been often reported as the result of the free use of this tincture, and Hanna, Freeman, and Courtwright have even known death to follow. I have, therefor, abandoned, in the treatment of neuralgias, the use of this drug, as being uncertain and dangerous. These inconveniences may be avoided by the use of gelsemin; but this alkaloid is little known, having been as yet little studied, and seems much inferior as an anodyne to aconitia.[1]

In the same group of medicaments, we must place electricity and hydrotherapy, which modify more or less directly the nervous system.

Electricity is one of the most active agents in the treatment of rebellious neuralgias. In my lecture on "Medical Electricity," I have told you that electricity modifies the molecular state of nerves during its application, and sets up polar currents in the nerves which prolongs its effect; you need not be surprised, then, at its beneficial effect in neuralgia.

You may make use of faradic or galvanic currents; the latter are much to be preferred. The negative pole is applied near the nerve-centre, the positive pole (which is the truly sedative pole) may be moved over the different painful points of the affected nerve. When you are treating tic douleureux,

[1] Numerous fatal cases are on record in American journals of poisoning by gelsemium. Thus, Pinkham's case in the *Boston Med. and Surg. Journ.*, for 1876; that of Boutelle, of Boston, in the same journal; that of Wormley, in the *Amer. Journ. of Pharmacy*, for 1870; also that of Seymour, in the *Therapeutic Gazette*, for 1882. Freeman's three cases (referred to in the text) occurred in 1860; death occurred from taking one or more (in one instance, less than one) teaspoonful doses of the tincture. I myself came near dying four years ago from the effect of a drachm dose (given through mistake) of Wyeth's fluid extract of gelsemium; there were dimness of vision and double vision, irregular breathing, the most alarming prostration, and general muscular paralysis; the use of electricity and stimulants (capsicum, quinine, and strong coffee) brought me out of danger in a few hours. The toxicological history of this drug is well summed up by Ringer, in the *Lancet*, for 1878.

Despite the danger attending the use of gelsemium in large doses, I have found moderate doses (five to ten drops of the tincture every two hours) a charming remedy in facial and especially dental neuralgias.—TRANS.

your currents should be very mild, and should not exceed three or four milliampères. In fact, too intense galvanic currents applied in the region of the encephalon, determine two effects which we ought to avoid—syncope on the one hand, and certain photopsias on the other; it is well, then, to use very light currents.

In the case of sciatica, your current should be much stronger; twenty milliampères, and even more. When treating of electricity in medicine I gave you a definition of this term (milliampère), and told you that it was the basis on which are graduated all our modern galvanic machines and the only scientific means at our command of comparing observations relative to the medical application of electricity. In the treatment of neuralgia it is necessary to be precise as to the quantity, if we would employ electro-therapeutics to advantage.

As for the duration of the current, authorities are far from being agreed, some recommending prolonged, others very short sittings. I think, with Apostoli, that the duration of the *sèance* cannot be fixed in advance, and that the passage of the current should be continued till the pain disappears, or at least till some mitigation is obtained.[1]

[1] In the treatment of neuralgia, faradic, galvanic, or static electricity may be employed.

Induced currents.—Becquerel was one of the first to recommend the use of very strong and rapid currents. He advised the extra current and a wet sponge for electrode, and directed to apply the positive pole over the part of the nerve nearest the nerve-centre, and the negative pole over the divisions of the nerve; to be passed to and fro. *Seances* of five minutes' duration.

Duchenne preferred the revulsion method—the painful region to be electrified by the metallic brush; a very strong current with rapid interruptions. This is the method of "electric fustigation," employed by Tripier.

Galvanic currents.—Magendie employed electro-puncture with the galvanic current; this process is now abandoned.

Remak, Ramios, Rosenthal, and Meyer make use of a centrifugal or descending current; positive pole in the vicinity of the nerve-centre, negative pole at the periphery.

Onimus also uses the descending current; placing the positive pole over the point of emergence of the nerve, the negative pole over the terminal branches, and passing for fifteen minutes a current of thirty elements of Remak. He advises weak currents, but of long duration.

Niemeyer, Tripier, Apostoli, and Bardet, on the contrary, recommend to apply the positive pole over the *point douloureux*, and this is the practice of most electro-therapeutists at the present day.

Static currents.—Arthuis has treated with great success a large number of neuralgias by Franklinic electricity. He employs the electric bath, and the electric brush, which is moved over the branches of the painful nerve.

As for the treatment of certain forms of neuralgia—facial neuralgia and gastralgia—this is the procedure of Bouchaud, Craddock, Apostoli, and Beard.

Apostoli employs, in the case of gastralgia—positive polar electrization of the pneumogastric: positive electrode over the pneumogastric, negative pole in the hand of the patient.

Bouchaud treats odontalgia by a constant current of ten elements; positive pole on the face as near as possible to the painful nerve, negative pole on the antero-lateral region of the neck. In a few minutes' time marked relief is generally obtained.

Craddock has used the constant current with success in neuralgia of the face. Beard

It is in proceeding in this way that Remak, Onimus, Bouchaud, Craddock, Ouspenski, etc., have obtained results that are truly marvelous in the treatment of obstinate neuralgias, and especially in neuritis. I, myself, employed as far back as 1872 these constant currents in the treatment, more especially, of sciatica, and one of my pupils, Dr. Cado, has given the results (often most gratifying) in his thesis.[2]

But if electricity, methodically employed, may mitigate and cure neuralgic pains, you should repudiate altogether those "electric" (?) chains, belts, and pads, which you see advertised for pain, and especially for the cure of migraine. These contrivances are so badly constructed that they are incapable of generating any current, and can have no effect at all, unless a moral effect by acting on the imagination of the patient.

Hydrotherapy, like electricity, is one of the most active agencies in the treatment of neuralgia. Cold water acts, not only by modifying directly the neurility of sensory nerves, but also in promoting healthy circulation and nutrition, and I know of no better means of arresting a paroxysm of neuralgia, or even of preventing a return of an attack than the douche.

Next in order come the surgical measures, which have a direct action on the painful nerve. These are: 1. Neurotomy;[3] 2. Neurectomy; 3. Nerve-stretching.

The section of nerves for the relief of neuralgias is quite an old opera-

has long insisted on the treatment of neuralgias by electricity. In facial neuralgia, galvanization and faradization rapidly cure, but care and prudence in the use of these means are necessary. In gastralgia, galvanization gives complete success; in sciatica, ameliorates or effects a cure. In the latter malady, Beard recommends to apply one of the poles to the vertebral column at the point of emergence of the nerve; the other pole to be moved up and down the sciatic nerve, and the current to be especially directed to the *points douloureux*.(*a*)

[2] L. Cado, "On the Treatment of Sciatica by Galvanic Currents" *Th. de Paris*, 1872.

[3] It was about the middle of the last century that Marechal first proposed the division of painful nerves for the cure of neuralgia. Andrè has cited cases where Marechal practiced neurotomy, but alarmed by the frequent relapses which followed these sections, Andrè advised to destroy the nerve by means of caustic.

In neuralgia simple section has now been abandoned to give place to resection, which gives much more lasting success, and rules have been laid down for the operation applicable to the different resections. Everybody seems now agreed in regarding neurectomy as indicated in all cases of neuralgia rebellious to all other modes of treatment. It is generally recommended to pursue successively the following course, in these desperate cases: 1. Simple stretching of the nerve; if this does not succeed, then: 2. Resection of a portion of the nerve.(*b*)

(*a*) Beard on the Treatment of Neuralgia by Electricity, in the Practitioner, 1873: and in Beard and Rockwell's Medical Electricity. Remark on Galvano-therapy, 1860. Onimus and Legros, Medical Electricity, Paris, 1872. Bouchaud on "Constant Currents in Odontalgia," (Bull. de Therap., tome lxxxv. p. 1.) Craddock, Trigeminal Neuralgia Treated by the Constant Current, (Practitioner, 1873). Tripier on Electric Revulsion, (Courrier Medical, 1870). Apostoli, Treatment of Gastralgia, (Bull. de Therap., 1882, etc.

(*b*) Boyer, Traité des Maladies Chirurgicáles, t. vi., p. 334 and 335, Paris, 1822. Otto Weber, Art, Nevrotumie, in Handbuch der Allgemeinen und Speciellen Chirurgie. Tripier, Art, Nevrotomié in Dict. encyclopediqué. See also Comptes Rendus de la Societé de Chir. 1882.

tion, having been performed more than a century ago, by Maréchal, in numerous cases. The results are generally temporary and disappointing. Simple division of the diseased nerve is not enough, and neurotomy has given place to (2) neurectomy, which consists in resection of a portion of the nerve; this operation gives permanent cures, the *rationale* of which is easily understood when you recall to mind the way nerves undergo regeneration. This method, which is only applicable to regions where the sensory and motor nerves are distinct, as in the face, has been signally successful in those painful affections of the fifth nerve known as the tic douleureux, and I have a case in point to relate which I am sure will interest you all.

The subject, a patient of mine, was head-clerk in the Hotel Monnaies. This man, for three years, had been a sufferer from a most atrocious facial neuralgia. All medical means had been employed without any decided amelioration. Opium, aconitia, electricity, had failed to give more than momentary alleviation, they could not prevent the return of the cruel paroxysm; the poor man, in despair of a cure, was meditating suicide. Such cases are not exceptional, and you will meet with them in your practice.

It was an infra-orbital neuralgia—perhaps one of the most painful of the facial neuralgias. I advised resection of the upper maxillary nerve, and the operation was performed by my colleague and friend, Terillon. The nerve was sought at its point of emergence from the foramen, and followed into the floor of the orbit; the terminal portion of the nerve, to the extent of two or three centimetres, was excised. From the moment that the man recovered consciousness from the ether to the present time, now two years, he has had no return of the pain, and the triumph of the operation is complete.

Is the operation always so successful? Unfortunately, no; and many instances are on record where branches of the trifacial have been resected for painful affections, and with the utmost skill and thoroughness, with no result but aggravation of pain to the patient and mortification to the surgeon. In fact, in these cases the neuralgia was undoubtedly central, and it is easy to see that remedial measures which are efficacious when the cause of the disease is peripheral, are useless, and worse than useless, when the prosopalgia owes its origin to some morbid condition of the encephalic trigeminus centre.

Neurotomy and neurectomy being, as we have seen, applicable only to facial neuralgias, it has been proposed, in cases of mixed nerves, where the operation of nerve-section would inflict on the patient a motor paralysis almost as distressing as the neuralgia, to resort to another operation, of quite modern origin, known as nerve-stretching.

Practiced for the first time in 1872 by Billroth and Nussbaum,[1] it was not

[1] Nussbaum was the first to practice nerve stretching with therapeutical intent (this was in 1872). Billroth also at about the same epoch performed this operation. Fornari proposed to give to it the name *neurecteny* (*neuron*, a nerve, *ekteneia*, extension).

Nerve-stretching has now been performed in England, Germany, America and Italy. In France, in 1876, Verneuil applied nerve elongation to the treatment of tetanus. In 1878 Blum published a memoir on this operation, and Arduzzi made known the results of this method in Italy. Several important publications have appeared on nerve stretching; in particular

until 1876 that this operation found favor with French surgeons, and Verneuil was the first in our country to attempt nerve-stretching, and this for traumatic tetanus. Since then the operation has become general throughout Europe. Chauvel has given us a very complete *résumé* of the history of this operation in Europe down to 1881, and from his monograph, we find that fifty-two cases of neuralgia had been treated in this manner; in thirty of these cases a permanent cure was obtained, in twelve there was a decided amelioration, and ten were unsuccessful. I have not time to enter into these details, which enable us to appreciate at its just worth, this therapeutic measure, and which consists, as you well know, in exposing the trunk of a nerve and making more or less forcible traction on the same.

Generally, after stretching the pain disappears, but it is liable to return in a short time; yet in a good many cases the benefit obtained is permanent.

How does this elongation of nerves operate in the alleviation of pain? This is a question which we are unable to answer. The more probable supposition is, that the stretched nerves have a reactive influence on the sensory spinal centres, an influence which somehow favorably modifies the molecular state of the cells; this view receives support from the fact that very powerful tractions often do the most good.[2]

those of Langenbach, Weiss, Mickulicz, in Germany, Chauvel in France, and Warnots in Belgium.

Nerve-stretching has been applied to a great number of diseases, such as paralysis, tetanus, tabes, dorsalis, contractures, convulsive seizures, etc.

From Chauvel's history we ascertain that in 1881 nerve-stretching had been employed in fifty-two cases of neuralgia, as follows:

Neuralgia of the face	14.
Intercostal neuralgias	2.
Neuralgias of the upper extremities	9.
Neuralgias of the lower extremities	27.

In these fifty-two cases of neuralgia there were thirty complete cures, twelve cases where there was marked amelioration, and ten failures. Twice there were accidents; in one case the elongation of the brachial plexus resulted in a hemorrhage from the jugular vein, and death fifteen days after from the entrance of air in the veins. In another case Nussbaum witnessed a severe hemorrhage from the popliteal space, after stretching the sciatic.

In no case, despite the severe tractions, has paralysis followed.(*a*)

[2] Many explanations have been given concerning the action of elongation of nerves.

(1) Callender thinks that continued irritation of disordered nerves enfeebles the nerve centres. Elongation restores the physiological tone and activity to those centres.

(2) Verneuil thinks that nerve stretching acts like an incomplete section of the nerve.

(3) Vogt maintains that it is by acting especially on the neurilemma that elongation produces its favorable effects. The neurilemma is the starting point of nerve inflammation,

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(*a*) Callender, A Case of Neuralgia Cured by Nerve Stretching; Lancet, June, 26, 1875. Nussbaum, Aerztliche Intelligénz blatter, 8, 1876. Duvalt, Thése de Paris, 1876. Trombetta, Sullo Stiramento dei nervi studdi Pathologici e Clinici Messina, 1881. Chauvel On Nerve Stretching (Arch. Gen. de Med. 1881, p. 701-710). Langenbuch, Berliner Klin. Woch., 1831. Weiss and Michulicz, Weiner Med. Woch., 1881. Warnotin Jour. de Med et Chir. de Bruxelles, Mai, 1882, p. 438. Pooley, Report of 37 Cases of Neuralgia, of Differe ent kinds, treated by Nerve Stretching (Med. Record, 1880).

Billroth has of late advised to practise what he designates subcutaneous elongation of the sciatic nerve. Struck with the distribution of nerves and blood vessels in the inferior member, which pass, the former to the posterior part of the thigh, and the latter to the anterior portion, Billroth thought that by flexion of the thigh on the pelvis he might, without injuring the vessels, make energetic traction on the sciatic nerve. This is his manner of proceeding: The patient being completely relaxed from chloroform, the thigh is flexed on the abdomen, and the leg is forcibly *extended* on the thigh till the toes almost touch the head of the patient. This second part of the operation demands great care in its performance. The biceps, semi-tendinosus and semi-membranosus muscles powerfully resist this movement, and too much violence would result in rupture of these muscles or their tendons, or even dislocation of the head of the femur. After this flexion and extension, the limb is placed in its natural position.

You have seen me this year perform this subcutaneous elongation in three cases. In one, the patient was unable to walk, from an obstinate sciatica, which had lasted three months; here, subcutaneous nerve-stretching brought immediate, permanent cure. In the other two, the benefit was temporary. You remember, too, that it was in arranging the preliminaries for an operation of this kind, that we met with that lamentable accident which caused such consternation among us; I refer to the sudden death from chloroform, whose details have been published by the medical press.[3]

Nevertheless, the misfortune that then happened to us does not militate against the utility of an operation which has now been so often performed with benefit. I believe, then, that in sciaticas rebellious to all therapeutic measures, we are warranted in attempting subcutaneous nerve-stretching, which is doubtless a safer operation than that of cutting down on the nerve, as is usually done, at the junction of the lower and middle third of the thigh, lifting out the nerve with the forefinger, and pulling on it with a force of forty or fifty pounds.

Having finished the group of medicaments which have a direct action on the nerve or nerve-cell, we come to our second group, revulsive or substitutive medication, which sometimes gives remarkable results in neuralgia. This group comprises a variety of derivatives, from simple rubefacients to the most powerful escharotics.

First, then, frictions of the painful region have been advised, these to be more or less energetic, and, to render them more efficacious, it has been recom-

and stretching, by causing rupture of blood vessels in the neurilemma, and dislocation of nerve fibrils in the same sheath, favorably modifies the inflammatory process, cause of the neuralgia.

In physiological experiments made on animals, it has been shown that a feeble elongation produces a real exaggeration of function, and then if the stretching is prolonged with still greater force, there follows a diminution in sensibility and movement, which becomes permanent if the traction exceeds certain limits. (*a*)

[3] *Vide* Comptes Rendus de l'Academie de Médecine, April, 1882.

(*a*) Warnots, De l'elongation des nerfs (Jour. de Med. et de Chir. de Bruxelles, Sept. 1882, p. 225.)

mended to make these frictions with certain cutaneous irritants, and especially turpentine. In this category ought to be placed the celebrated remedy for sciatica of the policeman of Lyons, which consisted in enveloping the whole thigh in a Burgundy pitch-plaster, and which has cured some inveterate cases. In England, there is another popular remedy which consists in covering the painful limb with flowers of sulphur, and over the whole applying a firm flannel-bandage. Of still more general use is the mustard sinapism, which, in some cases of intercostal neuralgia, suffices to affect removal of the pain.

Next comes the vesicant, which is in current practice in the treatment of neuralgia. These vesicants may be of different kinds; sometimes the strong water of ammonia is applied locally till the cuticle is destroyed; sometimes the cantharidal blister, medicated or not with opium, is used.

In order to obtain relief with these blisters, they should be applied over the painful points. In sciatic neuralgia, I have been in the habit of employing a long, narrow blister, three centimeters in width and extending the whole length of the thigh; this blister is applied, as near as possible, over the course of the sciatic nerve. I can, from experience of its utility, recommend this as a most excellent mode of treating sciatica.

In other circumstances, when the neuralgia is more obstinate, it has been the custom to resort to cauterizations of greater or less depth.[1] Legroux was in the habit of employing sulphuric acid; with a stick soaked in the strong acid, he marked out on the painful member the branches of the sciatic nerve. This method is a severe one, and is no longer employed; but instead we use the hot iron, and in particular the Paquelin cautery; with this cautery, points are made all along the nerve. If you prefer transcurrent cauterization, you lightly brush the skin covering the nerve or nerves affected, with the Paquelin cautery, heated to a white heat. These cauterizations are a powerful means of cure, and, being little painful, you can always resort to them when other means fail.

In order to act still more directly on the diseased parts, it has been proposed to penetrate to some depth into the tissues, and this is what has been realized by acupuncture.[2] You perhaps know the use that has been made of

[1] Cauterization in neuralgia may be performed in different ways; the moxa, issues made by escharotics, the actual cautery have all been used.

The latter is now the only means employed, either under the form of transcurrent cauterization, or punctiform cauterization. The latter (*pointes de feu*) is the most ancient form, and is especially indicated where the pain is limited. In cases where the neuralgia is less definitely localized, transcurrent cauterization is the kind to employ. Fleury, Jobert, Valliex Seguin, etc., have especially vaunted the latter cauterizations, which have taken the place of those made by sulphuric acid, as recommended by Leroux and Dubourg. (*a*)

[2] In the 17th century two physicians of the East-India Company, Ten Rhyne and Rœmpfer, made known the manner of performance of acupuncture by the Japanese, but this operation was not practiced in France till the year 1810, and it had for a long time a great vogue, owing to the labors of Jules Cloquet and of Dantu of Vannes.

In the East the physicians who practice acupuncture, call themselves *Jecqua* in China,

(*a*) Treatment of Neuralgia by Transcurrent Cauterization (Union Med. 1847). Valleix, Compendium de Med. Pratique, t. VI., p. 186. Séguin, Arch. de Medicine, 1879. Legroux, Cauterizations by Sulphuric Acid, (Bull. Gen. de Ther., Sept. et Oct. 1852).

acupuncture in the far east—it was there that we learned the manner of performing it; this revulsive method which was much in vogue at the beginning of this century, owing largely to the labors of Jules Cloquet and Dantu of Vannes, is now altogether abandoned. The principle, however, has been adopted by Baunscheidt in that little invention of his called *réveilleur de la vie* [life-awakener], and sold by our instrument-makers under the name of *Baunscheidt's Dermabioticon*, which, twenty years ago, excited so much enthusiasm. This instrument consists of a bunch of pins which are made to penetrate the skin by a spring, and, in order to give a more intense revulsive action, the pins are dipped, before using, in croton oil, or in a highly irritant mixture which Baunscheidt devised, of equal parts of oil of black pepper and oil of mustard. Baunscheidt's "Life-awakener," with its accompanying oil, has had a great celebrity in the treatment of sciatica, but is rather a thing of the past than in actual use at the present day.

A modification of acupuncture, electro-puncture, much used by Magendie with galvanic currents in the treatment of neuralgia, has also had its day, and is now abandoned. Medical electricity has, however, utilized these acupuncture needles in galvano-thermy, which is one of the most powerful revulsive methods that I know of, and the excellent effects of which I have seen in my own service and in that of my friend Perier. This operation is performed with the condenser of Planté, appropriated by Trouvé to medical practice; with a wire heated to a red heat by electricity, points are made to the depth of half a centimetre, and some little distance apart, over the tract of the affected nerve. The punctures are followed by considerable inflammation, but they often bring the greatest relief to the patient.

I need only glance at another method of making punctiform eschars, a horribly painful method, now happily gone out of fashion. I allude to *aqua-puncture*. A filiform jet of water is projected by means of a force-syringe with such violence upon various points of the affected nerve that the skin is perforated, often to the depth of several millimetres, in many places. Siredey is responsible for the vogue which this method has had.

Luton's mode of treatment of sciatica is based on the same principle, though the manner of application is different. The Professor of Rheims has proposed to introduce by the hypodermic syringe certain irritating substances, as nitrate of silver, which are injected over the painful spots. The caustic solution is made with one part to ten, or five. These irritating injections determine an artificial anthrax, which results either in induration of the tissues or in

and *Farittate* in Japan. They make use of needles of different metals (gold, silver, steel) of extreme fineness, which they insert by means of a conductor. The latter is a metallic tube of less length than the needle, enclosing the needle as a sheath; the whole is made to penetrate the skin, like the trocar in its cannula; the conductor is then withdrawn, and the needle is insinuated more deeply into the subcutaneous tissues by a movement of rotation.

Acupuncture has caused the cure of a great number of neuralgias, particularly those of the face and sciatic nerve. (*a*)

(*a*) Ten Rhyne, Dissertatio de Arthritide, London, 1783. Dantu de Vannes, Traité de l acupuncture, Paris, 1826. Dujardin-Beaumetz, Art Acupuncture, in Dict. de Therapeutique, 1882.

abscess. The partisans of this revulsive procedure claim signal success in its use. Out of Luton's fifty cases of sciatica, forty-eight of them are reported permanently cured. Rupaner (of Boston), Bertin, Le Dentu, Damaschino, Gerin Rose, Dureau, and Angelé, all report good results from this operation, which Luton, the inventor, has designated as "subcutaneous injections for local effect." It cannot, however, be maintained that the operation is altogether certain or safe, and troublesome sequelæ have resulted, and are likely to result, from these irritant injections.[1] In certain cases, instead of making the cauterization over the painful point, it is made at a distance; and we have seen Jobert cure sciatica by cauterizing the lobule of the ear. Even at the present day, there is sold, under the name of *Indian Remedy*, an irritating substance which is designed to be introduced into the auditory canal, and which is believed to act beneficially in the treatment of odontalgia.

To finish the consideration of the external medication of neuralgia, I shall simply allude to massage, or rather what has been described under the name of *Kinesitherapy*. In the treatment of this disease, massage is now much used, with its various methods, kneading, pinching, and percussion; Schreiber has lately insisted on the advantages of massage in neuralgia and in muscular rheumatism.[2]

I have finished the long enumeration of the more important measures which constitute symptom-medication, and whose object is the relief of pain. It remains for me in order to complete this subject, to speak of the empirical means, whose mode of action in the treatment of neuralgia is thus far unknown; and I am going to allude to turpentine, phosphorus, guarana, and sulphate of copper.

Turpentine,[3] which, as I told you, is sometimes used in embrocations and

[1] These injections, first introduced and popularized by Luton, in 1863, are chiefly of use in that most rebellious of neuralgias—sciatica. They are made just behind the trochanter major, towards the inferior border of the gluteus maximus. The injection is made into the subcutaneous cellular tissue, and with varying doses of a solution of nitrate of silver, one part to five, of which from fifty centigrammes to one gramme may be used at one time. In rheumatic sciatica, Gerin Rose injects six cubic millimetres of the following solution, which contains one part to fifteen: ℞.—Argent. nit., grm. .50; Aquæ dest., grm. 7. M. He seeks the most painful point, which is generally where the nerve issues from the pelvis at the great sacro-ischiatic foramen, and plunges deeply the Pravaz needle so as to penetrate the cellular tissue into the muscular interstices, in which (providing no blood wells up through the needle, making its appearance at the proximal end), after having adapted the syringe, he slowly injects, drop after drop, the solution. The second day, a phlegmonous tumor as large as the fist forms over the site of injection; this, however, rarely suppurates, but disappears by resolution. Gerin Rose has been successful in thirty cases, and has witnessed no troublesome sequelæ.(*a*)

[2] Bull de Ther., t. cii. p. 276, April 15, 1882.

[3] It was in England that oil of turpentine was first employed for the "*mal ischiatique*." Home, Pleyne and Pitcairn have written in its favor; it was popularized in France by Mar-

(*a*) Luton, Des injections sous-cutanees a effet local, Paris, 1875. Blosart, Treatment of Chronic Sciatica by Injections of Nitrate of Silver (Thése de Paris, 1872). Angelé, Treatment of Neuralgia by Irritating Injections, These de Paris, 1878.

liniments in this disease, has also been given internally; and Martinet and Trousseau have prescribed, in sciatica, capsules of essence of turpentine, six or eight to be taken every day. It is possible that some cases of sciatica may have been cured in this way, but turpentine readily disorders the digestive functions, and is often badly tolerated, hence is little used as an internal remedy.

Phosphorus[4] has been the most often employed in England and America in the treatment of neuralgia. This use of phosphorus is altogether empirical, and although we have seen that protagon, the proximate constituent of cerebral substance, contains a notable proportion of phosphorus, no direct relation has as yet been established between the functions of the cerebro-spinal axis and the presence in the nervous tissue of a greater or less quantity of phosphorus. However this may be, Thompson, in England, and W. A. Hammond, in the United States, have highly recommended its use.

Phosphorus has been given in two ways, as phosphorated oil and as phosphide of zinc. [In this country the pill-form is generally preferred, each pill representing $\frac{1}{100}$th grain; one or two of these pills three times a day.—TRANS.] Phosphorated oil is administered in capsules containing one milligramme of phosphorus; beginning with one capsule, and gradually increasing to ten cap-

tinet in 1818. Large doses, four to 12 grammes (teaspoonful to a tablespoonful), during the twenty-four hours are required:

Teissier of Lyons has obtained good results from turpentine in certain cases of nervous cephalalgia (*a*).

[4] Edwin Sladeking recommends phosphorus in neuralgia, and this is his mode of administration: The full dose should not be more than a twentieth, nor less than a thirtieth of a grain, and should be repeated every two hours, the patient being made to take a little mucilage before the medicine. After eight doses thus taken, the interval between the doses should be increased to four hours, then eight hours, and the medicine should be discontinued when the total quantity taken equals one grain. If after this the neuralgic pains persist, some other treatment must be adopted.

Ashurst and Thompson have reported eighteen cases of neuralgia treated by phosphorus. Their formulæ are as follows:

℞	Phosphorated oil	6	(ʒ jss).
	Pulv. acaciæ	12	(ʒ iij).
	Spts. menth	1	(gr. xv).
	Water	200	(℥ vj and ʒ v).
M.			
℞	Tinct. phosphorus	6	(ʒ jss).
	Alcohol	4	(ʒ j).
	Spts. menth	1	(gtt. xx).
	Distilled water	200	(℥ vi and ʒ v).

M. Sig. Dose: A tablespoonful after meals. (*b*)

(*a*) Martinet, Du traitément de la Sciatique et de quelques aurtres Nevralgiés par l'huile de terebenthine, Paris, 1827; (Teissier de Lyon, Union Med., Jan., 1864, No. 10). Janneson, On the Use of Turpentine in the Treatment of Sciatica; (Edinb. Med. Jour., p. 749, Feb., 1877).

(*b*) Edwin Sladeking, On the Administration of Phosphorus in Neuralgia; (Med. Times and Gazette, April 19, 1873). Ashurst and Thompson, Some Observations on the Use of Phosphorus in Neuralgia, Illustrated by Eighteen Cases; (Practitioner, July, 1873).

sules, three times a day. Phosphide of zinc is an excellent form for administration of this medicament. This phosphide readily undergoes decomposition in the presence of the acids of the stomach, yielding up its active principle. In connection with a former pupil, Proust, one of the victims of the late Franco-Prussian war, I made quite a thorough study of these metallic phosphides, which had lately been introduced into therapeutics by Vigier, and our experimentation showed that we might profitably utilize in medicine many of these compounds. Phosphide of zinc is given in pills of four milligrammes (about $\frac{1}{15}$th grain), this represents one milligramme of phosphorus. From one to ten of these pills may be given a day. I shall return to phosphorus-medication when I come to speak of chronic myelitis; as for its results in the treatment of neuralgia, in my experience they have been simply *nil*.[1]

Guarana, or paullinia, has been recommended for neuralgia, and especially for migraine. This substance, as you are aware, comes to Europe in the form of cakes made by drying a paste of the seeds of *Paullinia sorbilis*. The latter is a climbing plant belonging to Brazil, of the family Sapindaceæ. Besides gum and starch, fatty matters, and tannin, it contains caffeine in notable quantity, which latter is the active ingredient. The guarana may be given in powder for migraine; dose, one or two grammes stirred into a little water, before or during an attack. Caffeine may be given instead, in the dose of twenty-five to fifty centigrammes. This medicament has an action which is often decided, though of short duration.[2]

Ferreol has of late recommended ammonio-sulphate of copper in the treatment of stubborn cases of neuralgia of the face. This medicament, whose *modus operandi* is unknown, may possibly act in accordance with Burq's theory of metallotherapy. It is given in potion in the dose of ten centigrammes a day, or (what is the better way) in capsules containing two centigrammes; five to ten of them being given daily. (The results have not been very favorable.)

Having finished symptom-medication, and considered successively anodyne, revulsive, and empirical modes of treatment, we come to our second part, or pathogenic medication.

You remember that we referred to three principal causes the etiology, or rather the pathogeny, of neuralgia; this disease being the result of modifications

[1] In this place *tonga* deserves mention, a remedy for neuralgia introduced to the profession by Sidney Ringer and William Murrell, of London, in 1880 (*vide Lancet*, March, 1880), and obtained from the Fiji Islands. It has long been used by the South Sea Islanders for all cases of neuralgia. It is employed in the form of alcoholic extract, in the dose of a teaspoonful every six hours. Its effects seem to be very similar to those of guarana. A good preparation of tonga is made by Parke, Davis & Co., of Detroit.

[2] Introduced into New England about the year 1870, and long sold at fabulous prices, no remedy has given more satisfaction in the treatment of migraine than paullinia, and the effects have generally been as lasting as those of any other remedy. The following formula by the late Dr. George M. Beard, has done good service:

℞. Citrate of caffeine,
Carbonate of ammonia, ää..... ... ʒj.
Elixir of guarana,..... .... ℥j.
M. Sig. Dose, a teaspoonful.—Trans.

affecting the integrity of the nervous system, central or peripheral, or of the blood, or finally of the circulation. Here, then, are three classes of causes which we must pass in review.

From the stand-point of the nervous system, leaving one side alterations more or less profound, and compressions of the nerves, I desire to call your attention to two points: first, the predisposition to neuralgias in the neuropathic and hysterical; second, to inflammation of the nerve-tubes or neuritis.

Neuralgia is one of the manifestations of the nervous temperament, and it may be affirmed that every nervous person suffers more or less from it. In these cases we witness the triumph of the bromides and of hydrotherapy. Bromide of potassium (alone or associated with other bromides), cold douches, local or general, and suitable outdoor exercise are the most certain methods of cure of neuralgias due to neuropathy; electricity, and especially static electricity, is a useful adjunct.

Neuritis is one of the causes of obstinate neuralgias; it entails atrophy of the member, and trophic cutaneous disturbances. The most effective remedy for neuritis is revulsion, which has a favorable influence on both pain and inflammation. Here all the revulsive methods before alluded to are applicable, and especially active cauterizations. To counteract the trophic troubles, you should have recourse to galvanism.

Neuralgias due to circulatory modifications are of two kinds, congestive and anæmic. Congestive neuralgias are especially frequent in the arthritic, and are best treated by ergot and aconitia. It is especially in facial neuralgias of plethoric persons, with marked congestion of the face, that aconitia is effective, and this by a sort of double influence on the circulation and on sensory innervation. Marino[1] has recently proposed ergotine for these congestive neuralgias, basing his recommendation on the known effects of this drug in constricting the minute vessels and anæmiating the tissues. I have never used this drug in neuralgia, having almost always found in aconitia a heroic and certain remedy. In neuralgias from cerebral anæmia, morphia is *par excellence* the medicament. It removes pain and provokes a salutary congestion of the sensory nerve-centres, which directly antagonizes the cause of the pain. Gymnastic exercises and hydrotheraphy are most excellent adjuvants in these cases.

As for the alterations of the blood, which are the points of departure of dyscrasic neuralgias, they are very numerous, and chlorosis deserves the first mention. It may be affirmed that every chlorotic girl is neuralgic, and here we have an illustration of that grand principle of Hippocrates, *sanguis moderator nervorum*. Therefore, every therapeutic means which shall augment the rich-

[1] Marino, Ergotina per uso Epidermico, nelle cura delle Neuralgia, Palerma, 1877. He uses the following solution for injection:

℞. Ergotine..... 2 gr.
Cherry laurel water..... 10 gr.
Glycerine..... 10 gr.

M.

ness of the blood, and the proportion of its hæmoglobin, is applicable to these cases; ferruginous or arsenical medication, baths of compressed air, inhalations of oxygen, country air and exercise, hydrotherapy, gymnastics, nourishing food, all these remedial measures are indicated. I cannot too strongly urge the use of arsenic in these cases of chlorosis; in my experience, the arsenical treatment has been quite as successful as the ferruginous, if not even more so; for arsenic acts not only as a reconstituent, but it is a direct modifier of nerve substance. Those who have had the most practical acquaintance with the use of arsenic in neuralgia are the most emphatic in its praise.

This medicament may be given in the form of Fowler's solution; dose, three to ten drops after meals. [Anstie prefers this form of administration; he finds arsenic especially useful in neuroses of the par vagum.] It is also given in granules and in pill form. [The combination with quinine, ext. of aconite, and strychnine of Dr. Gross, known as Gross' neuralgic pill, is a favorite one in the United States.] [1]

Certain neuralgias are of malarial origin; here we witness the triumph of sulphate of quinine. Marrotte has given us a good description of these *febrile* neuralgias, due to marsh poison. Where there is any reason to suspect any pathogenic influence of this kind, you should be particular to ascertain whether the neuralgic attack comes on at a fixed hour, in which event you can easily and speedily control the affection by a full dose of quinine. You can increase the effect of the quinine by combining it with aconite, giving every three hours a capsule or wafer containing one-quarter of a milligramme of crystallized nitrate of aconitia, and twenty-five centigrammmes of quinine; four of these may be given each day.

The diatheses, and in particular, syphilis, arthritism, dartre, have often a marked etiological relation to neuralgia. As for the first, you must not confound the so-called "osteocopic pains" with the neuralgic pains, which really often exist under the influence of syphilis. These cases demand the ordinary anti-syphilitic treatment.

As for neuralgias of arthritic origin, they are among the most frequent, and sciatica and gout are often one and the same thing. The means which succeed the best in the treatment of gouty and rheumatic neuralgias are baths, and in particular, sulphur baths and vapor baths; the latter are often medicated to advantage with turpentine or pine shavings. In rheumatic neuralgias, the thermal waters are often successful; those of Plombières, Bourbonne, and especially Aix-les-Bains. In these neuralgias we may employ cyanide of zinc, proposed by Luton, and especially salicylate of sodium.

The dartrous neuralgias are readily amenable to the arsenical treatment.[2]

[1] *Vide* Cohen on "Arsenical Treatment of Neuralgia" in *Jour. Med. de Bruxelles*, 1864. Barilla, in do., for 1863. Vanlair, *The Neuralgias, their Forms and Treatment, etc.*, 1882.

[2] Marrotte. "Febri-nevralgies de l'isthme du Gosier," *Bull. Gen. de Therap.*, 1874. Abbot, "Sciatic and Facial Neuralgia Treated by Salicylate of Sodium," *Boston Med. and Surg. Journ.*, July, 1879. E. Labbé, "Nevralgies traités par le Salicylate de Soude," *Soc. de Therap.*, Paris, Feb. 9, 1881. Lagrelette, "De la Sciatique," *Th. de Paris*, 1869. This writer advocates strongly vapor baths and hydrotherapy in sciatica.

Such is a somewhat curt summary of the principal indications of the pathogenetic treatment of neuralgia. I must now briefly consider the therapeutics of certain forms of neuralgia, and for convenience of arrangement will begin with the foot and end with the head.

Plantar neuralgia is one of the most painful of neuralgias, and incapacitates the sufferer from walking or standing. It is especially gouty and rheumatic patients that are affected in this way. This neuralgia is often rebellious, lasting months and even years. You have seen a good example in our wards; I allude to a certain female, who, in consequence of rheumatism following an accouchement, has been for six months confined to her bed by plantar neuralgia. What has seemed to succeed best in her case has been the application of strong tincture of iodine, and hot sulphur foot-baths.

I shall not dwell long on sciatic neuralgia,[1] which has been often taken as

[1] Sciatic neuralgia (sciatic rheumatism, sciatica, femora-popliteal neuralgia) is characterized by the presence of pain along the course of the sciatic nerve, and its branches. More frequent in the male than in the female, it has its seat indifferently on either side. It may be caused by wounds, contusions of the nerve, the impression of humid cold, neuritis, the presence of abdominal, pelvic, stercoral tumors, displacements of the womb, pressure of the fœtal head during accouchement, bony alterations of the neighboring parts, spinal meningitis; according to Bailly, Everard Home, Founier, blennorrhagia may be a cause.

Sciatica is almost always single, at the same time it may be double. Worms has pointed out the frequency of these double sciaticas in diabetic patients, but more generally these double sciaticas are rather the painful expressions of affections of the spinal cord.

Rarely the disease has a sudden commencement. Generally it announces itself by numbness, heaviness, a sensation of cold in the entire limb, or in certain limited parts; then after a variable time there is an outburst of pain, which may occupy different branches of the nerve (genito crural, cutaneous femoral branches of the lesser sciatic, articular branch of the great ischiatic and peroneal, internal popliteal, short saphenous or posterior tibial, or lastly, the terminal plantar nerves); it may remain limited, or be progressively diffused over many branches.

It is dull, continuous, contusive, accompanied with formications and with tingling; it presents also paroxysms, or exacerbations. Under the influence of walking, muscular exertion, heat, or without any known cause, lancinating pangs are experienced radiating along the course of the nerve; the patient can often mark out with his finger the tract of the painful nerve. These pains are exasperated by pressure, by movement; the patient instinctively seeks repose and avoids all muscular contractions, lying on the opposite side from the pain. In some cases the patients feel in the bones and joints a sort of deep and piercing pain, which, according to Jaccoud, indicates an intra-vertebral origin of the neuralgia. When there are, moreover, alterations of sensibility, consisting in formications, tingling, aching sensations in the back, girdling pains (*douleurs en ceinture*), the neuralgia has for its origin a lesion of the cord or meninges acting on the posterior columns. Apart from the attacks, some patients suffer little and are able to work. Others become incapacitated, walk with difficulty, limping, or even are compelled to cease walking altogether. Besides these pains, disorders of the cutaneous sensibility have been noted, and Hubert Valleroux, in his thesis, describes sensory troubles (pertaining to tactile sensibility, sensibility to temperature, etc.), especially occurring in the posterior region of the thigh, four or five finger breadths below the popliteal space; atrophy of the affected member has been noted; a slow muscular atrophy in the pure neuralgias, a more early atrophy in the neuritis; but in the latter cases there is sometimes excessive development of fatty tissue in the member. Some writers have observed changes in the temperature and in the color of the skin, erythema, furunculi, patches

the type of neuralgia, Here the revulsive medication, carried out in all its rigor, succeeds best. Sciatica is often a neuritis, and it may almost with certainty be affirmed, when this neuralgia is obstinate, and is not due to compression of blood-vessels, viscera, etc., that it proceeds from an inflammation of the nerve. I believe that this frequency of neuritis of the sciatic nerve results from proximity of that nerve to the surface, and from the modifications which it is likely to experience from external influences, and especially from atmospheric changes; there is certainly no form of rheumatic neuralgia so common.

Apropos of these stubborn sciatic neuralgias, I must remark that they are often dependent on affections of the spinal cord, especially when they are bilateral. Essential double sciaticas are very rare, and when they occur, they are generally occasioned by tabes dorsalis, or, as Worms has shown, by diabetes.[2]

Neuralgias of the uterus, bladder, testicle, and spermatic cord have frequently been observed. I know that it has been disputed whether these *viscer-algias* ought to be considered true neuralgias, but it is of little consequence what we call them, they are painful affections, and prompt relief is demanded. In uterine neuralgia, cauterizations are of striking utility. You will in fact observe a certain number of females, who, apart from all organic disease of the uterus, suffer pains in that organ presenting all the distinctive characters of neuralgia. In these cases revulsive applications to the os or cervix with the Paquelin cautery, or the acid nitrate of mercury, give excellent results. Do not, however, forget that in this neuralgia of the organs contained in the pelvis, one of the best methods of administering anodynes is the suppository. [Here the morphia suppository of the United States Pharmacopœia, with one-third grain extract of belladonna, will do good service.]

Ileo-lumbar neuralgia[3] is often the cause of cruel suffering, besides being rebellious to the most energetic treatment. In fact, this affection is frequently

of herpes along the tract of the nerve. Sciatica has a very irregular march. It may cease spontaneously, and gradually; its duration is very variable, from several days or weeks, to years. Relapses are frequent. The *points douleureux* indicated by Valleix are as follows: 1. The lumbar point immediately above the sacrum. 2. The *sacro iliac point*, on a level with the sacro iliac articulation, in front of the posterior superior spine of the ilium. 3. *Iliac*, over the middle of the crest of the ilium. 4. The *gluteal*, at the top of the great sciatic notch. 5. *Trochanteric*; upper border of the great trochanter. 6. *Femoral*, points, superior, middle and inferior, on a level with the origin of the principal nerves given off from the sciatic. 7. *Popliteal*, over the popliteal space. 8. A *patellar point*, over the external border of the patella. 9. Peroneo-tibial over the superior articulation of the tibia and fibula. 10. *Peroneal*, about the neck of the fibula. 11. Malleolar, at the posterior and inferior part of the external malleolus. 12. Dorsum of the foot and plantar region.

[2] Worms, Symmetrical Sciaticas in Diabetes, Paris, 1880.

[3] Neuralgia of the lumbar plexus is generally situated on the left side; its causes are various; impression of cold, contusion, alteration or compression of nerves by bony tumors, or other tumors in the vicinity. It may be provoked by a morbid state of the genital organs, testicle, uterus and its annexes, and exist at the same time with neuralgia of the neck of the womb. It may occupy all the branches of the plexus, or several of them, or each of the following branches separately: 1. The abdominal branches which furnish the ilio scrotal nerve. 2. The internal inguinal branch. 3. The external inguinal branch which furnishes the

due to profound troubles of the kidney, and particularly to renal lithiasis. You are aware that in these renal cases of persistent neuralgia it has been proposed to remove, or to open the kidney; in a word, to perform nephrectomy or nephrotomy, as Professor Leon Le Fort and Le Dentu have done. I pass by gastralgia, hepatalgia and the greater part of the abdominal neuralgias, only referring you to what I have already said in regard to them while treating of diseases of the stomach, liver and intestines, and I come now to intercostal neuralgia.[4] This is a very common neuralgia, and all delicate, nervous women suffer from it more or less. Peter, in his remarkable lessons on *pains in the side*, insists that intercostal neuralgia is always limited to the left side; I do not quite agree with him in this. It is true that the far greater part of painful intercostal affections are on the left side. You will nevertheless now and then see hysterical patients whose painful sensations and whose anæsthesia are exclusively right-sided. On which-

scrotal or labial branch. The pain, as in all other neuralgias, is permanent, dull, or contusive, or is paroxysmal. The attacks are spontaneous or provoked by walking, sudden movements, pressure over the nerve, etc., and remain limited to the bones, the flank, and the inferior part of the hypo-gastrium, or are propagated to the groin and to the testicle, or labia-majora, according as the scrotal or labial branch is or is not affected. Irritable testicle, painful testicle of Sir Astley Cooper, is an ilio-scrotal neuralgia. Valleix has described the following foci of pain: 1. A lumbar point, seated a little outside of the first lumbar vertebra. 2. An iliac point a little above the crest of the ilium. 3. A hypogastric point above the inguinal ring and just outside of the linea alba. 4. An inguinal point about the middle of Poupart's ligament. 5. A scrotal or labial point at the inferior part of the testicle or in the substance of the labia majora.

[4] Intercostal neuralgia is very common, especially in females. It is unilateral or double, and is seated generally on the left side; several intercostal nerves being almost always affected at the same time. Its causes are multiple; impression of cold, contusion of the thorax (a zona often accompanying it); neuritis, neuroma, lesion of neighboring organs as the lungs, pleura, vertebral column, tumors of the mediastinum, aneurisms of the aorta, cardiac affections, neuritis of the cardiac plexus, mammary tumors, etc. This neuralgia may be reflex and accompany catarrh of the digestive tube, cancer or ulcer of the stomach, or utero-ovarian diseases. Intercostal neuralgia may depend on disease of the spinal cord such as acute or chronic myelitis. It is also observed in hysteria, chlorosis, anæmia (in this case its seat is always on the left side), malaria, lead poisoning, syphilis, and rheumatism. Michel Peter in his lessons on "pain in the side" defines the pain of pneumonia as a pleuritic pain, and the latter as nothing but an intercostal neuropathy. The pains in the side observed in phthisical patients at the apex of the lungs are neurites which recognize for cause, inflammation of the lungs and pleura. In tuberculous neuritis it is the first, second and sometimes third intercostal spaces that are the seat of pain. In the neuralgia of chlorosis and anaemia it is the fourth, fifth and sometimes sixth intercostal spaces, and the pain is most severe on a level with the fourth dorsal vertebra. Intercostal neuralgia ordinarily develops slowly and gradually. The pain is dull persistent, but subject to exacerbations which manifest themselves by pangs shooting through the intercostal space, or limited to only a part of it. These shootings of pain may come on spontaneously and provoke a passing dyspnœa or anguish. Generally they are caused by movements of inspiration, attacks of coughing, pressure, by simply raising the arm, etc ; they frequently radiate toward the neck, shoulder, forearm, mamma. The pain in intercostal neuralgia is almost always circumscribed. This enables us to distinguish it from the diffused pain of pleurisy or pleuritic rheumatism (pleurodynia). The fixed points described by Valleix are three in number: 1st, A vertebral point at the posterior part of the intercostal space a little outside of the spinous

ever side it may occur, this neuralgia is obstinate, and resists not only morphine injections but also revulsive treatment. Hydrotherapy, applied in the form of douches to the painful region, seems to me one of the best means of combating this rebellious intercostal neuralgia.

I shall finish this lecture by a brief consideration of the neuralgias of the fifth nerve.

Odontalgia,[5] I need not tell you, is one of the most common of painful affections, and every one has at some time experienced the atrocious pain of toothache. This neuralgia is often determined by alveo-periostitis, or by a carious tooth, which affects the terminal portion of the dental nerve. There exists a ready means of relief for this pain in arsenious acid, which destroys the dental pulp, a method which Tomes, Magitot, and Combe have advised. A paste is recommended (to be applied on cotton to the cavity of the tooth), consisting of two parts of white arsenic, two of morphia, one of gum tragacanth, and one of glycerine. Among the numerous measures which have been employed against odontalgia, Bouchaud has counselled electricity. His method is to place the positive pole over the diseased nerve, and the negative pole a short distance from it, and to pass a mild continued current.

process ; 2d, a lateral point about the middle of the intercostal space ; 3d, an anterior point corresponding to the sternum (between the costal cartilages), for the upper nerves (*point sternal*), to the epigastrium, for the inferior nerves (*point epigastrique*).

On making pressure over these different points the seat and nature of the pain is recognized.

Intercostal neuralgia has often a long duration; it is very rebellious in some persons, and subject to relapses.

[5] Redier of Lille has given several formulæ which apply particularly to the treatment of toothache. As a calmative application he advises the following:

℞. Tinct. benzoin ..... 3 i.
Fluid ext. opii .....
Chloroform .....
Creasote ..... ää 3 ss.

M.—Introduce into the carious tooth on a little cotton. The whole may be covered by another cotton wad saturated in the following mixture:

℞. Gum benzoin .....
Alcohol ..... ää equal parts.

To destroy the pulp, he employs the following paste:

℞. Acid arsenious, morphia ..... ää 3 ss.
Pulv. acaciæ, glycerine ..... ää gr. xv.

M.—Apply to the pulp cavity and let it remain twenty-four hours. It is generally necessary to renew the dressing two or three times. (*a*)

(*a*) Rediér in Bull. Gen. de Ther., t. CIII, p. 357, 1882. Tomes, A Course of Lectures on Dental Physiology, London, 1848. Magitot, Treatise on Dental Caries, Chandler's translation; Boston, Houghton, Mifflin & Co., 1880. Combé, Bull. Gen. de Ther., t. XCIX, p. 485, 1880.

A word now about facial neuralgia,[1] properly so called. These neuralgias affect sometimes the supra-orbital nerve, sometimes the infra-orbital branches; these last are the most obstinate. As I have already told you, they often yield readily to treatment by aconitina, or to sulphate of quinine when of an intermittent character. They sometimes defy all treatment, and have been known to involve the facial nerve, as well as the fifth. Without discussing the question of recurrent neuralgia—a subject which has of late been treated in a brilliant manner by Cartaz—you all know that neuralgia is often accompanied by painful contractions, and that to this syndrome the name has been applied of epileptiform neuralgia, or tic douleureux of the face. It is the most atrociously painful affection that has ever afflicted humanity, and instances have been known where it has driven its unhappy victim to suicide.

It is in these cases that surgery steps in, with its nerve-stretching and neurectomy; here, too, the advantages of galvanism have been lauded. If you

[1] Facial neuralgia tic douleureux (André); prosopalgia (Simon); neuralgia of the face (Halliday); trifacial neuralgia (Valleix) comes by order of frequence after sciatica and intercostal neuralgia. It may be divided, according to the seat of the pain, into 1st, neuralgia of the opthalmic branch; 2d, neuralgia of the superior maxillary branch; 2d, neuralgia of the sensory part of the inf. max.

It is about as frequent in men as in women; is ordinarily unilateral.

Causes: Cold when the individual is sweating; carious teeth; contusions, wounds of the face; compression of the nerves by foreign bodies; neuromata; tumors of the petrous bone, aneurisms of the internal carotid; tumor of the pons; fungus of the dura mater.

It may come on in the beginning or during the course of locomotor ataxia; it may depend on visceral affections, fibrous tumors of the womb, gastro-intestinal troubles, malaria, poisoning by opium, lead, mercury; may supervene during rheumatism, gout, syphilis, anæmia; may show itself after suppression of the menses, of a hemorrhoidal flux, of a habitual exanthem; after a severe emotion.

It does not generally come on suddenly, but gradually. At first limited to several nerve branches, it only gains the others progressively. The patients experience dull, contusive, persistent pain, or paroxysmal pain which may be spontaneous or provoked by some movement, and even by penetrating odors.

During the attack the patients suffer atrocious pains, often of a lancinating character, which call forth outcries; they toss about on their bed and smite their head; the muscles of the affected side of the face are the seat of rapid contractions, convulsive shocks, multiple distortions succeeding each other at very short intervals. All the muscles are not affected, and often the contractions are limited to the frontal portion of the occipito-frontalis to the zygomatici, to the inferior maxillary muscles.

The face becomes turgescent, there is often photophobia, lachrymation, buzzings in the ears, then the paroxysmal shocks diminish in frequency and intensity, and all becomes calm; the storm has passed, to be renewed again under the same form in a time not far distant.

Every attack has not, it is true, this intensity; sometimes the lancinating pangs are of short duration (epiliptiform seizures). According to the branches affected, certain phenomena present themselves; photophobia, injection of the eyes, lachrymation, passing amaurosis in neuralgia of the opthalmic; odontalgia, pituitary secretion in neuralgia of the superior maxillary; painful deglutition and mastication, exaggeration of the salivary secretion in neuralgia of the inferior maxillary nerve. Commonly facial neuralgia occupies the entire trifacial nerve.

The tender points (points douleureux), according to Valleix, are as follows:

1. Supra orbital, over supra orbital foramen.

employ electricity,[2] you must never exceed a certain intensity (two or three milliampères, for instance); you must also, as Apostoli enjoins, make use of rheostats, and interpose a certain resistance to the current, to avoid the *photopsias* which are produced with each modification of the current. It is understood that the positive pole must be placed over the painful point, and as for the duration of the *sèance*, it ought to be continued till the pain disappears.

I must, before finishing, say something about migraine,[3] which (therapeu-

2. The palpebral.
3. The nasal. Internal and superior part of the nose.
4. The ocular.
5. The infra orbital.
6. The malar.
7. The superior dental.
8. The superior labial.
9. The palatine.
10. The pituitary.
11. The temporal.
12. The temporo maxillary.
13. The mental.
14. The lingual.
15. The inferior labial.

Facial neuralgia has a variable duration, and is subject to relapses. When it lasts a long time, it is not rare to observe trophic troubles of the skin, which may become hypertrophied, or of the hair, which may have an exaggerated growth, may fall out or turn white. The patients fall into a state of languor and become "used up;" others, in the worst forms of tic douleureux, seek in suicide a release from their sufferings.

[2] Letourneau has much employed cephalic electrization, which acts on the vaso motors, diminishing the cephalic congestion and even preventing the cerebral neoplasms which often follow repeated attacks of hyperæmia. The cerebral anæmia provoked by the constant currents explains the vertigo which the patient experiences under the influence of electricity, and the unconquerable somnolence which always follows these electrical seances. (*a*)

[3] Migraine is a painful affection, which has from time immemorial exercised the sagacity and skill of physicians. It is still almost as difficult to treat as it ever was.

This disease, which used to be attributed to certain diatheses (arthritism, herpes, gout, etc.,) has been referred to a variety of causes, as disorder of the frontal sinuses (Deschamps) neuralgia of the 5th and 7th pairs of nerves (Chaussier and Pinel), compression of the trifacial by the engorged, cavernous sinuses (Auzias Turenne).

Some authorities consider it as a symptom of lesions of the nervous system, central or peripheral; others (as Hervez and Liveing) as a discharge from the nervous system too charged with fluid. According to Piorry it is an ascending neuralgia, taking its departure from the nervous fibres of the iris. Du Bois Reymond thinks that migraine originates in the cilio-spinal center.

The causes of the attack are multiple and various: indigestion, constipation, exposure to the open air and sunshine, fatigue of the sight or the hearing, too prolonged watching, absorbing intellectual labors, changes in the hour of meals, too much or too little food; privation of an habitual stimulant (tea, coffee, etc.); all may provoke an attack, It is the same with changes of habit, and errors of hygiene, suppression of a hemorrhoidal flux, etc.

(*a*) Letourneau, On Cephalic Electrization (Congrés pour l' avancement des sciencés, 1878, p. 913).

tically at least) belongs to the neuralgias. You are not ignorant of the discussions which have arisen over the pathogeny of migraine, some considering it simply a neuralgia of the trifacial, others as a special neurosis of the same nerve, or even as a neuralgia of the brain itself, a cerebralgia, as Romberg maintains. There are still others who assert, as does Du Bois Reymond, that the principal seat of migraine is the cervical portion of the great sympathetic. This is the view generally held in France, especially by Gubler and Jaccoud. It is, in fact, probable that migraine is not a simple neuralgia, but a complex neurosis, affecting alike the cerebrum, the trigeminal nerve, and the cervical portion of the sympathetic.

Whatever its pathological nature, migraine is a very distressing affection and you will often be consulted in reference to it. You ought always, if possible, to ascertain the first cause, and as far as this is concerned, this is what you will discover: in nine cases out of ten migraine is a diathetic affection, and for my part I have frequently observed it in hemorrhoidal, arthritic, and asthmatic subjects. Your treatment, then, should be directed to the arthritic diathesis, of

In women it is not rare to see migraine coincide with the menstrual epoch, cease with it, reappear with the next period, and cease altogether at the menopause.

Everything in fact in the case of a person predisposed may provoke an attack ; even a slight blow on the head, breathing a peculiar odor, mental emotion, etc.

Attacks vary according to individuals. Sometimes there are prodromes the evening before ; too keen an appetite, cerebral excitation, or somnolence. Oftener the patient goes to bed well, but wakes up in the morning with a feeling of lassitude, torpor, and inaptitude for work. Others wake up feeling more active, more lively, but there are at the same time certain indescribable sensations known only to the migrainous, which announce the impending paroxysm.

Little by little the attack develops; the headache appears ; at first slight and limited to the forehead, the temples or the orbit ; it changes place, goes to the nucha, darts from right to left to return to the right or *vice versa*. The patient complains of a sort of cranial tension, of oppression over the frontal sinuses, the sensation of a leaden cap or girdle surrounding the head. The least movement exasperates the pain; walking, ascending a flight of stairs, gives a sensation as if the cranium was pounded. The patient seeks darkness, silence, rests apathetic, indifferent to everything, but when there are exacerbations of the pain, twinges in the cranium, in the orbit, he becomes agitated and wild, and only recovers calmness when the anguish is assuaged. The pain is habitually localized on one side (hemicrania), and not rarely there are irradiations to the back and front of the neck, and shoulders of the same side. During this time the skin is pale, or it may be slightly flushed, the features are drawn, the eyes encircled with a ring, the temporal artery beats with force. On the part of the eye there are also certain troubles, such as diplopia, mists before the sight, or dazzling sensations, *muscæ volitantes*, and photophobia ; the eye at the same time seems smaller; the pupils slightly smaller than natural are sometimes animated by fibrillary contractions; and the ball of the eye is tender. There is also in some persons perversion of the hearing (buzzing in the ears); or of the smell, (exaggeration or abolition).

The appetite, abolished in some, is exaggerated in others ; certain drinks, certain articles of food are not supported, but there is an annoying and constant symptom, a sort of seasickness—nausea followed by vomiting, which exasperates the pain, or which may even usher in the end of the paroxysm, or at least the end of the special malaise which accompanies it (rigors, horripilation, cutaneous hyperæsthesia, gaping, eructations).

The cerebral troubles are somewhat rare. Liveing has noted cases of aphasia, and

which the migraine is an expression. At other times you will find the migraine due to causes of a different character, occasional causes to which you should address your therapeutic endeavors. These causes may be ranged in three groups; first, excess of work, and especially brain work during the night-time, and with the aid of too strong a light. Piorry referred all migraines to fatigue of the eyes; to him, migraine was only a manifestation of *irisalgia*. Second, anæmia; the megrim of chlorotics is an example, coming on whenever by any cause the organism is enfeebled. Third, congestive head troubles, instances of which we see in the hemicranias of the gouty or arthritic.

The first class of patients are benefited by rest from mental toil, and by bromide of potassium; the second may require hydrotherapy and morphia; the third will need alkalies, intestinal derivatives, and especially aconitia.

I have finished this long exposition of the treatment of neuralgia, an exposition far from being complete notwithstanding its length. I believe, however, that I have furnished you the general principles which ought to guide you in your practice.

In the combat with pain your therapeutic resources will be taxed to the uttermost, and you can only fulfill your professional duty by the intelligent endeavor *always to relieve, if you cannot cure*.

Charcot has seen similar cases. Gubler and Bordier say that they have observed during the attack a greater facility of the circulation and respiration.

Diarrhœa and constipation are symptoms varying according to the subjects; it is the same with diuresis.

The duration of the attack is variable and often in the direct ratio of its intensity ; from three, four, five and six hours to twenty-four, thirty-six, forty-eight, and even more. The pain in some persons is gradually alleviated during the day, especially during conversation; in others, after a short lull it reappears, and only is calmed when the patient succeeds in going to sleep, after long searching for a place on his pillow which is not too hard for his head. He wakes up restored, or with a weight in his head which little by little goes away, or is only the prelude to another attack.

The attacks, whose intensity is extremely variable, sometimes present themselves in a regular manner, at fixed periods, which gradually become longer and longer with age, and finally the disease disappears altogether, or is replaced by gout, hemorrhoids, asthma, or some cutaneous or other affection.

The baldness seen in some migrainous patients is rather due to *pityriasis capitis* than to the migraine.

After the attack the health is often excellent ; the patient recovers his natural tone and spirits, and experiences a *bien être* which is wanting when by any means the paroxysm is aborted.

Migraine is most common in the female ; it attacks all classes of society. (*a*)

(*a*) Tissot, Des nerfs et de leurs maladies, t. XI, Paris, 1873. Bouillaud, Nosographie médicale. Pelletan, Coup d'œil sur la migraine et sur ses divers traitements. Du Bois Reymond, Archiv. für Anal., 4e livraison, 1860, p. 461. Gubler et A. Bordier, Dictionnaire encyclopédique des sciences médicales, art. Migraine. Piorry, Mémoire sur la migraine; Trait. med. pratique, t. VIII, p. 75.

ON THE TREATMENT OF HYSTERIA.

SUMMARY: Difficulty of the Subject—Vague Delimitation of Hysteria—Comprehends a Great Number of the Diseases of the Nervous System—Impossibility of Assuring a Therapeutic Result in Certain Cases of Hysteria—General Treatment of Hysteria—Hygienic Treatment—Education, Its Rôle as a Prophylactic—Influence of the Uterus in Hysteria—Influence of Continence—Of Marriage—Influence of the Husband—Kind of Life—Influence of Disappointments—Excitement—Alimentation—Medical Treatment—Antispasmodics—Valerian—Castor Assafoetida—Bromides—Baths—Hydrotherapy—Means of Application—Mineral Waters—Electricity—Influence of Static Electricity—Galvanism Metalloscopy and Metallotherapy—History—Burquism—Æsthesiogenous Substances—Results of Metallotherapy—Its Modes of Application—External and Internal Metallotherapy—Treatment of the Attack—Cold Water—Compression of the Ovary—Mechanical Compression—Galvanism—Medicinal Inhalations—Nitrite of Amyl—Treatment of Certain Symptoms—Paralysis—Contractures—Anaesthesia—Amaurosis—Gastric Hysteria — Anorexia — Vomiting — Anuria—Electricity — Ether Spray—" Gavage "—Conclusions.

Gentlemen:—In taking up as my subject to-day the treatment of hysteria, I do not conceal the difficulties of my task. Hysteria embraces a great number of affections of the nervous system, from the so-called " vapors " of hypochondriacal females, to that hystero-epilepsy[1] so recently described by Charcot as the

[1] As the observations of Briquet show, hysteria may manifest itself in infancy, be hereditary or acquired, or appear at a more advanced age under diverse influences. It comprehends two forms: the convulsive form (*petite hystérie*, and *grande hystérie*) and the non-convulsive form.

Convulsive hysteria comes on in paroxysms or fits preceded for a short time by prodromes, consisting in psychical troubles, troubles of the organic functions, troubles of motility and troubles of the sensibility.

The psychical troubles sometimes appear several days before the attack. They consist in a change in the disposition and moral deportment. The patient is no longer interested in her daily duties, neglects her toilet, becomes gloomy, morose, or even gay and silly, is anxious about trifles, has attacks of jealousy, hatred, raises disturbances and quarrels with everybody.

Frequently there are hallucinations in the night time and even by day. These show themselves on the side that is anaesthetic (Charcot), and consist in visions of black cats, rats, spiders, vipers, etc., and these animals flit from left to right and from right to left according as the anæsthesia is on the left or right side. It is the same for the hallucinations of hearing, which are less common than those of vision. There are hissing noises in the ears, roarings, ringing of bells, etc., which are heard in the anæsthetic side. Sometimes the hallucination of sight is the prelude to the attack. The patient has the eyes fixed, widely opened, staring at vacancy, then the attack comes on. The troubles of the organic functions consist in digestive, secretory, respiratory, circulatory disturbances, want of appetite, vomiting or nausea, ptyalism, laryngeal troubles, spasmodic cough, palpitations, hiccough, paroxymal bursts of laughter, spasm of the throat, hysterical suffocation. Among the troubles of motility, there is noted an amyosthesia more marked than is habitual, painful cramps, trembling or convulsive startings of a partial or general character, affecting especially the anæsthetic side. These epileptoid commotions sometimes precede the attack by only a few minutes. Besides the convulsions, contractures are also observed beginning suddenly and occupying one member first before becoming general, and fixing the patient in

great hysteria. If the domain of this neurosis is immense, its limits are far from being precise, and he would be a bold man who would in all cases venture by a hard and fast line to separate nervousness, hypochondriasis, epilepsy, and even lunacy, from hysteria. So, as Lasègue has very judiciously said, we are not able to-day, and perhaps never shall be able, to give an exact definition of

a particular attitude. The troubles of sensibility consist in a total or partial anaesthesia (hemi anæsthesia), and becoming more marked if it existed before. Certain patients manifest, on the contrary, hyper-æsthesia; in others the sensorial sensibility is affected at the same time (amblyopia, deafness, etc). Such are the remote prodromes of the attack. Those which are the nearest the paroxysm are certain painful phenomena, constituting the *aura hysterica*. The *aura* may have different seats, taking its departure from the hypogastrium or the abdomen, from the ovary or other hysterogenous points or zones, varying according to the patient.

These zones exist upon all points of the body; zones above and below the mammary region, zones costal, iliac and ovarian, superior and inferior dorsal, etc. The point the most frequently observed is the ovarian. Pressure over any one of these points may provoke the attack when the convulsions are absent, but may also arrest it when the convulsions do exist, on condition always that the pressure be strong enough.

The aura is spontaneous or provoked; if, for example, you make pressure over the ovarian point, the patient complains of a pain, sometimes very keen, which radiates toward the epigastrium, with painful constriction, nausea and sometimes vomiting (first link in the aura); then, if the pressure be continued, palpitations of the heart, the *globus hystericus* (second link in the aura); the sensation of a ball which, starting from the abdomen mounts upward to the thorax and reaches the larynx. Then follow cephalic troubles; hissing in the ears, sensations as though the temporal region were pounded by a hammer, and obscuration of the sight, sensations which are right or left according to the side of the ovary which is compressed. The patients become unconscious (third link in the aura), and the convulsive paroxysm bursts forth; the patient falls down, but does not utter a peculiar cry like an epileptic patient; the face is congested, she puts her hands to her neck as if to tear away a tight cord that is choking her, lets escape a few sighs, then hiccough and convulsions appear. In some cases, nevertheless, the attack is sudden, and the loss of consciousness instantaneous.

Charcot recognizes four periods in the attack: an epileptoid period, a period of *clonism* (contortions), a period of passional attitudes, and a period of delirium. The first period resembles an attack of epilepsy, with tonic and clonic convulsions, and resolution. The tonic phase may be subdivided into "tonic with movements that have a wide range, or tonic convulsions," and "tonic with tetanic immobility, or tetanism."

The movements in the first phase resemble much those observed in partial epilepsy called by Richer tonic partial epilepsy; they are slow, extensive, general, but predominating on one side; they are movements of circumduction. With the superior members the inferior members are agitated as well, and the trunk does not remain passive, it turns from side to side, flexes or extends, contortions carry the pelvis in all positions, the head goes from right to left, or makes movements of salutation more or less violent.

To this period succeeds the tonic phase, with immobility; the muscles are tetanized, the patient remains fixed, the head is bent backwards, the neck is prominent, swollen, the face cyanosed, and bloated. The upper limbs are stiff in different positions, the hands tightly shut, the thumb against the palm of the hand covered by the other fingers, the legs extended, strongly pressed the one against the other. The entire body is fixed in different strange attitudes, the arc of a circle, a ball, etc. The patient has completely lost consciousness and there is spasm of the respiration.

But soon (clonic phase) supervene brief and rapid oscillations in the tetanized members; they succeed each other rapidly, become general, the tetany ceases little by little, respiration

hysteria ; we can only affirm that, by its strange manifestations, hysteria has erased the word *impossible* from pathology.

But, before entering into the details of the question, I owe you a declara- of principle ; it is that, from the point of view of treatment, hysteria, by its very nature, defies all positive and scientific therapeutic rules. This results from

is resumed; to a whistling inspiration succeeds a jerking expiration, then comes muscular resolution, sometimes incomplete and interrupted by sudden starts which give the patients strange attitudes. The breathing becomes regular, but remains loud and stertorous.

After the epileptoid period, whose duration is variable, and of which any one of the phases may be modified, prolonged to the detriment of the others, or be wanting altogether, appears the period of contortions and of grand movements. In the period of "clonism" the patients assume divers attitudes, the most strange and bizarre; the most common, however, is that of the bow, [arc en cercle], the body being arched forward or backward, or laterally, (emprosthotonos, opisthotonos and pleurosthotonos).

In the phase of "grand movements" the body executes very extended movements. Many patients, however, are seized with a sort of fury, strike, tear everything within their reach. Then is ushered in the period of "passional attitudes or fictile postures." The patient is a prey to hallucinations, and her countenance, her fictile postures betray the thoughts which by turn agitate her. During this period she is quite insensible to all external excitations.

In the fourth period, (period of delirium) which succeeds the third, with which it is often confounded, consciousness returns in part, the patient remains a victim to delirium attended with hallucinations and sometimes with troubles of movement. The delirium is often a delirium of memory and the patient recounts a scene in her past life ; in her hallucination she hears voices, the sounds of bells, sees animals, etc.

The troubles of movement consist in a general or partial contracture and persist sometimes after the attack for variable periods. The attack frequently terminates by an abundant emission of tears, of urine or vaginal mucus.

Such is hystero-epilepsy in its ordinary manifestation. Generally the attacks are not single, but several appear in rapid succession, running into each other, without any return of consciousness; they may, however, be separated by lucid intervals. The attacks may be as many as a hundred a day, each with varying duration and intensity.

"*Petite hysterie*" (the minor hysteria) is an attenuation of the grand. It is almost always ushered in by prodromes: palpitations, yawning, lassitude, malaise, motiveless bursts of crying or laughing, painful sensations in the region of the ovary, a ball rising in the chest and coming up to the throat (globus hystericus), whistling noises in the ears, then the patient falls with loud shrieks, her head is thrown backward and is stiff, the face, pale at first, becomes congested; the eyes roll in their sockets, the pupil dilated, sometimes contracted, hides itself under the upper lid. The mouth is wide open, the tongue moves from side to side or is thrust forward. Often there is gnashing of teeth; then in the midst of sobs, hiccough and convulsions set in.

In the great hysteria, according to Charcot and Féré, from the commencement the pupil is contracted during the tetanic period, to be in turn dilated during the great movements; during the phase of passional attitudes and delirium, it is alternately contracted and dilated. Compression of the ovary modifies the dimensions of the pupil, as it modifies the march of the attacks. (*a*)

(*a*) Landouzy, Traité Complet de l. hystérie, Paris, 1846. Briquet, Traité clinique et therapeutique de l. hystérie, Paris, 1859. Bernutz, Lecons cliniques sur l. hystérie, (Gaz. des Hôp, p. 83, 1874, et art, Hystérie du Dict Encycloped.) Richer, Etudes Cliniques sur l. Hystero-epilépsie, 1 vol. de 764 pages. Paris 1881. Charcot, Description da la grande attaque hystérique. (Progrès Med., 1879, p. 17.) Ch. Féré. Notes pour servir a l. histoire de l. hystero-epilepsie. (Arch. de neurologie. Paris, 1882, p. 360.) Huchard Traité des nevroses. Paris, 1883, p. 919.

two causes: first, the preponderant part which the imagination plays in this disharmony and disordered equilibrium of the functions of the nervous system, and which determines, as a consequence, that oftentimes where the physician, well-informed, conscientious, patient, devoted, fails, the most brazen charlatan will easily succeed. Hysteria is, in fact, the harvest-field of quacks, the domain of miracles and surprises. A second factor of importance, as having a bearing on the therapeutics of hysteria, is the disposition which the hysterical female has to deceive her attendants, a disposition which Dally has characterized by the name *délire malicieux* (malicious delirium).[1]

This mental condition of hysterical patients, to which Huchard attaches so great an importance, will prompt intelligent females to endure extreme tortures in order to maintain a morbid state which their will alone has engendered. It results from this singular perversity, that every exhibition of drugs and every therapeutic application which has for its end the treatment of hysteria, may be attended with disappointment; and that one can never affirm that a medicament which has given good results in one case of hysteria will give the same results in another case. In a word, in this neurosis everything may fail, and everything may succeed.

With these reservations (which it belonged to me to make), I come to the

[1] By the side of the sensory or motor troubles, and the convulsive phenomena observed in hysteria, it is interesting to take note of the changes which in this neurosis manifest themselves in the character, the moral disposition and intelligence of hysterical females.

One of the dominant traits of character in these patients is their mobility. They are seen to pass from one movement to another, from the most lively joy to the most complete sorrow. They laugh, they weep, they sigh readily and very often without any apparent motive.

They converse with volubility and even vivacity, or remain as mute as the dead; gay today, they are to-morrow gloomy, taciturn, and reserved; amicable and sweet naturally, they suddenly become cross and peevish; they detest what they adored only an instant before.

They search even for everything which can injure the object of their hate, invent stories and misrepresent facts, which they present in a bad light. This is the history of many households which at first sight seem to be happy and harmonious, but become a hell under the dominion of a hysterical person.

Hysterical females, in a word, manifest a want of mental equilibrium which causes that insensible to a *real* misfortune, before a trifling disaster they exhibit the most extravagant sorrow; they are, moreover, unable to resist the impression of the present moment.

When they are, several of them, brought into company together, as in a hospital, you will see them on the alert for mischief, making confidants of one another, fomenting little quarrels, and denouncing each other; their fickleness, their want of discipline, their perpetual fault-findings keep the whole hospital in a broil. They seek to attract attention, and often lie without any motive; they simulate sicknesses from which they are entirely exempt; they even go so far as to threaten to play the comedy of suicide, announcing that such a day and such an hour they will make way with themselves, which they take good care not to do. In a word, they strive to make themselves objects of interest, and it is their vanity and their delight to make people believe extraordinary things about them. One says that she never eats anything, and refuses all victuals of every kind and in some hiding place in the night time with wonderful cunning she devours the food which she had there concealed; another one, before her physician, vomits urine which she had just before drank in her hiding place.

treatment of hysteria, which comprehends three parts—the general treatment; treatment of the attacks; and, finally, the treatment of certain hysterical symptoms.

The general treatment of hysteria is subdivided into hygienic and medical treatment. We will commence with the hygienic treatment. Here the first place belongs to education, as being of prime prophylactic importance. We can, in fact, in the majority of cases, prevent the development of this neurosis, for it is hereditary, and a hysterical mother has a great chance of seeing her children neuropathic or hysterical.

I believe that the education of children, when they have attained the age of eight or ten years, ought not to be left with the mother. I would remove the young child, and particularly the young girl, from a tutelage too indulgent, too tender, and too ill-regulated; the child should never be allowed to witness any hysterical manifestations on the part of the parent, for imitation plays a considerable *rôle* in hysteria.

It is a good plan to place the girl in a boarding-school, situated, if possible, far from the city. I say boarding-school, for isolation is a bad thing in hysteria and education with other girls and boys, notwithstanding some serious inconveniences, has real advantages in the case of neuropathic children. Young girls with predisposition to hysteria, should not be permitted to read exciting novels, fairy tales, etc., which heat the imagination. Even the culture of piano music, and especially organ-playing, has disadvantages which make it desirable, when possible, to interdict these accomplishments. I have seen hysterical patients who have found in the practice of the organ an aggravation of their nervous symptoms, and this as well as from the excitement to the nervous centres occasioned by working the pedals with the lower extremities, as by the effect of the music in stimulating their emotional natures.

On the other hand, neuropathic girls should be allowed physical exercise in the open air, horseback riding, gymnastics, even swimming. In fact, their discipline should be fortifying, virile, and severe. I say *severe*, but it will

Having a passion for the marvellous and extraordinary, they often put themselves in the attitude of victims and heroines, and invent stories in which they play an important part. They accuse themselves of imaginary crimes, or simulate wounds; and with invincible pertinacity, they even accuse innocent persons of crimes which exist only in their imagination, and these charges they maintain to the end. The annals of justice are full of such monstrous facts.

Arrived at this point, a prey to fixed ideas, which constitute, according to Esquirol, a catalepsy of the intelligence, these unhappy persons have no longer entire responsibility for their actions. They act under an impulse which they cannot resist, and all reasoning, all prayers and entreaties are powerless to deter them from their mad purposes. They are real victims of mental alienation; one will maintain that she lacks a viscus, the stomach for example, and will no longer eat, will let herself die of starvation; another will assert that she is turned into glass, and will not dare to move, etc., etc. (*a*)

(*a*) Bodeau, Étude sur la folie hystérique, thèse de Bordeaux, 1881. Voisin, De la folie hystérique, 1880, p. 122. Duponchel, De la folie hysterique, thèse de Paris, 1857. Huchard, Character, Manners and Mental state of Hysterics. (Arch. de Neurologie, 1882.) Dally, De l'etat malicieux des hysteriques, (Bull. et Mem. de la Soc. de therapeutique, 1881.)

not do to go to the other extreme, and, while interdicting romances and dancing, develop unduly the religious emotions, for it is quite possible to cultivate in them a state of religious mysticism and ecstacy, which is nothing less than the very disease against whose protean manifestations we are contending.[1]

It is generally at the epoch of puberty in young girls, and at the time of the appearance of the menses, that the first manifestations of hysteria occur. Although the old doctrine that would place in the uterus itself the exclusive point of departure of hysteria, and which has given it its name, is to-day abandoned—since we do now and then observe hysterical men, and even in the female this neurosis may develop without any uterine trouble at all—it is none the less true that the uterus plays a preponderating part in this neurosis.

Michelet, in one of his works, has given the following definition: "Woman is a womb, served by organs." This somewhat spiteful definition finds justification in the case of the hysterical female, to whom it is especially applicable, and it may be established as an immutable law, that in hysteria it is during the menstrual period that the nervous symptoms are most accentuated; this period, then, claims your most watchful attention, and your treatment ought always to follow these menstrual epochs. This question of the *rôle* of the uterus leads me to speak of another point of hygienic treatment in hysteria to which great importance has been attached. I refer to continence and to marriage, and I ask you patiently to follow me in what I have now to say touching this debatable question.

Plato compared the womb to an animal which has but one end to fulfill, that of conceiving, and which becomes furious when its functions are not accomplished.[2] From this is derived the doctrine that continence is one cause

[1] Herbert Spencer, in his treatise on education (Appleton ed., p. 212), has these golden words, which, if they summarize the highest duty of the educator, also convey a valuable lesson to the intelligent physician who would be to his constituency more than an administrator of drugs. A "self-governing being" is not merely one who is governed by others—it is a being whose lower propensities are subordinated to the higher; in hysteria this subordination is lacking.

"Bear constantly in mind the truth that the aim of your discipline should be to produce a self-governing being; not a being to be governed by others."—TRANS.

[2] The ancients, believing that hysteria was only the result of uterine fury, considered as demonstrated the influence of continence on this neurosis. Hippocrates and Galen admitted this opinion without dispute; they maintained that the seminal matter ought, like other excrementitious matter, to have a ready vent, and when this seminal matter, which was by nature cold and aqueous, was accumulated in the economy, it produced syncope and other hysterical accidents.

Too long the words of the masters have held sway over the minds of men, and the doctrines of Hippocrates and Galen were accepted without dissension. It was not till the discovery was made that the ovaries secrete ovules, and not seminal liquor, that doubts began to be entertained concerning the Galenic doctrine, and it was Dubois, of Amiens, who, in our time, was one of the first to protest against this notion of the influence of hysteria, a notion which was held by Georget, Brachet, Sandras, Giraud, Lelut, Gendrin, and especially by Landouzy.

It is Briquet who has advanced the most serious argument to show that continence plays

of hysteria, and that sexual relations are essential to a cure. This doctrine is so much in vogue, here in France, that one needs only utter the word *hysteria* in a family to suggest the idea of excess of continence to those attending on the patient, and in some circumstances this would be taken as an insult. Hence, I advise you to be chary in the use of the word in your private practice, especially in the presence of the family; say that the patient is neuropathic, that she is affected with nervousness, but avoid the word *hysteria*.

This popular opinion is based—bear in mind—on the declaration of medical men, and till recently the majority of physicians who have written on hysteria, and their number is considerable, have maintained the influence of continence on the development of this neurosis. Briquet was the first to take a stand against this way of thinking, and the arguments which he has adduced have, in my judgment, a high cogency. He has shown that when you take under consideration groups of females who from the point of view of sexual relations lead quite opposite lives, nuns, on the one part, among whom continence is the rule, and prostitutes on the other, among whom continence is unknown—he has shown, I repeat, that hysteria is much more common with the second class than with the first. Moreover, do we not see in our hospital services that the greater part of our hysterical patients are women to whom continence is the rare exception, and who have a more than sufficient satisfaction of their sexual wants? I quite agree with Briquet, and believe that if continence may have a certain influence on hysteria, an influence by no means scientifically demonstrated, genital excitations are quite as detrimental.[2]

only a secondary rôle in hysteria; he has based his doctrine on 430 cases which he has witnessed, and these are his conclusions:

1. That widows are no more liable to hysteria than other women; this neurosis results much oftener from moral and emotional than from other causes.

2. That, contrary to the assertions of authorities, hysteria is very infrequent above 30 years, and very common below that age.

3. That hysteria appears in a fifth part of predisposed patients before the age of puberty, and that then it can have no relation with continence.

4. That this disease is less common in married females than in the unmarried, but only in the proportion of 7 to 9.

5. That it is not now frequent in persons who live continent lives, and that it is on the contrary somewhat more frequent in those that are wanting in chastity.

6. That the satisfaction of the sexual wants does not in any way give exemption from hysteria.

7. That it is untrue that hysterical attacks often terminate by an evacuation of a liquid coming from the genital organs.

8. That it is untrue that from the time that the genital organs have arrived at their complete development, it is necessary that their functions shall be exercised under penalty of hysteria.

9. That it is possible that in certain circumstances not well defined, the genital wants, naturally or artificially aroused, and lacking a sufficient satisfaction, may be a cause of painful excitation of the encephalon, from which may spring a disposition to hysteria; but, thus far, this predisposition must be admitted as a result of deduction, rather than as a direct consequence of observation.(*a*)

[2] Briquet, Traité de l'Hysterie, Paris, 1859.

(*a*) Briquet. Traité de l'hysterie, p. 126.

Families will often ask you whether young hysterical girls ought to marry; it is best to be non-committal in this matter, and not affirm, as has often been done, that marriage may cure the hysteria.[1] To counsel marriage in such a case is a responsibility which the physician ought not to assume, for it is not proved that marriage ameliorates the condition of a hysterical person, and in order to obtain a problematical benefit, he may doom a husband to a life of chagrin and unhappiness.

It would be a curious chapter which should relate the history of the part which husbands have to play in this deplorable neurosis. The husband of a hysterical woman often finds himself in a sorry plight. However amiable and attractive, however persuasive and commanding, he can neither please nor control a woman of disordered brain, before whose capricious whims he is powerless; whose actions, however seemingly reprehensible, are performed almost without volition and without consciousness. In other cases the husband undoubtedly favors the development of hysteria in his wife by the incessant concern with which he treats her manifestations. By the attentions which he lavishes on her, by the anxious exaggerated affection which he displays, he fosters and encourages the ataxic phenomena. The man is fortunate who, constantly and sympathetically watching the hysterical explosions of his wife, does not, by imitation, become hysterical himself. The spectacle has more than once been witnessed of a neuropathic couple (generally without children) bewailing and intensifying their mutual ailments. Here separation is most salutary to both parties.

Fortunately, the marriage of a hysterical person is not always so gloomy in its results; where especially the husband, by his coolness and firmness, his good sense and moral influence, gives to the wife a sage and dominant direction, which mitigates and moderates the nervous phenomena.[2] While, then, it may be said that marriage is a good thing for hysterical women, when it brings

[1] The Hippocratic notions concerning continence had one practical consequence, viz: the tenet that marriage was curative in hysteria and this doctrine may be summed up in these words; *Fœmina hysterica eget viri, ergo vir praebeudus est.* Valescus of Tarentum favors this notion. Forestus affirms that hysterical patients must be made to marry, if they would escape the exciting consequences of an accumulation of sperm. Sennert, Baillou, Duret and Riviere adopted this view of Hippocrates and Galen, and carried it farther than they. Bouvard Antoine, in his thesis defended in 1612, affirms that it is necessary, in order that marriage may succeed, that it take place, *cum viro succulento.* Similar theses, moreover, characteristic of the times, were maintained in 1560 and 1564, by Tauret and Daguet, and had for title, *An Venus hystericis?* Landouzy, in our epoch, has affirmed that marriage being the physical and moral union of beings according to the purpose of nature, is one of the most powerful means of prevention and cure of hysteria. Briquet has risen against this doctrine, and has shown that marriage has little effect on hysteria; he has cited instances of hysterical women having had 22 accouchements and abortions. He has shown that of 98 cases, in 50 marriage was injurious, in 31 without any influence, and in 17 it was attended with amelioration.(*a*)

[2] Bernutz thinks that marriage may in certain cases be useful when hysteria has not gone too far; in support of his opinion he observes: first, that an early marriage prevents a great number of young girls belonging to the lower classes of society from contracting

a Briquet, Treatise on Hysteria, page 461.

with it happiness and tranquillity, it is nevertheless true that oftentimes those most favored by fortune and surrounding conditions, whose life, calm and peaceful, ought to be without a cloud, suffer from groundless fears and imaginary ills, and are always unhappy beings, and all in consequence of an ill-balanced nervous organization.

There is no kind of life which is exempt from hysteria, and we find this neurosis among the poor and among the rich, those that labor and those that hire; we see constantly examples in our private practice, and in our hospital service. The country also furnishes its contingent of hysterical patients. It has been maintained that country life preserves from hysteria. This is a mistake, and we observe instances the most curious and obstinate of this neurosis is our rural villages. Apart from heredity, disappointed hopes are a most prolific cause of hysteria, and whatever the station or occupation in life, depressing cares and disappointments will come.

As occasional or aggravating causes of hysteria, we may refer to two kinds of life diametrically opposite: on the one hand, a too fashionable life, with all its pleasures and all its fatigues; on the other hand, a too solitary life, with all the ennui which accompanies it. In the one case the hysteria is brought on by nervous excitement, in the other by a morbid brooding over neuropathic symptoms which are thereby perpetuated and aggravated. It is important, then, that you should find diversions for your hysterical patients, but such diversions should not exceed certain limits.

As for diet, it should be of a nourishing and unstimulating character. I advise you especially to forbid the use of tea and certain alcoholic liquors. I believe that the abuse of tea is an occasional cause of hysteria, especially where one is not accustomed to it, and I have seen nervous women improve with suppression of this beverage.

Among the wines, you ought especially to forbid heady and sparkling white wines, as champagne, all the strong alcohols, and particularly absinthe. Lancereaux has, in fact, shown that in alcoholic patients, and especially absinthe-takers, there exist sensory troubles akin to those of hysteria, and it is probable that the greater part of men who are afflicted with hysteriform neuropathic disorders are men who have been addicted to alcoholic stimulants and to absinthe.

I come now to the medicinal treatment of hysteria. This treatment will comprise three parts: the pharmaceutical treatment, the treatment by balneotherapy, and the treatment by electricity and metallotherapy.

The pharmaceutical treatment formerly consisted in the administration of that class of medicaments described under the name of antispasmodics, such as

illicit liaisons; second, that celibacy, which is an abnormal state, is, by the preoccupations of every kind which it engenders in young girls of the opulent and middle classes, as fruitful a cause of hysteria as misconduct; third, that often marriage is the very way to change the conditions of life for a great many young girls whose hysteria is fostered by the bad influence of the family which surrounds them. (*a*)

(*a*) Bernutz art. Hysteria in Nouv Dict de med. et de chir. t. xviii.

(more especially) valerian, musk, castor, galbanum, and assafœtida.[1] The greater part of these medicaments are to-day almost forgotten, and this for several reasons: first, because their antispasmodic effects are far from being

[1] Assafœtida is the concrete juice of the root of Narthex assafœtida, an umbelliferous plant which flourishes in Persia, and the adjacent countries. It is obtained from incisions made in the upper part of the root. In commerce it is met with in the form of tears or irregular reddish-brown masses. Its chief constituents are resin and gum, from 50 to 75 per cent. of the former, and about 20 per cent. of the latter, besides nearly four per cent. of volatile oil.

The officinal preparations are the emplastrum, the mistura, the tincture, the pilulæ (pil. assafœtidæ and pil. assafœtidæ et aloes). The Pil. Galbani Co. also contains assafœtida.

In Persia, assafœtida is used as a condiment, either mixed with the food, or rubbed upon the vessel in which the food is contained. It is regarded as useful in correcting the flatulence to which the Orientals, as vegetable eaters, are subject. The Germans call this drug *stercus diaboli*, while in the East it is known by a title that signifies *God's meat*.

This drug has no very marked medicinal properties; it gives to all the excretions the odor of assafœtida. It has been of use principally in the treatment of functional nervous affections.

Besides the officinal preparation above mentioned, the author gives several popular preparations in use on the Continent from which we select the following:

ANTI-HYSTERIC DROPS (GERMAN PH.).

℞. Tinct. assafœtida,..... 15 | ..... (℥ ss).
Tinct. castor..... ..... 12 | ..... (℥ iij).
Tinct. opii..... ..... 4 | .... (℥ j).
M. Sig. Twenty or thirty drops in potion or in lavement two or three times a day.

ANTI-HYSTERICAL LAVEMENT.

℞. Ext. valerian,..... 10 | ..... (℥ ijss).
Camphor,..... | 75..... (gr.xii).
Yolk of one egg.
Laudanum, gtt. xx.
Water,..... 300 | .... (℥ x).
M.

ANTI-HYSTERIC PILLS (BAILLY).

℞. Powder of castor,
" " amber resin,
" " assafœtida,
" " valerian, } ää..... 4 | ..... (℥ j).
" " camphor,..... | 60..... (gr.x).
Syrup papaver, q. s.
F. S. A. Massa, div. in pil. q. s.
Each pill should weigh about 30 centigrams, or five grains. Give 7 or 8 a day.

ANTI-HYSTERIC PILLS (DR. BREYNE).

℞. Camphor, assafœtida, ää..... 12 | ..... (℥ iij).
Ext. Bellad.,..... ... ... 4 | ..... (℥ j)..
Ext. opii.,..... 1 | ..... (gr. xv).
Syr. acaciæ. q. s.
M. F. S. A., pil. No. 120. Sig. Give one pill the first day, and increase by one pill a day till six are taken in the 24 hours. (*a*)

(*a*) Dujardin Beaumetz. Dict. de Ther. t. I. Ar.. Assafœtida. Stillé. Therapeutics and Materia Medica, Art. Assafœtida.

demonstrated, and, in the next place, because they have been superseded by a more active medication, that of the bromides. I shall not, then, dwell on all the numerous formulæ of potions, syrups, pills, ptisans, suppositories and lavements of supposed anti-hysterical virtues,[1] for which I refer you to your ancient formularies; but before passing to the bromide treatment, I desire to say a few words about valerian, which still enjoys a certain repute in the treatment of hysteria.

Valerian, the officinal portion of which is the root, is administered in infusion, in tincture (the ammoniated tincture is perhaps the best preparation), in the form of valerianates, and especially of valerianate of ammonia. For my part I have little faith in the therapeutic action of these valerianates, and finish what I have to say of this medicament by adding that the pills of Meglin, so much prescribed for nervous disorders, contain a notable quantity of extract of valerian.[1]

Who says hysteria, says bromide, and at the present day there is not a hysterical person but has taken bromide. The bromide of potassium is the most often employed, but you may also use the bromides of sodium and ammonium in combination with it, constituting solutions of the mixed bromides, of whose effects Charcot has spoken so highly. Here is the formula which I habitually use: ℞.—Bromide of potassium, bromide of sodium, bromide of ammonium, ää x; water ccl.—M. Signa.—From a dessertspoonful to a tablespoonful night and morning.

I do not intend here to enter into the details as to the physiological action of these bromides, of which I shall have more to say when I come to the treatment of epilepsy. What I wish now to impress upon you is that these medicaments are among the most powerful depressants of the cerebro-spinal axis, and that it is owing to them that we can control the exaggerated manifestations of the nervous system. If we add that the bromides allay genital excitation, you comprehend all the advantages which may be derived from this precious remedy in the treatment of hysteria; at the same time I am far from affirming that the bromide medication is to be applied indiscriminately to all cases of hysteria, and it is because abuse has been made of this medicament that we see to-day certain physicians maintaining that it is rather detrimental than useful in the treatment of hysteria. This is by no means the case; only here, as for other medicaments, it is necessary to know the indications and contra-indications for this bromide treatment. Moreover, we must not fail to keep in mind that whatever may be the relationship between hystero-epilepsy and epilepsy (and some pathologists affirm a very close relationship), there exists, from a therapeutical point of view, a great distinction between these two affections. In fact, while epilepsy is tributary to the bromide medication,

[1] This is the formula of Meglin's pills called compound pills of hyoscyamus and valerian.

℞. Alcoholic extract of hyoscyamus,
Alcoholic extract of valerian,
Oxide of zinc, ää 10 grm. (or ʒ ijss.)

M. S. Divide in pil. No. cc.

this same treatment has never effected a cure of the attacks provoked by hystero-epilepsy.

When the hysteria is accompanied by insomnia, excitement, and, in particular, genital excitement and much agitation, moreover, when the patient is of robust frame, the bromide will give admirable results. On the contrary, when your patient is feeble and anæmic, manifesting her neurosis by gloom and tears, and the nerve-centres are depressed in their action (there being no genital excitation), the bromide can do nothing but harm. The great inconvenience of the bromide results from its depressant action on the nervous system, and patients submitted to this treatment experience such a physical and mental torpor that it is difficult for them to apply themselves to their ordinary tasks.

The acne eruption which often follows the continued use of bromide in large doses is a serious evil, especially to fashionable young ladies, who strongly object to see their faces disfigured with this rash, and sometimes refuse the remedy altogether. I know no means of preventing this bromide eruption, which results from the elimination of the bromide by the skin. I know that it has been claimed that the internal use of arsenic will prevent the eruption, but I have often given it for this purpose with no result whatever.

As for the dose, this varies according to individuals, but, as a guide, you ought always to have recourse to an examination of the reflex sensibility of the velum palati, and your doses should be large enough to obtain, in most cases, anæsthesia of the pharynx. By way of caution, I would advise you not to give the bromide for a great length of time, and to occasionally suspend the treatment. For your guide, you have only to follow the evolution of the nervous manifestations. In most cases these manifestations are produced about the time of the catamenia; it is before, during, and after these periods that you ought to administer the bromide, and in such a manner that there may be in each month fifteen days of treatment and fifteen days of rest.

Beside the alkaline bromides, other bromides have been recommended, such as bromide of zinc and bromide of camphor.[1] The latter has been much vaunted these late years, but its action is very uncertain, and it has no efficacy except in cases of genital excitement; as for bromide of zinc, this preparation, little employed in this country, has been highly spoken of by Hammond, of the United States, who advises it especially in epilepsy. Opium plays an important part in the treatment of hysteria, and like bromide, has its advantages

[1] The bromide of camphor ($C_{10}H_{15}BrO$), was discovered and described by Swartz in 1862. It is obtained by heating in sealed tubes a mixture of one part of camphor and two of bromine at the boiling point. When it is pure, bromide of camphor presents itself in the form of transparent prisms. Its taste recalls that of camphor and spirits of turpentine. It is insoluble in water but very soluble in alcohol and ether; it melts between 76 and 77° C., and boils at 274°. Bromide of camphor is administered in pills and in capsules, in the dose of 50 c. g. to two grammes in the twenty-four hours.(*a*)

(*a*) Deneffe On mono-bromide of camphor. (Presse Medicale Belge. 1871.)
Bourneville On the therapeutic employ of bromide of camphor. (Progres Medical, 1874-5-6.)
Petrovitz, On bromide of camphor (th. de Montpellier, 1875.
R. Lawson, Practit, 1875.
Pathault On mono-bromide of camphor (th. De Paris, 1877).

and disadvantages. It was my master, Bernutz, who, after Gendrin, extolled especially the opiate medication. He administered laudanum in the dose of two drops twice a day, and gradually increased the dose till forty drops were taken in the twenty-four hours. This treatment is mainly applicable to the asthenic forms of hysteria; I believe it useless and dangerous in the sthenic forms, and you plainly see the indications for the opium treatment are directly opposite to those for the bromide treatment, for opium has an exciting action on the nervous system, while bromide is depressant. Unhappily, this treatment by opium has another disadvantage, in the large doses which one is compelled to attain in these cases, and many hysterical patients become morphomaniacs. In order to avoid these disadvantages, it has been proposed to substitute chloral, but here again you encounter serious inconveniences, for the continued use of chloral in doses gradually increased is very detrimental.

This question of dose in neuropathic patients is of the greatest interest; hysterical subjects present, as Huchard has well said, *a veritable therapeutical ataxia*. Sometimes they are poisoned by extremely small doses of certain substances, and sometimes they experience no therapeutic effect from really enormous doses. It is well to bear this fact in mind when called to treat a hysterical person. Do not forget, moreover, that there exists from the point of view of medicinal treatment, a moral influence of a direct and positive kind, and that here you will have occasion to witness the triumph of pills of *mica panis*, of potions of the extract of dandelion; in a word, of all those preparations which act on the imagination alone. The history of medicine abounds in cases where, owing to the assurance with which they have been prescribed, these pills and these potions have had the most signal curative efficacy in neuropathic individuals.

By the side of pharmaceutical treatment, and even above it, is placed balneotherapy, which comprehends three modes of application; baths, hydrotherapy, and mineral waters. Warm baths, and particularly prolonged baths, have a very happy influence in the treatment of nervous disorders, especially in the period of excitation, and Bernutz has greatly vaunted their effects. These baths ought to be of from one to two hours' duration, and the water all this time should be kept at the same temperature. The therapeutic virtues of these baths are augmented by adding infusions of aromatic plants, as melissa or valerian, of which medicated baths Beau speaks in high terms. The good effects derived from these medicated baths are explicable, not on the principle of cutaneous absorption—the skin with its epidermic covering does not absorb medicinal substances contained in baths—but entirely by the introduction through the respiratory passages of the odorous and volatile principles of the herbs employed. It has, as you are aware, been maintained that in order to obtain the therapeutic effects of valerian it must be administered, not by mouth but by inhalation.[1]

Hydrotherapy plays an important part in the treatment of hysteria; it

[1] Pomme has greatly extolled prolonged baths in hysteria; he regrets that the day is not more than twenty-four hours long, because, that now, he is not able to give them as long as he would like.

constitutes, with the bromides, the grand basis of the therapeusis of this disease, but it is important that you should know how the cold water should be applied. It is advisable to employ douches at the beginning of the treatment, but always tempered douches. The effect on the nervous system of cold water is sometimes so violent in hysterical patients, as to determine such a state of suffocation that after enduring the first cold douche, they obstinately refuse to submit any longer to this treatment. It is well, then, to begin with tempered douches (about 25° to 30° Cent.), and to progressively lower the temperature of the water; and it is only when the system is habituated to this mode of treatment that you will be able to give cold douches, or rather alternating douches (douches alternately cold and hot). These last sometimes have too stimulant an effect and determine hyperexcitation; you must then return to tempered douches. In a word, in your hysterical patients, you ought always to begin with tempered douches, and then according to the periods of excitation or depression in which your patient is found, you should employ the stimulating action of the alternating douche, or the sedative effects of the tempered douche. You must avoid at first douching the heads of your patients; I have often seen the shower-bath on the head determine neuralgic pains of a severe nature, or quite persistent vertigines. The duration of the douche ought not to exceed thirty seconds.

You will derive from hydrotherapy thus utilized, very beneficial results; cold-water treatment restores not only the sensibility of the skin, as Thermes has shown, but it also promotes the equilibrium of the functions of the nervous system, and nutrition in general. But in order to obtain these results satisfactorily, it is often necessary to remove the patient from her family surroundings, and to place her in some hydrotherapeutic establishment, where the administration of cold water is made with great skill and prudence. And this is a point on which Charcot has justly insisted. Mineral waters have a feeble part in the treatment of hysteria, and generally as it is the action of cold water that is sought, patients are sent to the hydrotherapic stations so numerous in the centre of Europe, and which especially abound in Switzerland and the Tyrol; stations of which Devonne and Aussèe are types, and which, with the action of cold water, unite all the climatic conditions favorable to the treatment of affections of the nervous system. In France we have a thermal station which enjoys a certain repute in the treatment of nervousness, I refer to Neris; to these waters you may join those of Ussat, St. Sauveur, and Forges les Eaux.

But, while on this subject of mineral waters, I must caution you against the employment of sea-baths in hysteria. I see many of my confrères send their hysterical patients to the sea-side; it is a bad practice. For my part, I have always seen sea-air and especially sea-baths, attended with such excitation

Beau and Bernutz advise warm baths of two, four, six, and eight hours' duration.

Bernutz has seen, under the influence of baths six hours long, cataleptic attacks that have lasted six or eight months disappear completely. (Pomme, Traité des affections vaporeuses des deux sexes, Paris, 1883. Bernutz, art. Hysterie, in Nouveau Dict. de Med. et de Chir., 1873).

physician by the name of Perkins[1] grouped together all the facts from Galen downward, and propounded a medical doctrine which bore the name of *Perkinism.* But almost all of these facts were forgotten when Burq commenced that my patients were much the worse for it; so, in my opinion, the hysterical condition contra-indicates the employment of sea-baths.

Electricity is doubtless an element of secondary importance in the treatment of hysteria; nevertheless, it renders us good service. It may, as we shall presently see, arrest the attacks, or diminish their number; it may also modify sensibility, like hydrotherapy. In these cases, it is especially to static electricity that you should have recourse, as it is this form of electricity, revived by Arthuis, and more recently by Charcot and Vigoureux, which gives the best results. It is here that you should make use of those general electric baths, those electric brushes, and those sparks which I described in my lecture on medical electricity, procedures which constitute what is called franklinization. But there is a kind of medication which has with electricity many points of contact. I refer to metallotherapy, on which I desire to dwell at some length. From the most remote antiquity, medicinal properties have been attributed to metallic plates,[1] and plates of copper, lead, or gold, applied as veritable amulets to the skin, have had curative efficacy in certain nervous disorders, according to the statements of ignorant pretenders. About the end of the last century, an American

[1] The application of metallic plates or disks is of very ancient origin; Galen, Paul of Egina, Von Helmont, all made use of plates of lead as anaphrodisiac, and in the last century the amulets of Saturn were of popular usage in accouchements. Metallic gold was employed by Marcellus, Epicurus, Alexander of Tralles, Péter Albanus, as an external remedy for pains. Copper plates were employed by the contemporaries of Aristotle to assuage pain. In India they employ, as a therapeutic measure, alternately applications of pieces of gold and copper. Finally at the commencement of this century, Perkins in America, Frank of Vilna, Wichmann, and D'Espine made known facts where the application of metals modified nervous states. But all these facts had fallen into oblivion, when Burq communicated to the Academy of Sciences on the 4th of February, 1850, his memoire entitled, "Note to Serve as History of the Physiological and Therapeutical Effects of Metallic Armatures, or of Certain Metals on Paralysis of Sensation, or So-called Anæsthesia." Burq completed this work in his inaugural thesis of February 7th, 1851. It was not, however, till 1876 that the facts recorded by Burq were definitely recognized in the conclusion of a report made to the Society of Biology by Dumontpallier. (*a*)

(*a*) *Schiff*, Arch. des sciences phys. et nat., Geneva, 1879, No. 3. *Westphal*, Berliner klin. Wochens., July 27, 1878, p. 81. *Mader*. Wiener med. Wochens., 1880, p. 681. *Ost*, Corresp. Bl. Schweiz Aerzte, 1880. p. 524. *Sciamanna*, Gaz. di Roma, June 1, 1878, p. 227. *Parona*, Ann. univ. dè Med. et Chir., Oct., 1879, t. xlix, p. 336. *Cennctt*, Brain, Oct., 1878, p. 331. *Eulenburg*, Deutsche med. Woch., June, 1878, p. 151–327. *Tuke*, Metalloscopy and Expectant Attention (Journ. Ment. Sci., Jan., 1879, p. 508). *Gradle.*, Metalloscopy and Metallotherapy (Journ. Ment. of Nervous and Mental Diseases, Oct., 1878, vol. 3, p. 781). *Petit*, La Metallothérapie ses Origines son Histoire, Paris, 1881. *Huchard*, Traité des nervoses, p. 1128. *Dujardin-Beaumetz*, Des proprietés esthesiogenes de certains bois, appliques sur la peau (Bull. Gén. de Thér., t. 99, 1880, p. 97). *Hammond*, Clin. lecture on Metallotherapy and Expectant Attention, in Philadelphia Med. and Surg. Rep., April 3, 1878. Galen Book V. Paul of Egina, Book vii., sec 3. Peter Albanus, vide Spregel, vol II. p 203. Wichmann Ideen zur Diagnostik. Hanover 1800, t. 1. p. 159. D. Espini, Observations de Med. Prat. Annecy, 1838. Burq Academie des Sciences, 14th Feb., 1858 (thèse inaugurale). Dumontpellier Gaz. Med. de Paris, 1877, p. 241, etc. Oscar Jennings. Comparisons of the effects of different treatments in hysteria, preceded by a historic sketch of metallotherapy. Thèse de Paris, 1878. No. 335.

his experiments, and it is to him that we owe the valuable discovery of metallotherapeutics and the indications which flow from it. The first tentatives of this experimenter were made in 1850, and it was not till nearly thirty years later, after the reports made to the Society of Biology, in 1877 and 1878, by Dumontpallier, that this method entered definitely into the domain of current practice. Burq affirmed that metals applied to the skin restore sensibility, force, and animal heat, and that according to circumstances little understood, the curative metal varies with individuals. Such a person is sensitive to gold, another to iron, another to copper, etc. etc., and from the results of these external applications of metals he drew conclusions as to the internal administration of metallic preparations, which had the same property of restoring sensation and bodily heat; in a word, metalloscopy led to metallotherapy.

The experiments made in this direction by the Committee of the Society of Biology, under the supervision of Charcot and Dumontpallier, brought to light a great number of new facts; they showed that troubles of sensibility, limited to one-half of the body, might, under the influence of these metals, be transferred to the half not affected, thus illustrating what has been described as the *law of transfer*.[2]

[1] Perkins was a physician who practiced about the end of the 18th century in Plainfield, N. J., and who died in 1800, in New York. He was the inventor of an instrument whose essential part consisted in the presence of needles of different metals, some of steel and some of brass; in moving these needles over the painful parts of the skin it was claimed that pain might be made to disappear. This mode of treatment, brought from America to Denmark, had a great reputation. Heroldt and Rafne, physicians of Copenhagen, perfected this mode of practice, and employed needles of silver, of zinc, of bismuth, of copper and of lead and even of ebony and of ivory, and noted that the latter had but little effect. The name of Perkinism was given to this therapeutic procedure. (*a*)

[2] Huchard has given an excellent description of the phenomena which are observed as the result of metallic applications, and this is the way he classes them: 1. Return of sensibility. 2. Phenomena of transference. 3. Consecutive oscillations. 4. Provoked anæsthesia. 5. Phenomena of inhibition.

1. The return of general sensibility takes place from ten to twenty minutes after the application of the metallic plates, in a zone of several inches around the plate. It is announced by prickings, formications, and elevation of temperature. Moreover, pricks which were made before the application of the metallic plates, are red and bleeding. The muscular force returns at the same time as the sensibility.

2. Transference is produced symmetrically in homologous points, and sensibility to the temperature and the muscular force may also manifest phenomena of transference.

3. The consecutive oscillations show themselves after the applications of the metal, and alternate returns of æsthesia, and anæsthesia are produced in the point where the metallic application has been made and in homologous points.

4. Just as one can produce æsthesia one can also provoke anæsthesia.

5. As for the phenomena of inhibition, they are produced by fixation of the phenomena of æsthesia or of anæsthesia, by the adjunction of neutral plates to active plates. (*b*)

(*a*) Alibert's Elements of Therapeutics, Vol. II., page 521.
(*b*) Huchard, Traite des Levroses, Paris 1871, page 123.

It was also discovered that metals were not the only bodies capable of modifying sensibility, and the number of æsthesiogenous substances, as they are to-day called, continually increases. Charcot and Regnard, taking up again the first experiments of the last century, noted the æsthesiogenous properties of magnets.[1] Vulpian showed that electricity, applied to a very circumscribed part of the cutaneous surface, possessed the same properties. Then Grasse, with the vesicatory; Thermes, with cold water; Parona, with metallic salts; Seure, with dried collodion and cellulose; and Lannois and Huchard, with jaborandi, obtained the same results.[2] I myself, in my hospital service, have shown, as Jourdanis had previously done, that wood, like metals, can restore sensibility, and that, just as there exists active and inactive metals, there exist

[1] Magnets have been utilized in therapeutics for many years, and without speaking of antiquity, when magnets were applied internally to cure nervous affections, in the 17th century they were employed in the crisis of hysterical suffocation. Father Hell constructed armatures which were used in France by the Abbey Le noble, Descemet, La Condamine and Arquier. In their report to the Royal Society of Medicine, in 1779, Andry and Thouret showed that the application of magnets is especially useful in diseases which have for their principal cause exaggerated action of the nerves, such as spasms, convulsions, and acute pain.

Lænnec employed magnets in certain spasms. Charcot, Debove and others have especially studied the action of magnets. (*a*)

[2] The number of æsthesiogenous substances is considerable, and, apart from electricity, it has been noted that the following substances may bring back sensibility:

1. Collodion. Seure has observed the action of collodion as an æsthesiogenous agent; he makes use of dried plates of collodion which he applies to the skin.

2. Pilocarpine. Grasset, Lanois, and Huchard have caused sensibility to return by practicing sub-cutaneous injections of pilocarpine.

3. Plates of bronze and of various materials. Plates of bronze, according to Wesphal, are æsthesiogenous. Parona has employed minerals, such as sulphate of iron, carbonate of lime, sulphate of lime, and fluoride of calcium, and by this means has brought back sensibility. On the other hand, sulphate of baryta and mica do not posess any æsthesiogenous property.

4. Hydrotherapy. Thermes has observed that the employment of cold water and of ice restores sensibility.

5. Vesication. Sinapisms like vesicatories may restore sensibility. Grasset has insisted on these facts, which were before pointed out by Barthez, Buzzard, and Russell Reynolds.

6. Sonorous vibrations. Sonorous and mechanical vibrations possess æsthesiogenous properties. Maggiorani went so far as to maintain that it is by this molecular action that is produced the action of the metals, and of all æsthesiogenous bodies. (*b*)

(*a*) Hell. Med. Prat. Bibl. de Murray t. xi, 1779, Gottingen. Andry and Thouret, Memoires sur le Magnetisme. (Mem. de la Soc. Royal, de Med. 1879, t. iii., p. 521, 638.) Lænnec, Treatise on Mediate Auscultation, 1828, t. ii., p. 69. Maggiorane, la Magneteli nervosi, Milan, 1869. Proust et Ballet, Congrès d'Amsterdam, Nov. 23d, 1879 et Jour. de Ther., 1879. Debove soc. Med. des hôp., 1880, and Gaz. hebd. de Med. et Chir, Sept. 19th, 1859, p. 903.

(*b*) Beard, Brit. Med. Jour. Sept. 6, 1879, t. ii., p. 373. Seure, Researches on the Electrical properties of dried Collodion. (Acad. des Sciences, 1880.) Maggiorani, Bull, de Ther., t 49, p. 100, 1880. "On the Physical Effects of Sonorous Vibrations." Gresset, Return of General and Special Sensibility in a Hemianæsthetic Patient, after the use of an infusion of jaborardi (Jour. de Ther., No. 1, 1880). Lannois, Jour. de Ther., April 10, 1880. Huchard, Jour. de Med. et Chir. Practiqués, Dec., 1882, p. 541.

also woods with variable action, so that, alongside of *metallotherapy*, we have *xylotherapy*.[1]

The method invented by Burq,and called *Burquism*, gave rise to numerous experiments which were not limited to the school of Salpêtrière. In Germany, Westphal, Eulenburg, Mader, Ost; in Italy, Maragliano, Sepellì, Sciamanna, Parona; in England and America, Thompson, Hughes Bennett, Tuke, Donkin, Sigerson, Beard, Gradle, and Hammond, repeated the experiments of Burq, and to-day we have documents sufficiently complete, and sufficiently numerous to enable us to appreciate this method at its just value.

First, how are these metallic applications made? In a very simple manner. All that you have to do, is to apply to the skin of your patient certain metallic plates as directed by Burq, or what is much more handy, pieces of money, and to watch the phenomena that occur after this application, which may have a variable duration and extent; thus, for example you can make bracelets or girdles of these coins, to be worn for a time around the diseased part. We utilize in the same way disks of wood or of dried collodion; as for magnets, you should use large ones, of considerable power, and a weight of at least twenty pounds.

Internal metallotherapy may be tried; *i. e.*, having once recognized the active metal, you may give some pharmaceutical compound containing a salt of the metal in question. On this principle, chloride of gold[2] has been given in the dose of one to two centigrammes a day, nitrate of silver in the dose of one centigramme, the salts of zinc, and especially oxide of zinc, in the dose of twenty to thirty centigrammes, the salts of copper, the salts of iron, etc.

What are you to think of metallotherapy? Are there certain genuine facts at the basis of this medication, or is it a species of dupery? After the report of Dumontpallier to the Society of Biology, medical men here in France and abroad were divided into two parties, one party maintaining that metalloscopy had no serious basis, and that a certain effect wrought on the imagination of hysterical patients, "expectant attention," as it was called, explained all the

[1] Hoggard had already shown the æsthesiogenous action of different kinds of wood as illustrative of "Perkinism;" in 1878 Bennett noted the action of various woods on the cutaneous sensibility. Dujardin-Beaumetz and Jourdanis have in their turn proved that there exists a series of active and inactive woods. The active woods are thuja, rosewood, mahogany, pitch-pine, butternut, maple, and apple tree; the most active of all is cinchona. Ebony wood, ash, poplar, and sycamore have no æsthesiogenous property. (*a*)

[2] Chloride of gold is obtained by putting in contact metallic gold with nitro-hydrochloric acid; a solid and crystalline mass is thus obtained, yellowish red, and very deliquescent. This chloride of gold had been before employed by Chrestien, of Montpellier, by frictions on the tongue and gums, in the dose of one centigram. It is a caustic and an emeto-cathartic which produces in the dose of 5 to 10 centigrams repeated vomiting. Of late it has been advised to use not chloride of gold, but gold leaf prepared for gilding; with this pills are made and given to the patient.

(*a*) Bennett, Brain, Journal of Neurolgy, October, 1878. Page 331. Dujardin-Beaumetz, On the æsthesiogenous properties of certain woods. (Bull. de Ther. t. 99, 1880, p. 97.)

phenomena observed; others, on the contrary, maintained the positive remedial power of the metallic applications, apart from any "moral" effect.

To-day, gentlemen, unless we except a few obstinate individuals whom nothing can convince, everybody seems to be agreed that there do exist æsthesiogenous substances which restore or transfer sensibility, or cause to disappear certain nervous troubles, not only in the case of neuropathic persons, but also in certain lesions of the nervous system. But while admitting the truth of the facts adduced by Burq, it must be borne in mind that from the exclusive point of view of therapeutics, this method has not realized all that has been expected of it. Yes, the application of metals to the cutaneous surface has sometimes caused sensory troubles to disappear; it has even cured certain contractures, but these are exceptional facts, and the results obtained are temporary. In short, metallotherapy merits a very humble and secondary place in the treatment of hysteria.

I have experimented much with metallotherapy in my hospital service. I have observed facts very curious, very strange, the physiological explanation of which seems to me, at present, impossible to give; but my hysterical patients have not derived from this method any definite or lasting benefit, and they generally go away in about the same condition as when they entered. I add that there is a certain number of anæsthetic hysterical patients on whom metallotherapy has no effect, especially when the loss of sensibility is general. At the same time I admit that there is between the convulsive manifestations of hysteria and disturbances of cutaneous sensibility a very intimate correlation, and when you cause the latter to disappear, you often cure the former. We have, then, every interest, from a therapeutic standpoint, in restoring sensibility to the skin, and as metallotherapy is one of the means for attaining this end, in spite of the temporary and often uncertain results which are obtained, it is not best to abandon this mode of treatment, which is attended with no danger, and enables us, in certain cases, to obtain alleviation, if not permanent cure

I have now finished the general treatment of hysteria, and come to the second part of my subject, the treatment of the attack. When a hysterical subject has an attack, you ought instantly to place her on a small bed or cot convenient for passing around; you should remove all tight clothing and everything which can cause constriction, and then proceed to employ the various means in repute for putting an end to the paroxysm. Formerly they were in the habit of pouring or dashing cold water on the face of the patient. Cruveilhier,[1] reviving an ancient practice, made the patient swallow large gulps

[1] This is the way Cruveilhier proceeds : At the moment when the jaws cease to be contracted, he introduces the edge of a teaspoon, which keeps the mouth open; then seizing a bottle full of water, he pours the water from a certain height into the mouth of the patient; this he continues to do for some time. The first mouthfuls are generally rejected, but the spasm of the throat ceases, the patient can swallow, and soon comes to herself. The water never in these cases penetrates the larynx. Anstie recommends to make strong pressure over the abdomen, in order to force the uterus into the pelvis, for it was supposed at this period that it was the uterus itself which, by its position in relation to different organs,

of cold water, but lately we have found a quicker and surer method—that of compression of the ovary.

The ancients, who attributed to the uterus a preponderating *rôle* in the convulsive manifestations of hysteria, had already proposed various manœuvres, which consisted in compressing the womb, in putting in the vagina odorous substances for the purpose of acting directly on the womb, or in various measures for ridding the womb of purulent humors which it was supposed to contain (such even as titillation of the external genitals and neck of the womb, as recommended by Galen, Forestus, and Ambroise Paré). Areteus, Aetius, Sauvages, Astruc, and others dwell long on the advantages of various procedures; you know even that external compression is of vulgar usage, and you often see persons make pressure and even *sit* upon the belly of patients to arrest convulsive seizures. But this practice has been reduced to method since the labors of the Salpêtrière, which have shown us that one of the most frequent hysterogenous points is the ovarian region, and that it suffices to compress this region, either on the left or on the right side, to bring on an attack or to cause one to disappear.

This is the way to practise compression: the patient being placed on a hard, low bed, the physician, standing by her side, plunges the closed fist perpendicularly into the sensitive ovarian region. It is necessary at first to employ considerable force to overcome the contraction of the abdominal muscles, but once this obstacle is overcome, the hand penetrates the iliac fossa, and the spasms cease if the pressure be continued for a certain time.

Certain apparatuses have been constructed, called *compressors of the ovary*, models of which I now show you, and the most simple of which is that of Ferrè, which consists in a hernia truss, terminated by a conical pad, which is applied over the sensitive ovary. This apparatus, they say, will prevent the recurrence of a convulsive attack; I avow that I have never made use of these compressors, and therefore know nothing about them. Surgeons have even gone further: they have proposed ablation of the ovaries, and we have seen Battey and Peaslee perform this spaying operation in cases of hystero-epilepsy.[1]

determined the attack of hysteria, and that all that was necessary, in order to cause the attacks to disappear, was to press the uterus into its normal position. Recamier, nearer our epoch, counselled an analogous procedure in the application over the abdomen of the patient of a pad, with which he made very energetic pressure. Among the common people this practice has been known for a long time, and we see in the history of the Convulsionists of St. Medard the account of women on whose bellies persons jumped, or even placed large stones; some even were in the habit of striking hard blows, frequently repeated, with iron bars or heavy clubs. Gustave Sadrain prefers compression of the ovary to galvanism in the treatment of the hysterical attack (*a*).

[1] To Battey is due the chief credit of this operation, now known as Battey's operation. There are on record three cases, at least, where ablation of the ovaries resulted in permanent cure of hystero-epilepsy, recurring at the menstrual period; those of Battey, Peaslee, and Braun-Ferwald. Vide Battey, Atlanta Med. and Surg. Journal, September, 1872, and American Practitioner, October, 1875. Also, Peaslee, Transactions of the Amer. Gynæcol. Soc., p. 340, 1876, and Hegar, Die Castration der Frauen, etc., 1878, pp. 136–138.

(*a*) G. Sadrain, Etude sur le traitement des attaques d'hysterie. Th. de Paris, 1880.

Unfortunately, not all hysterical females have ovarian troubles, and in such cases the method of compression is not applicable; you can then advantageously have recourse to electricity.

Vigouroux and Richer have shown that galvanic currents, one of the reophores being applied over the front, and the other over some other part of the body, diminish the duration of attacks of hysteria; moreover, if you suddenly reverse the direction of the currents, which is easily done with the commutators of Trouvé and Gaiffe, the attack ceases immediately. You must not exceed six to ten milliampères, for if you do, you will determine severe head-troubles.

In fine, inhalations have been proposed of odorous substances; the number of these is considerable, and the ingredients very strange, from deer's horns and goat's feet, to the odors of candle snuff, of the hairs of men and of animals, and the feathers of partridges and woodcocks; the ordinary perfumes, benzoin, musk, ambergris, etc., have all been advised. To-day we discard all these things, and recognize but a very few medicinal substances, whose inhalation has a beneficial effect on hysteria; these are ether, chloroform, and especially nitrite of amyl. Ether and chloroform may render you some service. I have not, however, been very successful with these anæsthetics. The attacks are prolonged, and they are almost sure to reappear when the anæsthetic sleep has passed off. Nitrite of amyl, with which Bourneville has made so many experiments in hysteria, certainly diminishes the intensity and the frequency of the convulsive paroxysms. You must not, however, resort to it, except during the attacks, for at other times it may determine convulsive seizures. When giving the nitrite of amyl, you pour five or six drops on a handkerchief, and cause the patient to inhale, them.

I shall finish this lecture by giving you, with as much brevity as possible, some indications respecting the treatment of certain manifestations of hysteria. The contractures are the most rebellious of symptoms in hysteria, and nothing is more painful than to see young women afflicted with various contractures,[1] which make life a torture. These contractures appear suddenly after an attack,

[1] Hysterical contractures, known for a long time, have been thoroughly studied the last few years by Charcot, Bourneville, and Voulet.

They may be transient and come on during the attacks of hysteria; artificial, and provoked by mechanical excitations, or permanent, and appear in the interval of the attacks, or after the attacks.

We shall here concern ourselves with only the permanent contractures. They may affect all the muscles, take on the hemiplegic or paraplegic form, strike singly a muscle or a whole group of muscles. They occur ordinarily suddenly and without apparent cause; sometimes, however, in a hysterical patient affected with flaccidity of the paralyzed limbs or even in a subject who has never yet presented symptoms of hysteria, a slight traumatism, or even muscular exertion suffices to give rise to contracture.

Contractures are always accompanied with a disturbance of sensibility, whether anæsthesia or hyperæsthesia of the skin. The muscles affected are in an absolute rigidity which the most energetic efforts do not succeed in overcoming, and which does not yield even momentarily except to chloroformization carried very far. The duration of the contractures is indefinite. They may last months, years, and cease spontaneously without apparent cause, or under the influence of some mental emotion, leaving the parts in a state of perfect integrity. The contracture may also persist indefinitely, and in this case the autopsy some-

and may disappear as suddenly after another attack. This is an occurrence which is witnessed in all the manifestions of hysteria, and you have seen a fine illustration of it recently in our wards. I refer to that young hysterical girl who entered the hospital for gastric troubles, and was suddenly taken with contractures, which disappeared after a convulsive attack, which we induced by chloroform, given to anæsthesia. This is then a means of cure which you can employ in hysteric manifestations of every kind.

Electricity, metallotherapy, and cold douches have sometimes caused these contractures to disappear; in other cases they have resisted every kind of treatment, and have persisted for months and even for years. But whatever may be their intensity, they disappear momentarily under the influence of anæsthesia, when carried to completeness, or of energetic compression of the contractured member.

By the side of these contractures we must place paralysis, which appears and disappears with extreme rapidity. This paralysis, which often affects the inferior members, presents this curious peculiarity that it is always accompanied by trophic disturbances, and you will sometimes see hysterical paraplegics recover in an instant the integrity of their motor functions. It is here that electricity and hydrotherapy may give unlooked for curative results.

times discloses a sclerosed state of the lateral columns of the spinal cord. Bourneville and Voulet divide contractures into partial contractures and contractures of the members.

The first embrace more particularly: (1) a half of the face; the muscles of the eye are not spared, whence result troubles of the accomodation; (2) the muscles of the upper maxilla (trismus); (3) the tongue, and sometimes the velum pendulum and œsophagus; (4) the muscles of one side of the neck (hysterical torticolis, which is one of the most frequent manifestations in infantile hysteria); (5) the muscles of the organic life, the choledic duct, whence icterus; the sphincter vesicæ whence retention of urine, etc.

The contracture of the the members takes on several forms; monoplegia, hemiparaplegia, paraplegia and hemiplegia. The contracture of an upper limb is quite rare; in these cases the limb is in a state of flexion, the arm adducted, the forearm supinated and half bent on the arm, the hand flexed on the wrist, the thumb bent into the palm of the hand and covered by the fingers strongly flexed. In the contracture of the lower extremity it is extension which predominates. When there is paraplegia, the member is in forced adduction; the knees are brought together, and the feet present a characteristic attitude (hysterical club foot); the heel is elevated, the tendo achillis is prominent and on the stretch, the dorsal aspect of the foot turned outwards, the plantar aspect is hollowed out and looks inward and backwards, the external malleolus becomes very prominent. The extremity of the foot is strongly depressed and the toes are flexed (Richer). It is quite rare to observe the crossed form in which the upper member of one side and the inferior member of the opposite side are affected.

What is sufficiently frequent is the periarticular form in the foot, and especially the hip.

When the muscles of the foot are affected, you observe, ordinarily, the variety of club foot known as *varus equinus*, sometimes the variety of *direct varus*.

In the hip contracture of the muscles of the pelvi-trochanteric region gives rise to hysterical coxalgia, spasmodic and nervous.

In these cases, as in all those where there is any doubt if it be hysteria or not, it is well to have recourse to chloroformization, to clear up the diagnosis; the hysterical contractures disappearing under the influence of the anæsthetic.

As for the troubles of sensibility,[1] I will not repeat what I said while treating of the neuralgias, and I will only say a word or two about anæsthesia. This is, as you know, a disorder almost constant in hysterical women, but one which

[1] Disorders of sensibility are quite frequent in hysteria, but those which are observed are generally cutaneous disturbances; hyperæsthesia and anæsthesia. Hyperæsthesia or dermatalgia, which is most often met in acute hysteria, according to Briquet, may present several degrees; touch acquires such a sensibility that the lightest contacts, even a breeze of fresh air, provoke a disagreeable impression, and in some cases even pain. The dermatalgia may commence by a limited point and from thence spread over the whole body; it may also be localized and affect half the body, the anterior or the posterior aspect, one or several limbs. It is accompanied also, in some cases at the beginning, with agitation, cerebral excitation, numbness and formications in the limbs, sometimes also with pains in the subjacent parts. Limited to the mammary region, it may provoke a severe pain in the gland and simulate a grave disease. Localized in the hand or foot it prevents prehension or walking; if it reaches the thorax it hinders respiration; if it is in the vulva and the entrance of the vagina, sexual relations become impossible. Hyperæsthesia sometimes co-exists with anæsthesia in certain points; hyperæsthesia of one side of the body, anæsthesia of the other. The superficial muscles are frequently affected; in 430 cases of hysteria, Briquet found only 20 that were exempt from muscular hyperæsthesia. Pressure, the lightest touch provoke pain, and this pain resides in the muscle itself, and is seated especially at the points of attachment of the muscles. Myoxalgia is peculiar to hysterical patients; it appears after an attack of convulsions, or slowly and gradually in anæmic patients and those who are a prey to disappointments. It is not accompanied by any inflammation, nor by any muscular lesion. Its duration is variable; it ceases with the causes which have produced it, or under the influence of an appropriate treatment. Cephalalgia, considered by some physicians an a neuralgia, a migrane, is, according to Briquet, a muscular hyperæsthesia; it is characterized by painful points on the forehead, on the temples, on the occipital region, on the top of the head.

The *clou hystrique* is ordinarily seated on the vertix or the anterior angle of the parietal bones; it occupies a variable extent, being as large as a two franc piece, or even a little larger; the pain is sometimes sufficiently violent to cause the patient to cry out, and is compared to the sensation of a hot iron or a nail bored into the head. Epigastralgia is extremely frequent (317 cases out of 358 have been observed by Briquet); it may have its seat in the recti muscles of the abdomen and accompany gastralgia. It generally precedes the attack of hysteria, augments during the paroxysm and persists some time after; it is intense and is aggravated by pressure, walking, coughing, and moral emotions; it hinders muscular movements and respiration. Rachialgia or hyperæsthesia of the muscles of the spinal column, is equally frequent (out of 430 cases it has been observed 306 times by Briquet). Like epigastralgia, it is generally seated on the left, and oftener in the upper half than in the lower half of the vertebral region. The pain may be brief and insignificant, or it may be permanent and so severe as to simulate Pott's disease of the spine, or some other spinal affection. Pressure awakens this pain, or exasperates it to such a degree as to provoke suffocation, dyspnœa, palpitations, a sense of strangulation in the throat, and constriction of the glottis. Plueralgia is very common in hysterical patients (out of 300 cases Briquet observed 233); it is very rare in men. It extends half the length of an intercostal space, starting from the vertebral groove, or it seems to be a continuation of the rachialgia and terminates in front being confounded with epigastralgia. It occupies ordinarily a space of four or five fingers' breadth on a level with the 5th, 6th, 7th, and 8th ribs. It is more common on the left side. The pain is either very light or very intense, and is exasperated by pressure, by cough and by movements. Under the name of cœlialgia Briquet describes hyperæsthesia of the muscles which compose the circumferance of the abdominal cavity, in front and behind; it exists in half of the cases; and it is frequently seated in different parts of the anterior wall. Hyperæsthesia of the muscles of the anterior part of the thorax constitutes thoracalgia. It is very rare. Hysterical patients suffer from arthralgia and this pain is developed in persons long

gives them so little trouble, that a person whom you observe for the first time will hardly call your attention to this loss of sensibility. I have seen patients presenting the strangest disorders of sensibility. I was first to observe what I

subject to neuroses; such as dental, facial, intercostal, lumbo-abdominal, coccygeal neuralgias. Rarely there is sciatica. According to Briquet, true neuralgias are infrequent in hysterical persons, and appear rather as a complication than as direct effects of hysteria itself.

The hyperæsthesia may also attain the organs of special sense, which thus acquire extra acuteness.

When the hyperæsthesia affects the larynx and the upper part of the trachea it gives rise to the hysteric cough, to pseudo-croupal suffocation, and to asthma. The hysteric cough, more common in girls than in women who have exceeded thirty years of age, is never a primitive symptom. It may be continuous and only cease during sleep, or come on in paroxysms and last only a few hours. The hysteric cough may persist for months or even for years, and go away, suddenly or gradually. The pseudo-croupal suffocation is quite rare, yet has been so intense that tracheotomy has been practiced for its relief, as in two instances by Michon and Velpeau. The asthma (uterine asthma of Von Helmont) is never permanent, often disappears suddenly, and frequently alternates with some other hysterical phenomenon.

The hyperæsthesia of the digestive passages gives rise to gastralgia, and to enteralgia. The gastralgia may be one of the first symptoms of the hysteria, and it is seldom that it appears for the first time before the age of twenty-five. Patients begin by losing their appetite, then they have curious longings; eat clay, earth, charcoal, or have singular antipathies, and cannot eat such and such kinds of food. In other patients vomiting constitutes the predominant symptom; they cannot keep down any kind of nourishment, and vomit it before it has undergone the least digestion.

The gastralgia may completely destroy the appetite, may excite it or pervert it. When the patients eat, it is not rare that the ingestion of food causes a severe pain which is not quieted till they vomit. This leads them to refuse all nourishment, and it is quite likely in some of these cases that the suffering and inanition may be sufficient to cause death. At the autopsy no lesion of the stomach is found. Like all the hysterical symptoms, the gastralgia is under the influence of mental emotion. It may cease abruptly, and be replaced by some other phenomenon. Enteralgia is quite rare; Briquet has noted it but 20 times in 400 patients. It is characterized by quite sharp colicky pains, appearing and disappearing suddenly, and accompanied by flatulent distension of the belly. At the same time constipation is noted, and this sometimes so great that patients will pass weeks without going to stool. Other hyperæsthesias have also been met with; nephralgia, very uncommon; cystalgia and hysteralgia of the body or neck of the womb. Anæsthesia is common in hysterical persons; it may affect the skin, the sense organs and the muscles. It is general, unilateral, or it occupies only a limited portion of the integument; it is complete, that is to say that it is accompanied with abolition of the sense of touch, temperature and pain; or it is incomplete. It may appear suddenly, before or after the attacks of hysteria; sometimes also it comes on after a pronounced hyperæsthesia. Generally, anæsthesia shows itself insidiously, the patient not even being aware of it till the physician discovers it.

When the anæsthesia is complete, you may even transfix the limbs with a sharp instrument and the patient experiences no pain, his features are impassive, and the puncture gives little or no blood.

These phenomena explain the self-mutilations practiced by certain hysterical persons; they account also for the attitudes of the convulsionists of Saint Medard.

Complete anæsthesia is ordinarily accompanied with a lowered temperature, a retarded capillary circulation of the anæsthetic part, with formications and numbness in the neighboring parts, and a muscular weakness appreciable by the dynamometer.

When the anæsthesia is very extensive it may be complicated with cephalalgia. Whatever part it may affect, it never occupies but the localities innervated by nerves of the cerebro-

have described as *autographic women*,[1] and always it was the attentive examination of the patient, and never her declarations, which enabled me to detect these disorders.

At the same time the troubles of sensibility are important from the point of view of treatment, because when they disappear it may be affirmed that the patient will have no more attacks of hysteria. There exists, as I stated before, an intimate relation between the troubles of cutaneous sensibility and the convulsive phenomena. Metallotherapy, static electricity, the application of magnets, in short, all æsthesiogenous substances, may restore this sensibility, but generally this restoration is momentary.

Troubles of the special senses have been noted, and especially of sight. Charcot has pointed out the alterations of vision in hysterical patients, and I have myself observed, with Dr. Abadie, a very curious case of sudden amau-

spinal axis; it never affects those regions which receive their nerves from the great sympathetic principally, such as the lungs, the digestive tube, the heart. The most frequent form of hysterical anæsthesia is the hemi-anæsthesia, which affects the head, the limbs, the trunk of one side.

It is always accompanied with muscular enfeeblement of the same side, and often with a lowering of the temperature. It affects all the modes of sensibility; sensibility to touch, to pain, to temperature; the organs of sense, the sight, the smell, the taste, the hearing are alike involved. On the part of the eye, you may observe amblyopia, achromatopsia, amaurosis. The two eyes may be affected. Sometimes only one is involved, and in this case, the well eye supplies the place of the other, and the patients make little account of their affection. The amblyopia is habitually accompanied by general achromatopsia; violet is the first color to disappear, then green, red and finally blue.

Amaurosis may appear suddenly after an attack of hysteria (Briquet), or without any precursory sign independently of the attacks (Landouzy). Hearing is more rarely affected. As for the sense of smell; loss, complete or partial, of olfaction has been observed.

The loss of sensibility is oftener partial. On the part of the mouth, the buccal mucous membrane is sensitive on one side, insensitive on the other; one-half of the two borders of the internal aspect of the cheeks, of the palatine arch of the velum pendulum, of the gums.

Sapid substances are tasted only on one side, and in consequence of the anæsthesia, mâstication is performed badly.

Sometimes a complete insensibility of the velum pendulum palati has been observed, titillation provoking no reflex action. The duration of the anæsthesia is variable; it may be temporary or continue months and even years; it ceases with the other hysterical accidents, or under the influence of treatment, such as the application of æsthesiogenous agents.

[1] Dujardin-Beaumetz reported to the Societé des Hôpitaux, at their meeting on the 11th of July, 1879, the first case of an autographic woman. In this patient it sufficed to trace on the skin characters or lines, to see developed at the end of a few minutes a salient gyrus, corresponding very exactly to the tracings, which remain for some time, and which, at first limited and strongly defined, spread more and more, to be effaced at the end of four or five hours. The characters so traced were sufficiently prominent so that a wet-proof could be taken from them, as was done for the museum of the Hôspital St. Louis.

Since the communication of Dujardin-Beaumetz the number of autographic women has considerably increased, and this same modification of the vaso-motors has been found, not only in hysterical persons, but also in men and women free from all nervous diseases. This symptom is an urticaria, limited to the point of the skin on which the markings are made. (Dujardin-Beaumetz, Note sur les troubles vaso-moteurs de lap eau observés sur une hysterique, femme autographiqué, Bull. et Mém. de la Soc. Med des Hôpitaux, t. xvi. 2e Serie, 1879, p. 197.)

rosis in a hysterical female, and which was speedily cured by the metallic applications.[1]

Gastric hysteria is one of the most formidable phases of this neurosis, for it interrupts nutrition, and eventually brings about such disorders as even to cause death. By the term gastric hysteria is understood all the gastric and intestinal disturbances which are observed in hysterical patients, from anorexia to incoercible vomiting. These vomitings may occur under two circumstances; either they succeed to that strange anuria, described by Charcot[2], or else they come on without any antecedents sufficient to account for them. In the first class of cases you ought to respect these vomitings, as they are uræmic; in the second you ought to endeavor to arrest them. To the therapeutic rules which I gave you when speaking of the treatment of vomiting, I now add artificial alimentation (gavage) and electricity. Forced feeding has given me excellent results in certain cases, when used at the onset of the attacks. Ballet has observed similar facts in the service of Charcot, and you will find in the excellent thesis of my pupil Deniau a certain number of observations of a like kind, cases occurring in my hospital service. At the same time, if you expect success from "gavage," you must begin the treatment at a period not far removed from the inception of the gastric troubles, for, as Débove has judiciously remarked, these vomitings, when they have lasted a long time, produce such an enfeeblement of the organism that all medical intervention is well nigh useless.

Apostoli has proposed to galvanize the pneumogastric during digestion, in order to prevent these vomitings. He requires the patient to take food; then immediately afterward he places the positive pole over the pneumogastric nerve on the right side, in the region of the neck, while the negative pole is held in the hand; then he passes a current of variable intensity, according as the nausea is more or less frequent. I have, by this means, employed in my

[1] Vide Charcot, Troubles de la vision chez les hysteriqués, Progrés Médicale, 1878, p. 37. Bonnefoy, Des troubles de la vision dans l'hysterie (Thése de Paris, 1874). Baron, Troubles de la vision ches les hysteriqués et les hystero-epileptiques (Thése de Paris, 1877). Galezowski, Progrés Méd., 1878, p. 39. Dujardin-Beaumetz et Abadie, Hysterical Amaurosis, Amelioration by Metallotherapy and by Magnets; Complete Cure under the Influence of Static Electricity (Progrés Médical, 1879). The following is a brief résumé of this most interesting observation: Mlle. X., aged sixteen, went to bed, January 21, with headache; had never before experienced any symptoms of hysteria; the next day, the 22d, she awoke totally blind. Examination of the eye by Abadie did not reveal any alteration of the fundus of the eye. There was loss of cutaneous sensibility on both sides of the body. Three pieces of gold were applied to the left temple, and in half an hour partial vision was restored on that side, but on the right side blindness persisted. Acuity of vision in the left eye, one-tenth. Magnets were applied, which ameliorated the right eye, and the sight of the left eye. February 5, acuity of vision was two-sevenths on the left, and one-fifth on the right. Each application of the magnet, or of metal, induced a state of lethargy; static electricity was then employed, and this completed the cure, and it has been permanent.

[2] Maladies du Syst. Nerveux, t. i. lect. ix. See also Ballet, Two Cases of Nervous Vomiting, Treated with Success by Forced Feeding (Prog. Med., June, 17, 1882). Deniau, De l'hysterie gastrique et de son traitement (Thése de Paris, 1883). Huchard, Traite des neuroses, Paris, 1883. Fabre (de Marseille), De l'hysterie viscerale, Paris, 1882.

service, seen digestion performed without rejection of the matters of the stomach. I shall not enlarge upon this therapeutic measure, which I fully treated of when lecturing on diseases of the stomach.

Such are the considerations which I wished to present respecting the treatment of hysteria. The therapeutic indications which I have furnished are far from being complete; at the same time I think them sufficient to enable you advantageously to combat the principal manifestations of this neurosis. But do not forget, gentlemen—and with these words I conclude—the complete cure of hysteria is very rare. You will hardly have triumphed over one of the many manifestations of this protean malady before others will make their appearance, and, notwithstanding all your knowledge, and all your energy, you will continually fail in the contest with these nervous troubles, ever renewed, and ever rooted in the depraved and insatiable imagination of the hysterical patient.

ON THE TREATMENT OF EPILEPSY.

SUMMARY.—Treatment of Epilepsy—Curability and Incurability—General Treatment—Pathogeny and Etiology—Experimental Epilepsy—Disease of the Spinal Cord, the Nerves, and the Brain—Causes—Therapeutics of Symptomatic Epilepsy—Antisyphilitic Treatment—Revulsion—Essential Epilepsy—Physiological Pathology—Treatment of Essential Epilepsy—Empirical Medication—Galium, Valerian, Hyosciamus, Belladonna, Indian Hemp, Nitrate of Silver, Oxide of Zinc, Ammonio-sulphate of Copper, Bromide of Potassium—History—Physiological Action of Bromide of Potassium—Employment of Bromide of Potassium in Epilepsy—Result of the Treatment—Rules of Administration—The Alkaline Bromides—Bromides of the Metals—Doses—Mode of Administration—Duration of Treatment—Curare, Cocculus Indicus and Picrotoxine—Treatment of the Attack—Hygienic Treatment.

Gentlemen : I devote this lecture to the treatment of that most formidable of the neuroses—epilepsy.[1] When we survey the numerous remedies which have been proposed for this disease—remedies often uncertain and inefficacious—we easily comprehend the discouragement and despair of many physicians

[1] Epilepsy (haut-mal, morbus sacer, herculeus, falling sickness, St. John's evil, etc.), is divided into symptomatic, idiopathic and sympathetic epilepsy. It is known under two principal forms, the grand-mal (convulsive form), and the petit-mal (form not convulsive). The grand-mal is often ushered in by prodromes lasting several instants or even hours or days. The patients are subject to divers troubles, lassitude, choking sensations, palpitations, pains in the stomach, cephalalgia, buzzings in the ears, dazzling sensations, perception of strong odors, of strange tastes, hallucinations of the sight and hearing. Some persons have an irresistible desire to walk, to run, to leap, others present a manifest change of character, become gay or sad ; some have cerebral excitation, genital excitation, pollutions. Others complain of a sensation of cold, of tickling, or of pain which pursues generally an ascending course, starts in the foot or some other remote part, to mount up to the head with greater or less rapidity. Whether these phenomena, constituting what has been called the aura epileptica, exist or not, the patient is taken suddenly in a fit, he utters a cry, loses consciousness, and falls as if by lightning, generally in front, no matter where or on what object. The face is of cadaveric pallor ; all sensibility is abolished ; the patient is comatose. Soon arrives the convulsive period, the face colors rapidly, tonic convulsions immobilize the patient, who lies extended on his back, the head thrown behind or inclined to one side, the eyeballs hidden under the lids ; the face is convulsed, the teeth are tightly set against each other, the limbs contractured, the hands bent back, the thumb adducted, flexed in the palm of the hand. Respiration is suspended. This period of tetanism gives place soon to short, rapid shocks, then to clonic convulsions, which become more and more rapid and general. The limbs, sometimes in supination, sometimes in pronation, flexion or extension, are agitated by continual shocks. The face is colored reddish purple, the forehead is wrinkled, the eyes roll in their sockets, the eyelids quiver, there is grinding of the teeth, the jaws open and shut with such force as sometimes to break the teeth or bite the tongue, wounding it severely ; a frothy and bloody saliva escapes from the mouth. Respiration is convulsive, unequal, stertorous. The heart beats with force. Sometimes there is an abundant and involuntary emission of urine or of fecal matters ; some subjects have even seminal polutions. After one or two minutes of this stage, the convulsions abate, the patient utters a deep sigh, respiration becomes full and strong, and is accompanied with stertor ; the countenance becomes pale, is covered with perspiration, and the patient sleeps profoundly. This apo-

who have pronounced epilepsy incurable; moreover we see why the ancients attributed a divine origin to this affection, for to them the words *morbus sacer*, *morbus divinus*, testified sufficiently that the disease was generally above the resources of their art. But this feeling of discouragement ought no longer to exist. We have already found in the bromides a remedial agent which enables us to cure one half our epileptic patients, and we may be permitted to indulge the hope that some day we shall find a remedy still more powerful, which shall give us complete mastery of the disease. For this end we shall labor, and with all zeal.

It may almost be said that every medicine under heaven has one time

plectiform state lasts more or less long (from several minutes to several hours), and then the patient comes to himself, stupid, in a maze, quite unconscious of what has passed. Generally he is exhausted and complains of headache. There are even subjects who remain for some time hemiplegic and even aphasic. Others, on the contrary, recover almost immediately and have full possession of their physical and mental faculties. During the attack the pulse and the temperature present certain modifications. The pulse before the attack is rapid, cordy, and acquires force as the paroxysm advances. The temperature rises during the attack to 38° C., 38.5° C., and even to 40° C. during attacks of great intensity. On the part of the eye, during the aura there is observed, according to Brown-Sequard, Kusmaul, and Tenner, contraction of the arterioles and anæmia of the retina; according to others a hyperæmia of this membrane and encephalic congestion. Sometimes the attack may pass unperceived, when, for instance, it takes place in the night time. The patient relates with astonishment that he has wet his bed, that he found himself in the morning lying at the foot of the bed, and that he has headache; in fine that his tongue is bitten and hurts him. The onset of the attack of epilepsy has nothing about it that is fixed, either in respect to the time of its appearance or its duration. The fits may occur only at long intervals, or they may come on very often—several times in the same week, or same day; one may scarcely end before another begins, this sort of overlapping constituting what has been called the *status epilepticus*. The attacks have not always the same violence and certain convulsive phenomena may be wanting; the convulsions may be slight, and be limited to a general stiffness, a partial convulsion, the projection of a limb in front, behind or to the side, an imperious desire to rise, to walk, etc.; the patient does not cry out, does not fall, grows very pale, then comes to himself semi-conscious and stupid.

The *petit-mal*, the non-convulsive form of epilepsy, is characterized by absence of mind, vertigo, delirium. The attack comes on without prodromes. The patient is suddenly taken while reading, or engaged in conversation, a game of cards, etc. He stops suddenly as if stunned, becomes pale, has a fixed look, an aspect of hebetude, makes grimaces, then two or three seconds after he resumes his occupation completely unconscious of what has passed. Other patients fall suddenly from where they are standing or slip out of their chair, and rise up without perceiving their fall. Others in the midst of some occupation leave their place, go out and come back, without any remembrance of their conduct. There are some who during their sudden attack present contractions of certain muscles, pallor of the face, but continue mechanically and automatically the work which they had commenced. Other patients are taken with a more or less violent delirium of word and of action; they suddenly ejaculate incoherent words, make strange gestures, gesticulate violently or feel an impulse to walk, to run, etc. Under the impulsive and instantaneous delirium some commit obscene or criminal acts and cause themselves to be arrested for outrages against decency, for theft, homicide or arson. Then when after a period of greater or less length these unhappy beings come to themselves they have not the least recollection of their acts. These attacks last a few minutes, several hours or even several days; they may have temporary remissions or exacerbations.

or another been prescribed for epilepsy. Do not, then, expect from me an enumeration of this long list of medicaments; I shall merely touch upon a few of them to lay particular stress upon such as experience has proved efficacious. To give some system to my exposition, I shall divide the treatment of epilepsy into two parts: first, general treatment; second, treatment of the attack. In order to grasp the principles of the general treatment it is necessary to enter somewhat into details respecting the pathogeny of this affection.[1] Sometimes epilepsy is manifestly dependent on a lesion of the nervous system, it is then symptomatic; sometimes no lesion is apparent, and we call the epilepsy essential.

As for symptomatic epilepsy, experimental physiology and clinical observation have given us certain proofs of the influence of lesions of the nervous system on the development of this neurosis. Brown-Séquard by his curious experiments on guinea-pigs has shown us that epilepsy may be produced by section or ablation of the sciatic nerves, and what is stranger and still more inexplicable, that this experimental epilepsy affects not only the animal so mutilated, but also its offspring, so that epileptic guinea-pigs, in consequence of lesions of the sciatic nerves, ever afterward have epileptic progeny.

[1] The causes of epilepsy, which are multiple, may be divided into predisposing and exciting. It may be symptomatic, idiopathic, and sympathetic. The disease appears to affect women oftener than men, and preferably individuals that are delicate, lymphatic and nervous. It manifests itself towards the age of puberty or adolescence; it is rare that it appears after twenty-five or thirty, and in these cases, if observed in an individual previously healthy there is reason to believe it to be of syphilitic origin. Epilepsy may be hereditary, entailed as a legacy to the children by the father or the mother, or by the grand-parents, if the neurosis has skipped a generation, as sometimes happens. The parents may not be epileptic themselves, but only sufferers from neuroses, or chronic alcoholism, which is capable of giving origin to the disease. Epilepsy whose primary cause seems to consist in an abnormal excitation of the medulla oblongata, may be symptomatic of lesions of the nervous centres or of their membranes, of lesions of the cervical cord determined by compression, according to Charcot. The experiments of Brown-Séquard have shown, moreover, that you may provoke epileptic convulsions in an animal by making section of a part of the cord. According to Prof. Lasègue, epilepsy depends generally on a malformation of the cranium, or asymetry of the face. The disease is also often observed to follow traumatism of the cranium, depressed fracture of the bones, and compression of the brain. In these cases the application of the trepan sometimes effects a cure, if there has taken place no alteration of the encephalon.

In connection with true epilepsy it is proper to allude to the epileptiform convulsions which supervene in certain paludal fevers, in poisoning by alcohol, lead and mercury; in disease of the kidneys, Bright's disease, uræmia, in cases of cerebral tumors (cancer), in general paralysis. These cases differ from true epilepsy in this respect that very often there is neither the initial cry nor the characteristic pallor of the countenance nor the same comatose condition.

Syphilis is a frequent cause of epilepsy; the crises are at first only occasional, then they become frequent; they are often complicated with partial paralysis which may affect the monophlegic or hemiplegic form. Strong mental emotions, such as fright, anger, joy, disappointment, nervous exhaustion brought on by mental or physical excesses, severe pain, neuralgia, extreme heat or cold, are, according to some authors, so many causes of epilepsy. Wounding of sensory nerves (pricking, contusion, lacerating by a splinter of bone), compression of these nerves by a tumor in the neighborhood, a neuroma; the presence of the

The same symptoms are produced in certain lesions of the spinal marrow or cerebrum. Westphal rendered guinea-pigs epileptic by blows on their heads. Hitzig, Eulenburg, and Landois by irritating the motor cortical centers of animals by mechanical and chemical agents, and by electricity, brought on attacks of epilepsy. Points have been localized in the cerebro-spinal axis whose excitation produces epilepsy, and Albertoni and Koloman-Balogh have given precise directions in this regard. Roberts Bartholow has gone even farther, and in a patient, the surface of whose brain was denuded to some extent, he has produced epileptiform convulsions by applying electricity to the exposed cortica, substance.(*a*) Clinical observation strikingly confirms these experimental facts, and the annals of medicine contain a vast number of cases where wounds and irritations of nerves have determined epilepsy, and where it has sufficed to remove the vicious cicatrix, or the foreign body embedded in the tissues, in order to obtain a permanent cure. In other instances the epilepsy has resulted from injuries or compressions of the cerebral substance, by spiculæ of bone, by abscess, by tumors ; the removal of the bony splinters or the disappearance of the tumors has brought about complete cure.

It is in cases of this kind that the application of the trepan in the treatment of symptomatic epilepsy gives good results. Extolled by the ancients in an empirical fashion, the trepan has of late years found its legitimate place, a place, in fact, of such importance that we have seen in America an eminent surgeon perform this operation for the cure of epilepsy twenty-three times in five years, and obtain seven complete recoveries. Echeverria, in his interesting statistics, gives the results of one hundred and forty-five cases, ninety-three of which were permanently cured by the trepan.

In the same group we place anti-syphilitic medication, for oftentimes the

larvæ of insects in the frontal sinuses may determine the development of the neurosis, (sympathetic or reflex epilepsy). It is the same with alterations or strange affections of the different viscera, of the stomach, of the intestine, the liver, the kidneys, the genito-urinary organs. Gastro intestinal epilepsies are equally admitted.

Some authorities have related cases of attacks occurring especially in plethoric individuals as a sequel of indigestion, where improper articles of food have been indulged in or where there has been departure from the ordinary habits of diet. The presence of worms in the intestine and obstinate constipation, have often induced convulsions in persons predisposed. Moreover, in females slight lesions of the neck of the womb or displacements of that organ are sometimes sufficient to determine epilepsy. Menstruation has a manifest influence on the development and march of epilepsy. It is, in fact, generally at the period of the establishment of the menses or at the epoch of the menopause that the disease first appears. In fine there is a multitude of other causes which are operative in persons predisposed ; the perception of certain odors, the sight of certain objects, sometimes the disappearance of certain rashes, etc.

(*a*) Brown-Séquard : Researches on Epilepsy, its Artificial Production in Animals, and its Etiology, Nature, and Treatment in Man, Boston, 1857; Pietro Albertoni –Influence of the Cerebrum in the Production of Epilepsy, Milan, 1876 ; Roberts Bartholow : Experimental Investigation into the Functions of the Human Brain, American Journal Medical Society, April, 1874 ; Westphal: Berliner klinische Wochenschrift, Nos. 24 and 39, 1871 ; Vulpian: Epilepsy in the Guinea-pig after section of the Sciatic Nerve.

relation which exists between this neurosis and syphilis is explained by the presence of gummata, or bony tumors compressing the brain and spine, and it is quite clear, as Fournier and Dreschfeld have shown, that in cases of this sort the specific is the proper treatment for the neurosis. In this same category we must place epileptiform convulsions due to the presence of worms in the intestines, and which disappear with the expulsion of the offending cause. In this group, too, we must place those cases of epilepsy connected with troubles of the genital functions, for the relief of which Marshall Hall proposed castration.

It was formerly maintained that epilepsy results from a chronic inflammation of the brain and spinal cord; a variety of epilepsy was even described under the name of plethoric epilepsy. Morgagni, Fothergill, and others defended this doctrine of the constant inflammatory origin of epilepsy, hence their antiphlogistic treatment, which consisted in blood-letting and the most powerful derivatives, such as cauteries, blisters, and setons. This kind of treatment is now a thing of the past; it gave no certain results of any value, and was based on a hypothesis which the recent anatomo-pathological researches on essential epilepsy have not confirmed.

We know that since the labors of Schroeder-Van der Kolk and Echeverria,[1] the post-mortem disclosures in deaths from epilepsy have generally been alterations of the medulla oblongata, characterized by an intercellular albuminous exudation and capillary ectases. It may, however, be reasonably affirmed that these lesions are the consequence rather than the cause of attacks of epilepsy.[2]

[1] These are the statistics of Echeverria:

Recoveries,	93
Ameliorations,	18
No change at all,	5
Aggravation,	1
Deaths,	28

Mason Warren, in 10 cases of trephining, reports 3 cures, 2 ameliorations, and 5 deaths. (*a*)

[2] The necroscopic examination of epilepsy very often gives results quite negative, with nothing to explain the phenomena during life; at other times, however, there are found alterations of recent date, or of long standing, to which the disease may be attributed. Leaving one side lesions of the members or of certain viscera which provoke sympathetic or reflex epilepsy (wounds of the sensory nerves, affections of the stomach, of the intestines, of the genital organs, etc.), we will recall the principal alterations described by writers. On the part of the cranium, thickening, deformity, whether by depressed fracture, the presence of foreign bodies, or of bony tumors; vices of conformation, cranial asymetry, an arrested development of the face; in fine, fronto-facial asymetry. According to Laségue, who has devoted much study to this question, the asymetry which is observed in epileptics seems to respond to two types: either the face has undergone movements of rotation in a direction opposite the frontal region, or else it is drawn in the same direction. In the first case, to the right frontal prominence corresponds a left molar prominence; in the other case, the prominences are on the same side. The first form is the most common. The lesions of

(*a*) Trephining for epilepsy (Boston Med. and Surg. Journal, 1872—Echeverria on trephining in hysteria from traumatism of the cranium (Arch. de Med. de Paris, 1878, t. 11, p. 529.652), Mason Warren, Boston Med. and Surg. Journal, 1867).

Nevertheless, the rachidian bulb has a predominant part in epilepsy, and it is by modifications of its functions that we best explain the convulsive paroxysms.

The first phase of the attack, that which corresponds to the initial outcry, to the loss of consciousness, and to the tetanic contraction of all the muscles of the economy, would seem to result from an excitation of the medulla oblongata, sufficient to cause sudden anæmia of the cerebrum and of the bulb itself. Next comes the asphyxia, consequence of this tetanic state, and the passive congestion of the cerebro-spinal axis which it produces. Next in order is a period of reaction, in which the accumulation of venous blood in the encephalon and spinal cord determines clonic convulsions everywhere, the respiration is stertorous, the face is blue, the attack terminates with exhaustion of the nervous centres implicated. In these phenomena the medulla oblongata is principally concerned, and the therapeutic indication is plain; every medicament which tends to diminish the excitability of the medulla oblongata, and the cerebral anæmia which results from it, is applicable to the treatment of epilepsy. But before beginning the consideration of the physiological treatment of epilepsy, I will say a few words about the empirical treatment.

Certain simple herbs have enjoyed a great repute in the treatment of epilepsy, and the common people have accorded heroic curative virtues to a number of indigenous plants which deserve a brief mention here, as their anti-epileptic properties have been endorsed by certain physicians.

Galium verum and galium mollugo ("white cheese rennet," "yellow ladies' bedstraw," are the familiar names) are reputed as having quite special virtues in the treatment of epilepsy, and we are frequently referred to the observations of Jourdan and Miergues, fils. I believe that even now certain religious com-

the encephalon are: for the meninges, a thickening of the dura mater, ossification of the falx cerebri, of the tentorium cerebelli, fungous growths, abscesses, adhesions of the thickened pia mater to the encephalon, tumors, cysts of the choroid plexus, the lesions of meningo encephalitis. The brain substance presents: congestion or pallor, softening or induration of the white and gray matter, atrophy or incomplete development of the cerebral lobes, tumors of divers natures, tubercles, cancers, cysts, hypertrophy of the pituitary gland, asymetry or inequality of weight of the cerebral hemispheres, lessened weight of the cerebellum, sclerous induration and atrophy of one or both of the cornua Ammonis, or softening of these cornua. These lesions, regarded immediately after death, may be considered as being of relatively ancient date. Among the recent lesions, or those seeming to be such, and judged to be consecutive to the attacks themselves, are found, if death has occurred during or immediately after an attack, certain phenomena of asphyxia, ecchymoses under the scalp, sub-pleural ecchymoses, congestion of the lungs, of the liver, of the spleen, of the kidneys, injection, with ecchymotic patches of the pia mater, etc. The cerebral hyperæmia so frequent is seated preferably at the level of the medulla oblongata, in the gray substance of the pons, and this hyperæmia entails divers changes of texture (ramollissement, or induration, hypertrophy, etc.).

The congestion, with enormous vascular dilatation, and the ramollissement are often found at the point of origin of nerves which have been concerned in convulsions (the hypoglossal, pneumogastric); likewise there has been observed a pigmentation of the ganglionic cells of the cervical sympathetic. The works of Luys and of Voisin (Arch. de Med., Dec. 1869) have shown that lesions may be met, not only in the medulla oblongata, but also in the cortical substance of the cerebrum in the cerebellum and in the cerebellar peduncles.

munities in France treat this disease with the expressed juice or an infusion of this plant.

Valerian is also an ingredient of a great many anti-epileptic preparations, and its employment in this disease is supported by a respectable number of eminent names. I will pass rapidly by hyoscyamus, vaunted by Storck and Hufeland; daffodill, employed with success by Dufrenois, Vieillchèse, Delonchamps; bitter orange leaves, counselled by Larcher; peony, extolled by Portal, to devote a moment's consideration to belladonna, which, before the introduction into therapeutics of the bromides, was one of the medicaments the most depended on in the treatment of epilepsy, supported, as it was, by the authority and experience of Trousseau. Belladonna is given in the form of pills, each containing one-sixth of a grain of the powder and one-sixth of a grain of the extract; dose, one pill morning and evening the first month, and every succeeding month you increase the dose by one pill a day, till you arrive at the enormous dose of twenty pills night and morning.

All these medicaments, belladonna included, are to-day completely abandoned; they have had to yield their place to more active and more certain medicines, and I have only mentioned them here because they belong to the history of the therapeutics of epilepsy. By the side of these vegetable substances we must place the mineral remedies which have been prescribed for the falling sickness; these are especially certain metals, such as silver, copper, and zinc.[1]

[1] Oxide of zinc (flowers of zinc, or philosophers' wool) is a white substance, tasteless, inodorous, insoluble in water, and is obtained by roasting metallic zinc in a crucible in contact with air. Oxide of zinc is given internally in the form of pills, or of powder, in the dose of twenty centigrammes to one gramme (from 3 to 15 grains). Herpin, of Geneva, employs oxide of zinc in the following way:

1. For adults during the first week, 3 grammes (45 grains), rubbed up with 4 grammes, (1 dram), of sugar, and divided into 20 doses; 3 doses a day, one hour after each meal. Increase by 1 gram (15 grains) a week till the weekly quantity of 15 grammes (225 grains) is reached; this to be continued for three months.

2. From 10 to 15 years of age, weekly quantity of 1 gramme (15 grains); increase by 1 gramme a week.

3. From 1 to 10 years, a weekly initial quantity of ½ a gramme (7½ grains); during the second week the dose is increased to 1 gramme; after that, a weekly increase of 1 gramme.

4. From the period of birth to 1 year, weekly initial dose of 25 centigrammes; increase by 25 centigrammes a week till 3½ grammes is attained, which is the maximum weekly dose.

Herpin, somewhat more recently, has substituted lactate of zinc for the oxide; he gives this salt in the weekly initial quantity of 3 grammes to adults and 1 to 2 grammes to children, according to their age. Valerianate of zinc has also been recommended as an antispasmodic. Devay, of Lyons, Cerulli, of Parme, and Martin Solon have published cases of cure from neuralgia and spasmodic affections by the use of pills of valerianate of zinc, containing 5 centigrammes (1 grain), and giving 2 to 4 of these pills a day.

More recently, Luton has recommended for rheumatic pains the cyanide of zinc, and this is his formula:

℞ Cyanide of zinc..... .20
Aquæ lauro cerasi..... 25.00
Mucilage 100.00

What physiological action can these metallic substances have in the treatment of epilepsy? We cannot say; possibly we must invoke, in explanation, the strange phenomena of metallotherapy observed in accordance with Burq's method. However this may be, silver is administered in the form of pills of the nitrate, and in doses sufficiently large and sufficiently prolonged to produce discoloration of the tissues. They tell a story of an aide-de-camp of King Louis Philippe, who had been cured of his epilepsy by this treatment, but whose skin was changed to a deep blue. I myself saw, twenty years ago, a man transformed into a negro (blue man, they called him) by the internal usage of nitrate of silver, but who, notwithstanding this kind of poisoning, was not cured of his disease.

Copper is administered in the form of ammonio-sulphate of copper, and is given in the dose of ten centigrammes a day in capsules. Zinc is given in the form of oxide; Herpin is the most zealous advocate of treatment by this remedy. Out of thirty-six patients treated by oxide of zinc, he obtained twenty-eight cures; the dose given was ten centigrammes three times a day, gradually increased till six grammes were taken in the twenty-four hours. Like the vegetable treatment above described, the metallic treatment of epilepsy has gone out of vogue, and to-day it is to the bromides that everyone has recourse.

When Balard,[2] in 1826, discovered bromine, and the striking resemblances

Mix and shake.
Dose.—One tablespoonful every hour. (*a*)

[2] It was in 1826 that Ballard discovered bromine. The first application which was made of this substance, and of its combination with potassa, under the name of hydrobromuret of potash, was directed against scrofula and goitre. Two years after the discovery of Ballard, in 1828, appeared a work by Pourché, Fellow of the Faculty of Montpelier, on the therapeutic employ of bromine. Ten years later, in 1838, bromine and bromide were again made the subject of experimentation, this time at the Pitiè in the service of Andral, and Fournet gives us an account of these trials. Then from 1840 to 1850, Ricord, at the hospital du Midi, endeavored to substitute bromide of potassium for the iodide. The two internes of this physician, Rames and Huette, studied the physiological and therapeutic effects of bromide of potassium. The first defended his thesis the 25th of April, 1850, and the second the 8th of May the same year. Rames, in his work, shows that bromide of potassium, in large doses, produces anæsthesia; he experimented on animals with this medicine, and compares the general action of the bromide with the symptoms which characterize the incomplete general paralysis of the insane. He mentions the loss of the sensibility of the pharynx, which makes it effectual against nausea, and also calls attention to the depression of the genital functions The thesis of Huette is much more complete. He points out all the symptoms of bromism, which he describes with great care, and shows the influence of bromide of potassium in syphilis. Locock, in 1851, was the first to apply the bromide of potassium to the treatment of epilepsy, and out of 15 cases he had 14 cures. Radcliffe repeated these experiments, and affirmed that the name of Sir Charles Locock deserved to be perpetuated in the grateful remembrance of all epileptics. Locock based his experiments on the results obtained several years before (1840–1842) by a German

(*a*) Herpin, of Geneva, on the Prognosis and Treatment of Epilepsy, Paris, 1852. Devay on Valerianate of Zinc (Gas. Med. de Paris, 1854). Martin Solon on Valerianate of Zinc in Neuralgias (Bull. de Ther., t. XXVII, p. 468). Luton on Cyanide of Zinc (Bull. de Ther., 1877, t. XCII, p. 97.

between this substance and iodine were pointed out, it was proposed to substitute the first medicament for the second, and it was in the treatment of syphilitic affections more especially that the substitution was made. From 1840 to 1850, in the Hôpital du Midi, the physicians attached to this hospital, and in particular Ricord, employed bromide of potassium in the place of iodide of potassium. The first labors recording the results of this treatment, and showing the physiological and therapeutical properties of the bromide, were made by two internes of the hospital—Rames, of Aurillac, and Huette, of Montargis. The thesis of Rames appeared April 25, 1850, and that of Huette several weeks after. Six years ago (in 1878) George Huette, in an excellent monograph on bromide of potassium, showed us the progress made in the usage of bromide of potassium since the first experimental and clinical studies of his father in 1850. Those early investigations, while clearly setting forth the physiological, therapeutical, and even toxic effects of the bromide, made no mention of any application of the drug to the treatment of the neuroses, and in particular to epilepsy.

The year following Locock, taking up a discovery, made several years be-

named Otto Graf, who had experimented on himself with bromide of potassium, and had remarked that 60 centigrammes of this salt (or about 10 grains), taken 3 times a day for a fortnight, had caused temporary sexual impotence; this is what led Locock to employ bromide in hysteria, in hystero-epilepsy, then in epilepsy. Williams, at the insane asylum at Northampton, experimented on 37 epileptics, 19 men and 18 women. The bromide was given for 5 months; the 19 men who had had 1,012 attacks in 5 months, had during the time of treatment only 706; and in the case of the females, the number of fits fell from 1,127 to 970. The same year, in 1864, Robert Macdonald experimented with this medicament in epilepsy, and obtained the same results as Locock. Blake, in 1864, employed the same medicament in a case of hystero-epilepsy. Bazin and Besnier published, in 1865, a case of cure of epilepsy. Then appeared, in 1866, in the Bulletin de Therapeutique, the much more complete memoir of Dr. Voisin, which was based on 24 observations of epileptic patients. From this period this kind of treatment became general, and special treatises, giving reports of successes obtained with this salt in epilepsy, have abounded in this and other countries, and their very titles are too numerous to mention here.

To judge of the constantly increasing use of this salt in the hospitals, I need only refer to the following statistics given by Lasègue and Regnauld, which indicate the consumption of bromide at the Pharmacie Centrale of the hospitals from 1855 to the year 1875:

1855	3.200 K.	1866	133.300 K.
1856	7.100 "	1867	135.643 "
1857	4.820 "	1868	211.650 "
1858	2.000 "	1869	406.313 "
1859	2.517 "	1870	389.900 "
1860	2.360 "	1871	319.690 "
1861	2 995 "	1872	529.740 "
1862	5.782 "	1873	596.620 "
1863	7.601 "	1874	741.358 "
1864	22.300 "	1875	730.910 "
1865	73.530 "		

From the table it appears that in twenty years the consumption of bromide of potassium which was 3½ kilogrammes, or about 7 pounds, in 1855, had increased in 1875 to 735.910 k., or the enormous quantity of about 1,500 pounds. This ought to be enough to

fore by a German, Otto Graf, who had noted in himself a marked depressant action following the use of large doses of bromide of potassium, and in particular, sedation of the genital functions, for the first time applied these data to the treatment of hystero-epilepsy and of epilepsy, and out of fifteen cases treated by the bromide recorded fourteen cures. The name of Locock ought to be immortalized in the history of medicine ; he deserves the gratitude of the whole human race, because through his happy discovery of the use of bromide of potassium in epilepsy, he has enabled us to cure one half our cases.

After the labors of Locock, came those of Radcliffe, Brown-Sèquard, and especially of Williams, showing that one could in five months diminish in a marked manner the number of attacks in a given number of epileptics. From this moment, bromide of potassium has been almost exclusively employed in the treatment of epilepsy, and the memoirs of Voisin, Legrand du Saulle, Falret of Lasègue, etc., in our country show the beneficial results which may be expected.

Consult these documents, examine the statistics furnished by these physicians, and you will see that in more than half the cases we may favorably modify the condition of epileptic patients. I say modify, and not cure, for I range myself on the side of those who contend that a complete and permanent cure of real epilepsy by the bromide treatment is rare, without being, nevertheless exceptional. But it is possible, in one case out of every two, to cause the attacks to disappear, on condition, always, of prolonging indefinitely the medication ; and this is no small blessing. The bromide is, then (in the words of Legrand du Saulle), the muzzle of epilepsy, rather than a definite curative medicament.[3]

negative the assertion of some writers, and particularly Drouet, that the bromide medication is destined to have only a fleeting popularity, to be hereafter abandoned like all other kinds of treatment that preceded it. (*a*)

[3] Legrand du Saulle has given complete statistics pertaining to 272 epileptics treated both in the hospital at Bicetre and in his private practice by bromide. His facts are grouped as follows:

Clinical observations of the first series.—Absolute suspension of fits ; no vertigo or petit-mal.

A, during five years, 2.
B, during four years, 17.
C, during three years, 11.
D, during two years, 8.

(*a*) Otto Graf, on the Internal Efficacy of Bromide of Potassium, as shown by Experiments. Leipzig, 1840. Locock, The Lancet, 1857, vol. I, p. 528. Pourché, Observations on the Employ of Bromide and Hydrobromuret of Potash in Scrofula and Goitre. (Ephem. Med. de Montpeleier, t. VIII, p. 45 to 54, 1828.) Fournet, on the Therapeutic Use of Bromine in Chronic Arthritis, (Bull. de Ther., t. XIV, p. 87.) Rames, Studies on the Anæsthetic and Therapeutic Effects of Bromide of Potassium (Thesè de Paris, 1850). Williams, on the Action of Bromide of Potassium, 1864. MacDonnell, Observations in Support of the Treatment of Certain Forms of Epilepsy by Bromide of Potassium (Dublin Quarterly Journal of Med. Science, 1855). Blache, Hystero Epilepsy Treated by Bromide of Potassium (Bull. de Ther., t. LXXVII, 1864). Bazin et Besnier, Epilepsy Cured by Bromide of Potassium (Gaz. des Hop., 1865). Voisin, Clinical Researches on Bromide of Potassium and its Employ on the Treatment of Epilepsy (Bull de Ther., t. LXXII, 1866). Drouet, Documents to serve as a History of Bromide of Potassium (Annal. Med. Psych., Sept., 1873). Lasègue et Regnault, Therapeutics Judged by Statistics (Arch. Med., 1877).

How ought you to institute the bromide treatment? Which bromide ought you to choose? What are the inconveniences of this medicament? How long ought you to continue the treatment? These are questions which I must now answer.

But I must first of all say something about the physiological action of the bromides. Already, *apropos* of diseases of the heart, I referred to the action of bromide of potassium on the economy, and I need not repeat what I then said. All physiologists are to-day agreed in conceding to the bromide a sedative action on the cerebro-spinal axis, and in particular on the medulla oblongata. If any point is under dispute, it is not whether this substance has an elective action on the rachidian bulb, but whether this action is primitive or secondary. Some, as Germain Sée and Binz, maintain that the bromide acts first on the heart, and consecutively, by producing anæmia, on the bulb; others, on the contrary, affirm that the heart is affected secondarily; that it is only influenced because the medulla oblongata has been first depressed. This depressant action on the excito-motor power of the mesocephalon is of marvellous applicability to epilepsy, since we have just seen that in this neurosis it is excitation

E, during eighteen months, 21.

Total, 49.

Clinical observations of the second series.—Suspension equally absolute of epileptic attacks :

A, during fifteen months, 11.

B, during one year, 8.

C, during eight months, 21.

Total, 41.

Clinical observations of the third series.—Considerable amelioration; no epileptic fit during the time which oscillates between three and seven months, 23.

Clinical observations of the fourth series.—Relative amelioration (remission of one to three months duration, disappearance of the major attacks, but persistence of occasional vertiginous attacks ; partial return of memory ; appreciable amendment in the mental condition ; complete cessation of the nocturnal incontinence of urine, of tongue-biting, and of headache, 30.

Clinical observations of the fifth series.—Failures, 129.

In his treatise on the action of the bromide of potassium, Voisin has gathered 96 observations of epileptics treated by bromide:

Complete cure, lasting for several years	22
Persistence of the aura, absences and vertigo	42
Failures	32
Total	96

Hughes-Bennett has furnished some statistics on the results of treatment by bromide; these statistics concern 117 cases. Twelve per-cent of the patients had their fits completely suppressed ; in 83-per-cent there was notable diminution, and in 5-per-cent only was there utter failure. (*a*)

(*a*) Legrand du Saulle, on the Prognosis and Treatment of Epilepsy, Second Ed., 1873, p. 15. Otto, on the Treatment of Epilepsy by Bromide Potassium (Arch. of Psychiatrie, und Nerven-Krank., Vol. V, fasc. 1, p. 24. Auguste Voisin, Bromide of Potassium in Nervous Diseases (Mem. del 'Acad. de Med., t. XXXI, 1875). H. Bennett, a Statistical Inquiry into the Action of the Bromides in Epilepsy (Edinb. Med. Journ., p. 706, Feb., 1881).

of the rachidian bulb which determines the congeries of symptoms which characterize epilepsy, and this physiological action explains why suspension of the convulsive attacks follows the use of the bromide.

In the bromides what is the active principle? Is it the bromine, or is it the base? This is a question which has been much studied, and which seems to us to-day to be solved. The bromine plays a considerable part in this depression of the bulbar functions, but the base does not by any means remain inactive or inert.[1] And this it is which explains the difference of action of the different bromides. We know, especially since the labors of Laborde, that the salts of potash have a much more marked depressant action than the salts of soda, and that they have a toxic effect on the heart in particular. Already, when treating of purgatives, I have showed you the difference which exists between the salts of potash and of soda; there is the same difference between chlorate of potash and chlorate of soda, as Laborde has shown; also between bromide of potassium and bromide of sodium, the first being more active than the second, while on the other hand the sodium salt is better tolerated than the potassium salt.

I have made many trials of bromide of sodium in epilepsy, and notwithstanding the considerable doses exhibited, 10 to 12 grammes (150 to 180 grains)

[1] Krosz in his experiments made on animals and on man, endeavored to show that in the action of bromide of potassium it is to *potassium*, to the base, that is due the paralysis of the heart muscle, the slowing of the respiration, the lowering of the temperature, the paralysis of the nerves and muscles. It is to the *bromine* on the contrary, that are to be attributed the insensibility of the pharynx, and the central paralysis of the nervous strands which connect the sensory with the motor ganglia. Sidney Ringer and Wm. Murrell have made comparative experiments with bromide of potassium and chloride of potassium, and they arrive at conclusions almost identical with those of Krosz. According to them, the action on the sensory nerves depends principally on the base, and not on the bromine. Nevertheless the paralyzing action cannot be due to the potassium alone, for the loss of sensibility lasts twice as long with bromide of potassium as with the chloride. Steinauer, of Berlin, has also experimented on animals with the bromine compounds.

Jules Cheron and Raoul Fouques, physicians at St. Lazarre, have experimented with the three bromides (bromides of potassium, sodium, and ammonium), and these are their conclusions: These salts act by their bromine as moderators of the reflex centers. Bromide of potassium to its sedative action on the nerve centers joins a depressant action on the muscular system; it is a neuro-muscular medicament. Bromide of sodium acts like bromide of potassium on the nerve centres, but it does not act on the muscular system; it is simply a moderator of the reflexes. The bromide of ammonium is a moderator of the reflexes by its bromine, like the two preceding, and by its ammonium, it is a diffusible excitant. Therefore when you wish to act on the reflex power and on the muscular system, you will choose the bromide of potasium. When you desires to act only on the reflex centres, the sodium salt is indicated. And lastly, when you wish to act on the nervous centres and induce a slowing of the circulation, a lowering of arterial tension without muscular depression, the bromide of ammonium should be chosen. (*a*)

(*a*) Krosz, on the Physiological Action of Bromide of Potassium (Arch. für Experiment. Pathol. und Phar., p. 1, 1876. Sydney Ringer and Wm. Murrell, Concerning the Action of Chloride of Potassium on the Nervous System of Frogs (Jour. of Anat. and Phy., t. XII, October, 1877). Steinauer, Untersuchungen übei die Physiologische Wirkung der Brompraparate (Arch. f. Path. Anat. Med. Physiol., LIX, lirr. 1). Jules Chèron and Raoul Fouques, on the Comparative Action of Bromide of Sodium, Bromide of Potassium, and Bromide of Ammonium (Jour. de Ther., 25, 1881, p. 617).

a day, I have never succeeded in arresting attacks either of petit-mal or grand-mal by this salt. I have, therefore, been astonished to see in Hammond's remarkable work on "Nervous Diseases," that this eminent neuropathologist gives the preference to bromide of sodium in epilepsy.[1]

By the side of bromide of potassium we must place bromide of ammonium, which has a still more powerful action than the first; then bromide of calcium, with which I have never experimented, but which is much employed in America, and especially by Hammond.[2] The latter, while giving the preference to bromide of sodium, considers bromide of calcium superior to the potassium salt; one gramme producing a sleep which is calm and refreshing. His vehicle of administration of the calcium preparation is syrup of the lacto-phosphate of lime.

I have enumerated the alkaline bromides, of which the most employed is assuredly bromide of potassium. These bromides are often associated in prescription, a mode of administration called the *mixed bromides*.

There are other bromide compounds which are sometimes given, as the bromide of zinc and bromide of camphor. Theoretically, the zinc bromide should be a good preparation, since zinc oxide possesses anti-epileptic properties, as we have before seen. Bromide of zinc is used in England and America in the form of a syrup. Hammond speaks highly of this salt in epilepsy.

Introduced into therapeutics by Deneffe, of Brussels, and investigated chemically by Clin, therapeutically by Bourneville, bromide of camphor[3] has been employed in the treatment of hysteria and epilepsy, and although favorable results have been obtained at the Saltpetriére, yet this preparation has not

[1] Hammond on Nervous Diseases, p. 806. Paris, 1879. (*a*)

[2] W. A. Hammond: The Therapeutic Usage of Calcium Bromide, New York Med. Jour., 1872, and Bulletin gen. de Therapeutique, 1872; also, Hammond on Diseases of the Nervous System, p. 886. Hammond's formula for bromide of zinc is as follows:

℞ Bromide zinc..... grammes iij. (or gr. xlv).
Syrup simplicis..... grammes xxx (1 fl. oz).

M. Dose.—Ten drops three times a day. The quantity to be gradually increased till thirty drops or more are given at a time. Each dose should be well diluted with water before taking, as it is apt to offend the stomach.

[3] Bromide of camphor has been obtained in the form of beautiful crystals by Olin and Silva. It has been studied from a physiological and therapeutical point of view by Deneffe, of Brussels, and Bourneville. It diminishes the pulsations of the heart, and the number of respirations; it also lowers the temperature. It has moderate hypnotic properties. Deneffe has treated delirium tremens with it, and Bourneville has employed it in chorea and epi-

(*a*) Dr. J. Leonard Corning, of New York, in the Medical Record, Sept. 29, 1883, takes the author to task for this denunciation of bromide of sodium in the treatment of epilepsy, and gives as the result of his own experience his preference for the sodium salt. He says: "If there is any one fact more thoroughly established than another, it is the superiority of bromide of sodium, and for this reason: that the prejudicial effects which are so conspicuous a concomitant of the other bromide preparations are, in great part, absent in the sodium salt." Dr. J. W. Morton gives testimony to the same effect. "It is," he says, "a matter of clinical experience that larger doses of bromide of sodium may be tolerated for months without evidences of the bromide rash, and without failure of health."

come into general use. Thus far the bromide of potassium remains the medicament the most active and most employed in the treatment of epilepsy.

How shall bromide of potassium be administered? Although it has been attempted to introduce this salt by the hypodermic method and by enema, these tentatives have been promptly abandoned, and for the reason, as I told you when treating of diphtheria, that bromide of potassium has an irritant and even caustic action. We are then restricted to the alimentary canal as the only practical way of introduction, and when given it should be diluted with a considerable quantity of water; the dragees, granules, and compressed pills containing bromide should be discarded. I should add that when you are forced to increase the dose of this salt, as in epilepsy generally, you should require the patient to partake freely of milk, in order to avoid the gastro-intestinal irritation which results from the prolonged use of the bromide in large doses.

The quantity of bromide which ought to be administered daily is variable. From twelve to fifteen grammes a day have been given; the medium dose, in the majority of cases is eight grammes. This dose cannot be given from the first; you must begin with smaller doses, as one gramme morning and evening, and gradually increase the dose till you have obtained complete control of the disease. Voisin thinks that we should regard as the maximum dose that which determines abolition of the reflex sensibility of the pharynx. I believe that this is an excellent rule in the case of hysteria, but not in epilepsy, and that in this disease we must not only attain abolition of the pharyngeal reflex irritability, but we must, if occasion demand, push the administration of the remedy even farther, till we have stopped the attacks. But it is absolutely necessary to have a bromide preparation which is chemically pure, for Voisin has shown that the impurities of this salt considerably modify the therapeutical effects which it produces.[4]

These large doses of bromide, given for therapeutic effect, are not without

lepsy. It is given in pill form (10 centigrammes, from one to two grains), one to ten pills being given a day. It is not a good preparation for hypodermic injection.(*a*)

[4] The purity of the bromide salt is a point of capital importance. It ought especially to be free from the iodide. To determine the presence of iodide of potassium, dissolve the suspected salt in starch water, add a few drops of nitric acid, and if there be any iodide of potassium present you will obtain a blue color from the formation of iodide of amyl. Lambert's method is even more delicate. Dissolve the bromide in a solution of potassium permanganate; if the bromide is pure the solution keeps its violet color, while it takes a yellowish tint if there are any traces of iodine present. According to Adrian a chemically pure solution of potassium bromide when treated by HCl, should evolve a few bubbles of CO_2. Treated by one gramme of benzine, and a few drops of bromine water, it ought not to give a rose color. Treated by HNO_3 and nitrate of baryta, it ought not to turn yellow (Adrian: Researches on the Chemical Composition of Preparations of Bromide of Potassium, Bull. gen. de Ther., t. lxxvii., 1870; Lambert: How to Detect the Presence of KI in Bromide of Potassium, Bull. gen. de Ther., t. lxii., p. 503, 1867).

(*a*) Lawson, on Monobromide of Camphor (Practitioner, April, 1875). Deneffe, on Bromide of Camphor and its Therapeutic Applications (Presse Med. Belge., 1871). Bourneville, Comptes Rend, des Observations Recueilles à la Saltpetrierè (Progres. Med., 1874, Nos. 32, 33, 39, 43). Pathault, on the Physiological Properties of Monobromide of Camphor (Thesè de Paris, 1877).

danger. They determine in certain patients a train of symptoms which in some instances have been grave enough to cause death, and to which the name *bromism* has been given. Besides the inconveniences mentioned in my lecture on hysteria, and which are the acne eruption,[1] the disagreeable odor of the breath, the peculiar unpleasant taste of the saliva, there are certain nervous manifestations of a grave kind, such as I lately observed in one of my patients who had taken in one day thirty grammes (a troyounce) of bromide of potassium. These symptoms consisted in a remarkable depression of the vital forces. The patient could not stand, could not make the least movement without difficulty. Intelligence was impaired, and there was aphasia and amnesia.

This state, in which the patient is plunged into a most deplorable physical and moral brutishness, persists till elimination of the bromide by the various emunctories has taken place.

These inconveniences of the bromide treatment are again and again experienced by the epileptic patient, who finds himself often in a sad dilemma; either he must desist from the use of the remedy and see his fits come back, or persevere in the treatment, notwithstanding the depression of all his faculties and forces. Believe me, he will generally choose the latter as the lesser evil, rather than suffer those terrible attacks which are to the epileptic a menace always suspended over his head.

But it is especially in the delirium of action, which makes the epileptic a criminal without his knowing it, that it is necessary to employ the bromide in massive doses in order to overcome the mania which impels him, unconsciously, to deeds of violence. Nothing, in fact, is more curious than to see in the wards of our lunatic asylums men enjoying their intelligence and their reason who have committed, and would still commit, the most astounding murders, if their maniacal propensities were not kept in check day by day by immense doses of bromide.

How long should you continue the bromide treatment of epilepsy? Often a very long time, and even during the entire life of the patient. When, moreover, you have obtained the full benefit of the drug, and have witnessed complete cessation of the attacks, you must not leave off abruptly the medicine, but must keep on with it for several years, gradually diminishing the dose, as Legrand du Saulle has advised.[2]

[1] Auguste Voisin was one of the first to indicate the bromide rashes; he ascribes four different kinds of eruption to the action of bromide. The most frequent is simple acne. The second kind is characterized by reddish patches, appearing oftenest on the calf of the leg. The third kind resembles erythema nodosum. The fourth is a watery eczema.

Neumann, of Vienna, has studied microscopically portions of skin which were the seat of bromide eruption, and has shown that the bromine in being eliminated by the sebaceous glands, determines in these glands and their vicinity inflammations characterized by hyperplasia of the epithelial elements.

Guttmann has been more successful, and from acne postules, produced by the internal use of bromide of potassium, he has obtained on treating them with chlorine water and chloroform, the manifest reactions indicating the presence of bromine.

[2] His rules are as follows; We will suppose a case apparently cured. During the first year—fifteen days of each month with the bromide every day in the usual dose, and fifteen

Under the influence of bromide medication, thus carried out, we witness mitigation, diminution in frequency, then disappearance—first of nocturnal then of diurnal attacks; then the vertiginous paroxysms and the aura cease, symptoms which most resist the bromide treatment. These favorable results you will, as I said, obtain in one-half your cases. But you can often anticipate what will be the result of the bromide treatment by determining the cause of the epilepsy. Here Voisin (*d*) has given us valuable hints. The epilepsy which results from malformations of the cranium or cerebral tumors is rebellious to the bromide, while the functional and hereditary neurosis is amenable to this treatment. Sex has no influence one way or the other.

Such, gentlemen, are the leading indications and methods of the bromide medication in epilepsy. If not absolutely and certainly curative, this medication, nevertheless, represents a real therapeutic progress when we consider the unsatisfactory nature of the treatment of olden times. I ought to add, as an item of interest in this connection, that experimental physiology has confirmed ordinary clinical results; I allude to the recent curious experiments of Albertoni,(*e*)

days with the bromide every other day. In the second year—fifteen days of every month with the bromide every third day, and fifteen days with the bromide every day. In the third year—fifteen days of every month with the bromide every day, and fifteen days with the bromide every fourth day. In other cases (and this is now his habitual method), after the patient has gone one year without an attack, bromide treatment six days in the week. After fifteen months of freedom from attacks, bromide five days in the week. After eighteen months, bromide four days in the week. At the end of two years from the last attack, bromide only three days in the week, (Traitement et Curabilité de l'Epilepsie, by Legrand du Saulle).

(*d*) Voisin thus formulates the prognosis of bromide treatment, in accordance with the causes of epilepsy, basing his views on ninety-six cases which he has treated:

1. Epilepsy linked to a tuberculous inheritance, or to the presence of cerebral troubles as, for instance, when caused by traumatism, and malformations of the cranium, as well as when resulting from teething, is rebellious to bromide.

2. Epilepsy caused by menstruation, by mental and emotional troubles, or by alcoholism in the parents is difficult of cure.

3. Hereditary epilepsy was cured in four cases out of five. That caused by sudden fright; three cures and nine ameliorations; in three cases there was no improvement. Epilepsy following typhoid fever; four patients out of nine were benefited.

4. Sex has not the least influence on treatment. Masturbation provokes the return of the fits, and all the other accidents, and hinders the action of bromide. The chronicity of the epilepsy has no influence on the bromide medication. (*a*)

(*e*)Albertoni performed an instructive experiment on some animals to which he gave for several successive days large doses of bromide; he was unable in these animals to provoke epileptic fits by irritating the cortex cerebri, although in animals not under bromide influence, convulsions are easily and surely so produced; when he had previously subjected his animals to moderately toxic doses of atropia, there was no protection whatever against fits when the surface of the cerebrum was excited. (*b*)

(*a*) Voisin, on the Employment of Bromide in Nervous Diseases, Paris, 1875. Charles Simon, on Epilepsy, Divers Medications, Action of Bromide of Potassium on the Epilepsy of Insane Persons (Thesè de Paris, 1880).

(*b*) Albertoni, on the Action of Certain Medicaments on the Cerebral Cortex, with reference to the Treatment of Epilepsy (Arch. Exp. Path. et Therap., t. XV, p. 3 and 4).

who, after prolonged administration of the bromide to animals was not able to induce in them experimental epilepsy by irritating the cerebral cortex, although after giving atropine under like circumstances such convulsive attacks could easily be provoked.

Other remedies which act on the medulla oblongata, or on the muscular system, have been prescribed in epilepsy, such as picrotoxine,[16] bromide of gold,[1] curare (*g*), and nitrite of sodium (*f*).

Curare or wourari has been tried hypodermically in epilepsy by Voisin and Liouville; the effects are not sufficiently encouraging to warrant continued use of this medicament, notwithstanding the more recent trials of Edelfsen and Kunze. Picrotoxine,[2] the active principle of cocculus indicus, has been made

[1] Bourneville has given bromide of gold for a period of seven months to a certain number of epileptics; he gives it in the form of pills containing one centigramme (1/6 grain), of these, ten a day; he reports no favorable result from this treatment.

(*g*) Kunze employs curare in the treatment of epilepsy, and makes use of the following solution:

℞ Curare..... 0.50
Distilled water..... 5.00
Hydrochloric acid, one drop.

M. Digest twenty-four hours and filter. One third of this solution is injected every five days. If there is no amelioration at the end of the fifth injection, Kunze would abandon the treatment. Out of thirty-nine cases he has obtained nine cures. (*a*)

(*f*) Law has employed nitrite of sodium in epilepsy. He gave one gramme (15 grains) a day, and under its influence the fits disappeared. Nitrite of sodium acts like nitrite of amyl, and nitro-glycerine.

Henry Ralf has used the same medicament, and has found it useful in cases where bromide is without result, or badly supported. It would seem, however, from the report of the London Medical Society that the effects of sodium nitrite are not to be depended on. (*b*)

[2] Boullay was the first to extract picrotoxine from cocculus indicus. This substance (C^5 H^6 O^2) has been studied from a physiological point of view by Glover, Bonnefin, Brown-Sequard, Vulpian, etc. Glover affirms that this poison has a quite special action on the cerebellum and tubercular quadrigemina. Vulpian has shown that the convulsions which take place in animals poisoned by picrotoxine, are due to the excitant action of this substance on the anterior portions of the cerebro-spinal axis, and particularly on the medulla oblongata and pons. Varolli, Chiroine and Testa have obtained a true artificial epilepsy in employing picrotoxine. Moreover, according to Chirone, picrotoxine is not a pure alkaloid, and is composed of three other substances, which are picrotoxin, properly so-called, which is bitter and toxic; picrotine, which is bitter and not toxic; and anamirtine, which is neither bitter nor toxic. Planat, of Valorville, basing himself on the action of picrotoxine on the bulb, has counselled this substance under two forms; the tincture of cocculus indicus and solution of picrotoxine. The tincture is made thus:

(*a*) Bourneville, on Bromide of Gold in Epilepsy (Progres Medicale, Feb. 3, 1883, p. 87). Kunze, on the Treatment of Epilepsy by Curare (Med. Chir. Revue, Oct., 1881). Edlesfsen, on the Treatment of Epilepsy by Subcutaneous Injections of Curare (Berlin Woch., July 4, 1881).

(*b*) Law, on Nitrite of Sodium in Epilepsy, Practitioner, June, 1882. Reports of Medical Society of London, Nov. 28, 1882, and Bull. Gen. de Ther.. Jan. 30, 1883.

[There is no doubt that many epileptics are temporarily benefited by momentary inhalations of a few drops of nitrite of amyl inhaled from the palm of the hand or from a handkerchief. Taken during the aura it is often successful in averting a fit. Epileptic vertigo is also alleviated by it. It is not, however, a remedy to be much relied on.—Trans.]

the subject of study by Brown-Séquard, Glover, Bonnefin, Vulpian, and others. These researches show that picrotoxine has an elective action on the medulla oblongata, and may even determine a veritable experimental epilepsy. Planat has utilized this special selective action of picrotoxine in the treatment of epilepsy; I have myself experimented with it, but have not obtained favorable results except in alcoholic epilepsy—which will get well of itself if the patient will practice abstinence from alcohol. Vulpian has also tried it without success. Add that picrotoxine is very poisonous, even in small doses, and we ought to conclude that this medicament should have a very humble place in the treatment of epilepsy.

Finally, Huchard has recently advised the association of digitalis with bromide in the treatment of epilepsy, and claims good results from the combination.

Thus far we have been occupied only with the general or pharmaceutical treatment of epilepsy; it remains to speak of the hygienic treatment, and of that of the attacks.

If hygiene has not a preponderant part in the treatment of epilepsy, nevertheless it is not without influence on the production of the attacks. Here, as in hysteria, the question of marriage comes up for consideration. Ought an epileptic to marry? It is well to bear in mind, and to urge upon your clients, when they consult you in reference to the marriage of an epileptic, that epilepsy, with all its gravity, is not necessarily and fatally hereditary, and in giving this opinion you can fortify yourself by the authority of professor Lesègue, than whom no one is more qualified to judge on questions of this kind. In

℞ Cocculus Indicus..... 1 part.
Rectified spirits..... 5 parts.

M. Of this tincture two drops are given the first day, one morning and night, and the dose is increased each successive day till fifteen drops are taken morning and night. The solution has the following formula:

℞ Picrotoxine..... 0.03
Alcohol..... 10.00
Distilled water..... 110.00

M. The dose is one-half teaspoonful morning and night, and at the end of a fortnight the dose is increased to a teaspoonful.

Planat claims to have cured by this means many cases of epilepsy without ever exceeding a quantity of three milligrammes of picrotoxine a day. Dujardin-Beaumetz has obtained no results from it except in alcoholic epilepsy which may get well of itself.

Vulpian considers this kind of treatment as very dangerous, and he has seen no good from it. (*a*)

(*a*) Glover, Monthly Jour. of Med. Sciences, April, 1851. Bonnefin, Thesè de Paris, 1851. Planat, Physiological and Therapeutic Researches on Picrotoxine. Application to the Treatment of Epilepsy (Jour. de Ther., Nos. 10, 11, 12, 1874.) Cayrade, a Study of Convulsivant Poisons, Paris, 1866. Vulpian, Action Physiologique des Substances Toxiques, Paris, 1882, p. 623. Chirone and Testa, Experimental Researches on the Physiological Action of Picrotoxine (Union Med., May 21, 1881). Dujardin-Beaumetz, Soc. de Ther., 1875.

fact, Lesègue[1] denies the hereditary nature of epilepsy. This is a matter of considerable importance, and holding this view we are enabled to tone down somewhat the sombre colors in which such a union would otherwise be invested.

If continence does not play an important part, it is not the same with venereal excesses, which have a most decided influence in the production of attacks. Masturbation is most pernicious to epileptics, and destroys, in a certain measure, the effect of treatment by bromides.

Epileptics should live in the country and avoid crowded assemblies, political gatherings, concerts, shows, and the like. You must often have remarked that theatrical exhibitions are frequently interrupted by attacks of epilepsy, and this for the reason, principally, that the bad air and the heat of the apartments are deleterious to epileptics.

The alimentary regimen has a certain influence on the falling sickness.

[1] The affirmation of Lesègue is so important that we reproduce here the entire paragraph: "Epilepsy, a disease of evolution, is not hereditary. This proposition seems to have excited considerable surprise, which I scarcely comprehend, so little is there that is new about it. I hardly need defend so patent a fact, but perhaps something by way of comment may be appropriate The formula of hereditary epilepsy, if such existed, would be that of inheritance generally. *Epilepticus autem genuit epilepticum* (the epileptic begets an epileptic). But statistics (and how numerous they are), have sufficiently proved that such direct begetting is the exception. Epilepsy so rarely transmits itself as never to have given rise to a popular saying of this sort (for which there would in fact be no justification), "to an epileptic father belongs an epileptic son." For a stronger reason a medical aphorism of this sort is inadmissible. In this respect epilepsy resembles deaf muteness by vice of development, and there is more here than simple coincidence. Must we conclude, then, that epilepsy, an autochthonous affection, arises by spontaneous generation, borrowing nothing from ascendants? Far from it. It is one of the diseases on whose genesis the health of parents has the most influence, but in an indirect, or as we might say, round-about way, as in the case of deaf muteness just referred to. There are very generally family diseases of a character kindred to epilepsy. The ascendants were neuropathic, at some time in their life manifested mental alienation, or at least were distinguished for eccentricity. There is, perhaps, a history of consanguineous marriages; the parents were given to debaucheries of every kind. The epileptic belongs to a race physically and intellectually degenerated, or he has brought this organic deterioration on himself. He has been given to alcoholic excesses, to low vices, to various degrading pursuits. Parallel with the inheritance of epileptic tendencies, we often find members of such families that are idiots, that are deformed, or otherwise unsound in mind or body. I have often been consulted as to the advisability of an epileptic marrying. The reply is easy enough, considering the incurability of the disease, and the gloomy future before the patient. Such marriages are not to be encouraged, but how is it with the children that may be born of them? What will be likely to be their future fate? Far be from me any denial of the disastrous consequences which may follow such unions. I only reserve for myself the right to deny as an absolute impediment to marriage, the probability of hereditary epilepsy. I cannot affirm with the same confidence that there will be immunity from other grave affections of the nervous system. Just as a neuropathic parent engenders, under certain circumstances, an epileptic child, so also the epileptic father may beget, according to the law of hereditary transformation, a healthy child, an idiot, a confirmed nervous invalid, or a lunatic. You would have to use the term in a sense different from the ordinary sense, to call these modes of transmission, or rather of influence, hereditary epilepsy.

First of all, the alcohols are themselves a cause of epilepsy, and you are not ignorant of the studies of Magnan as to alcoholic epilepsy, and in particular that form of epilepsy which is produced by absinthe;[1] it is proved that these nerve-excitants produce epilepsy in men and animals; you ought then to interdict the use of alcoholic beverages to your patients.

You ought also to advise a diet which shall contain nitrogenous substances in very sparing quantity. It seems, in fact, proven that a vegetable diet diminishes in a marked manner the number of attacks, while an azotized diet considerably increases them; the epileptic, then, should be strictly vegetarian. To sum up the rules of hygiene, the epileptic patient should live much in the open air, be very moderate in sexual indulgences, take a great deal of exercise, abstain from spirituous liquors, and live almost exclusively on vegetable food.

As for the treatment of the attack, it consists in placing the patient in a horizontal position, and loosening any part of his apparel which may cause constriction of the neck or thorax. It is generally customary to place some hard substance (as a clothes-pin) in the mouth of the patient to prevent biting of the tongue, a means which has not been very successful; the foreign body, if too resisting, breaks the teeth of the patient, and if too little resisting, is

[1] When spirit of absinthe is introduced into the stomach or veins, toxic phenomenare observed, which vary in intensity according to the dose. A small dose causes short, quick, convulsive movements, or shocks like battery discharges, affecting principally the neck and the fore limbs; the same dose determines a vertigo very similar to epileptic vertigo, but the resemblance is much more striking when larger doses are used. Then veritable epileptic attacks ensue, characterized at first by tonic succeeded by clonic convulsions; the animal froths at the mouth, the tongue is bitten, and there are involuntary evacuations of urine, of fecal matters, and of sperm. These attacks, which last several minutes, may be renewed at intervals varying from ten to twenty minutes or more. In the intervals of the paroxysms the animal seems dull and listless, and gradually comes completely to himself. Animals deprived of their cerebrum, like those that have not undergone this mutilation, experience epileptiform attacks under the influence of essence of absinthe. If section is made of the cord below the medulla oblongata, the epileptic attack shows two well-marked stages; you note first the tonic and clonic convulsions of the head with froth in the mouth, this may be called the bulbar attack; then ensue general convulsions of all the muscles of the body, with expulsion of urine and fecal matters, this is the spinal attack. In animals poisoned by essence of absinthe, one always finds, even at the commencement of convulsive accidents, a bright injection of the optic disk and dilatation of the pupil. This congestion is not limited to the retina, but affects the whole brain. In fact it is easy to observe when trephining of the cranium has been practiced in the first stage of absinthe poisoning, and in the commencement of the attack, a very intense congestion of the encephalon. In man the prolonged and daily use of absinthe determines a series of symptoms which have been designated and described under the name of absinthism, and which have been studied by Mottet, Magnan, Challaud, Lancereaux, Rodet, Smith, Voisin, etc. (*a*)

(*a*) Magnan: Epilepsie Alcoolique, Actior. spéciale de l'Absinthe, Compt. Rend, de la Soc. Biol., t xiii, Paris, 1869; Rodet: Troubles Caused by the Abuse of Alcohol and of Absinthe. Gaz. Méd. de Lyon, t xvi, pp. 590–592, 1864; Dujardin-Beaumetz: Art. in Absinthe, in Dict. de Ther., 1882. John Mersin: Influence of Food and Hygiene in Epilepsy, West Riding Lunatic Asylum Med. Reports, 1875; Bourneville et Ollier: Recherches sur l'Action physiologique du Bromure d'Ethyle dans l'Hystérie et l'Epilepsie, Gazette Méd. de Paris, No. 35, 1880; Bourneville: Du Nitrite d'Amyle dans l'Epilepsie, Soc. de Biol., June, 1875.)

liable to be bitten off in the struggle, and to find its way to the throat or windpipe of the patient, causing suffocation.

Certain measures have been advised to prevent the convulsive seizures, such as the energetic flexion of the great toe, compression of the temporal regions, of the infra-occipital hollow, etc. Others have counselled by various compressions to prevent the aura from spreading; Rozier has even devised a special instrument for this purpose. All of these means are only of use in certain exceptional cases where the epileptic has premonition of his attack by sensations of aura which precede the convulsive seizure by a brief interval. It has also been proposed to employ during the paroxysm, hypodermic injections of apomorphia,[1] inhalations of bromide of ethyl, and nitrate of amyl. Bourneville has given us some interesting facts relating to the two last medicaments but these inhalations have not come into general use.

This finishes what I deemed important to say relative to the treatment of epilepsy, and the beneficial influence of therapeutics in this terrible disease. In the next lecture I shall consider chorea and its treatment.

[1] Vallander, of Brauweiler, has in three cases arrested epileptic attacks preceded by an aura, by subcutaneous injections of apomorphine. He is in the habit of injecting subcutaneously, a minute dose (not exceeding a twelfth of a grain) of apomorphia. The injection does not cause vomiting, though it produces a little nausea.(*a*)

(*a*) Vallander, on Cutting Short an Epileptic Fit by Subcutaneous Injections of Apomorphia (Berlin Klin Wochens, No 14, p. 185, 1877).

ON THE TREATMENT OF CHOREA.

SUMMARY.—Different Kinds of Chorea—Curability of Chorea—Pathogeny of Chorea—Divers Medications Proposed—Muscular Medicaments—Strychnine—Aniline—Eserine—Curare—Medullary Medicaments—Picrotoxine—Hyoscyamine—The Bromides—Electricity—Galvanic Baths—Ether Spray—Anæsthetic Medicaments—Morphine—Chloral—Chloroform—Medicaments that Act on the General Condition—Tartar Emetic—Blood-Letting—Hydrotherapy—Sulphur Baths—Gymnastics.

GENTLEMEN—From the standpoint of therapeutics, what distinguishes chorea from the other neuroses which we have been considering, is its spontaneous march toward recovery. This is a fact of capital importance and has a preponderant bearing on the discussion in which we are about to enter.

Chorea[1] in fact presents, like all the cyclical diseases, a period of increase

[1] Chorea (St. Vitus' dance, St. Guy's dance) is a disease of the second period of childhood and of puberty; its maximum frequency is from the age of 11 to 15, and 15 to 25. It may, however, show itself at all ages of life, and is more frequent in females than in males. It is acute or chronic, general or partial, continuous or intermittent, and may, in accordance with its causes, be divided into hysterical, rheumatic, saturnine, etc. The onset of the disease may be sudden and marked by an epileptiform or hysterical attack after a fright or a strong emotion, but almost always its development is slow and gradual, and it announces itself by a change in the character, the intelligence, and the habits of the patient; the child becomes ill-natured, impressionable and irritable, forgetful, inattentive and idle; its voluntary movements are jerky and incoördinate. When the disease is confirmed, involuntary movements make their appearance, commencing by the face, one of the arms or one hand (ordinarily the left), then they gain the trunk and the lower extremities; these choreic movements at first light, soon increase in intensity and become general, attack the muscles of the arms and legs.

In order to seize an object the patient executes a series of jerky movements, or projects vehemently his arms forward, over-reaching his end, or hits the object without being able to grasp it. He cannot grasp a small object or he lets it fall; he cannot carry his cup or his food to his mouth without spilling a portion. His manner of walking is uncouth and jerky; he walks zig zag, his legs cross each other and frequently a fall is the consequence. The face is the seat of irregular contractions, twitchings; the forehead wrinkles and again becomes smooth; the eyebrows corrugate spasmodically, the eyelids wink in a lively manner; the lips open and shut, the mouth is the seat of grimaces; the visage in a word, executes a series of movements, and expresses in a brief space of time sentiments the most diverse. The muscles of the tongue, of the larynx and of the pharynx are affected also. The tongue is thrust violently out of the mouth, executes divers movements which prevent the patient from speaking intelligibly; there are even children who are so conscious of their condition that they seem to hesitate before speaking, slowly meditating what they wish to say. The troubles of the tongue and pharynx impede deglutition; those of the larynx give a hoarseness to the voice. When the limbs are affected there is no rest; the child moves about from place to place; whether sitting or lying down, its members execute abrupt constant movements, so dangerous even, that it is often necessary to put on the strait-jacket, or to protect the bed on which the patient lies, and even the walls, with boards or cushions, so as to keep him from falling, or to deaden the effects of the blows. The movements are persistent and rapidly wear out the bed clothes, and cause irritation with excoriation of the skin. When the patient wills to execute a movement it seems that the very desire and attention are excit-

or "augment," a stationary period, "fastigium," and a period of decline; it passes through all these stages in an average time of two to three months, and you well understand that this spontaneous tendency toward cure modifies the results obtained by an appropriate treatment, according as such treatment is instituted at the beginning or decline of the disease. Therefore, whenever you would appreciate the value of any kind of internal medication directed against chorea, you should base your judgment, not on the duration of the treatment, but on the entire duration of the disease; and when the latter corresponds pretty closely with the normal and spontaneous evolution of the malady, you may conclude that the medicine has been of little utility.

From such considerations, moreover, we ought utterly to abjure all violent modes of treatment, which may become dangerous by the troubles which they are likely to occasion in the organism. Death is fortunately rare in chorea, but does sometimes happen in consequence of excoriations produced by the disorderly movements of the child.

What I have to say on this occasion will concern true chorea, that ordinary form of motor incoördination which affects childhood and develops, as Sée and Roger have shown, under the influence of rheumatism.[2] I leave, then,

ants of the inco-ordination, and develop an ataxic condition of the muscles (*folie musculaire*). The child executes a series of strange movements and contortions before being able to touch the object that it desires. Except in very violent cases of chorea these movements cease during sleep. The sphincters are affected in some cases. According to Spetzmuller and Benedekt, the heart muscle may also be affected. The sensibility is troubled in different ways; pains in the temples, the forehead, the back of the neck, the muscles, formications, numbness in the limbs or joints; anæsthesia and hyperæsthesia of the skin, and there are often painful points over certain nerves. In hemichorea, symptomatic of a cerebral lesion, hemi anæsthesia is frequently observed. The memory, attention, intelligence are all lost; the character is changed; the patient is indifferent, changeable, good natured or passionate, and becomes very timid. You also observe hallucinations, diurnal or nocturnal, sometimes even maniacal delirium. All these divers troubles have an influence on the general condition; there are palpitations of the heart, often intermittences, irregularity in the beats (chorea of the heart), cardiac pains; the digestive functions are disturbed; there is anorexia, flatulence, often constipation and anæmia, or chloro anæmia, develops rapidly. In young girls menstruation ceases or becomes very irregular. Chorea has an average duration of two to three months; it may last longer than this, rarely has a shorter run. Fatal terminations are quite infrequent, yet death may take place either suddenly by cerebral rheumatism, or slowly by nervous exhaustion as a consequence of insomnia, extreme agitation and delirium; the excoriations, the wounds and bruises, the phlegmons caused by the disordered movements of the little patient often induce prolonged suppurations which cause death. Ordinarily chorea gets well without passing to a state of chronicity, or leaves after it nothing but facial spasms (*tics de la face*, a sort of partial chorea). Relapses are frequent; they often break out in autumn, at the period of puberty, on the occasion of pregnancy, but the attacks become less and less long and less intense. Chorea of pregnancy develops especially in primiparæ and in the first four months of gestation; it predisposes to abortion or premature accouchement.

[2] The causes of chorea are predisposing and exciting. Among the former we reckon age, sex and heredity. The disease, rare in warm climates, is oftener seen in winter than in summer. Very frequent between the age of 15 and 20, it has been observed in very young children (Simon and Constant report cases in infants not a year old), nor is it rare between the ages of 35 and 50; Charcot has seen chorea at the age of 70 years, Roger at 83,

completely to one side those symptomatic choreas and all those disorders of movement which have been described under the name of "St. Wyt's dance" (dancing chorea), and all those partial choreas and rhythmical twitchings of muscles which are referred to athetosis, disseminated sclerosis, to paralysis agitans or simple nervous debility.

The causes of chorea are predisposing and determining. Among the first are age, sex and heredity. The disease, rare in warm climates, is more frequent in winter than in summer. It is observed between the ages of eleven and twenty, rarely between thirty-five and fifty, and occasionally in advanced life. It is much more frequent at the age of second dentition, or at the period of puberty. It is also more frequent in females than in males. Heredity plays an important part. Children inherit this neurosis from choreic parents, or it may be that epilepsy, hysteria, etc., are family diseases. Venereal excesses and masturbation predispose to chorea.

The determining causes are numerous: Strong emotions, fright, anger, may produce it. It is sometimes seen in the course of a protracted fever, or during convalescence. Pregnancy, menstrual irregularities, uterine affections, are causes of chorea.

Among the most powerful causes are articular rheumatism, endo-pericarditis, intestinal worms and anæmia.

The relation of rheumatism to chorea has long been noted. In France it has been studied by Germain Sée and H. Roger, who consider chorea a rheumatic affection. This opinion has been vehemently combated by Grisolle,

but its greatest frequency is at the time of second dentition, or at the period of puberty. It is more common in females than in males. Heredity plays an undoubted part, and children inherit this neurosis from parents that were choreic, hysteric, or epileptic. Venereal excesses, onanism, by the nervous exhaustion which they entail, predispose to this disease. The exciting causes are numerous; strong emotion, fright, anger may provoke the disease, and it is not rare to see it manifest itself during the course of continued fever or during convalescence. Pregnancy, menstrual troubles, uterine affections, are all causes of chorea. Among the most powerful causes we include articular rheumatism, intestinal worms and anæmia. The relation of rheumatism to chorea has been long remarked. In France it has been studied especially by Germain Sée (1850), and H. Roger, who consider true chorea as a rheumatic affection. This opinion, however, is not accepted by all; (for instance, by Rilliet and Barthez, Barrier, Grisolle, Monneret, Graves, Niemeyer, Empis). According to Sée the coincidence between chorea and rheumatism is so frequent that out of every two rheumatic children, one will be choreic. Chorea may, moreover, show itself in the course of rheumatism, precede it, or alternate with attacks of rheumatism. Roger has, moreover, shown that chorea may manifest itself in children that have had rheumatism, that it appears a little while after the rheumatism, or as a complication.

It may develop at the period of decline of rheumatic fever, or may attend the cardiac manifestations of rheumatism (pericarditis, endocarditis), when there are no joint manifestations. In these cases the chorea either precedes or succeeds the cardiopathy; it may, however, occur simultaneously.

Some authorities consider the cardiac lesions as the starting point of the neurosis, the disease having for origin irritation of the nerves of the heart (Bright and E. Cyon).

According to Hughlings Jackson, Tuckwell, and others, chorea is due in these cases to cerebral embolisms, caused by pre-existant endocarditis; these emboli occurring in the corpora striata.

Graves, Niemeyer and others. According to Professor Sée, the coincidence of chorea and rheumatism is so striking, that out of every two children affected with rheumatism, one of them becomes choreic. Roger also has shown that chorea manifests itself often in children who have had rheumatism; and that it accompanies or immediately succeeds that disease.

Its existence frequently coincides with the cardiac affections of rheumatism (endocarditis, pericarditis). Certain authorities consider the cardiac lesions as the point of departure of the neurosis. Bright and Cyon think that it is due to irritation of the nerves of the heart. Hughlings Jackson and Tuckwell trace its origin to cerebral embolisms caused by a preëxisting endocarditis; the em bolic infarctions being in the corpus striatum.

Like every disease which tends of itself toward recovery, chorea has re ceived a variety of treatments; it has been natural to attribute to the medicine given the cure which one has observed. Therefore, in order to give system to the details into which I am about to enter, I shall have to range these treatments in different classes, and we will study them under four heads.

In the first group we shall examine muscular medicaments. Struck by the ataxia of movements characterizing the disease, certain physicians have essayed to cure chorea by means absolutely opposite; one class of remedies augmenting muscular contractility, like strychnia and aniline, another destroying it, like eserine and curare.

In the second group we place medicaments addressed directly to the spinal cord. Although the latest researches have attributed to a cerebral origin the clonic movements which are observed in chorea, a preponderating rôle in the production of this neurosis has always been assigned to the spinal cord and its membranes, and authorities have even gone so far as to pretend that it was only the result of a rheumatic affection of this part of the cerebro-spinal axis. You will not, then, be astonished to learn that medicines addressed particularly to this supposed medullary affection have been recommended, such as bromide of potassium, oxide of zinc, the ether spray and applications of ice along the spinal column.

It is upon an altogether different basis that is established our third class of medicaments. Noting that sleep arrests choreic movements, some have thought that by artificially producing sleep, they might stop the muscular disorder. Therefore chorea has been treated by soporifics, such as opium, chloroform and chloral.

Finally, in a fourth and last group, I place those medicaments which are directed to the state of the vital forces, and here, as in the case of the first class, we have two kinds of treatment diametrically opposed; in the one are the depressants, such as tartrate of antimony; in the other tonics, such as arsenic, hydrotherapy, sulphur baths and gymnastics.

Let us examine the first of these groups, the muscular medicaments. In this group we have the tetanizers and the paralyzers of muscles. It was Trousseau who first brought into vogue the treatment of chorea by strychnia, though this drug had previously been employed by Lejeune, Neumann and Cazenave of Bordeaux. Trousseau prescribed very large doses of strychnia, giving five

and even ten centigrams of strychnia daily (from one to two grains) to choreic patients, and determining tetanic contractures of the masseters. Despite the support which West has quite recently given to this treatment, and the favorable results cited by Lacaze Duthiers and others, notably by Hammond in America, I have not seen any benefit from such heroic medication, and cannot advise it, being persuaded of its inefficacy and its danger.[1]

I must say the same of aniline,[2] which is, as you know, a convulsivant poison, which Turnbull, Filiberti and Frazer have employed in chorea.

By the side of these convulsivant medicines I must place those which have an opposite action, namely, the paralyzers of muscle. I shall pass by curare and curarine, which have been employed by Drummond, Day and Fulton, remedies whose utility in chorea is still *sub judice*,[3] and shall make brief mention of the alkaloid of Calabar bean.[4]

[1] Instead of translating a long foot note of the author giving the French method of giving strychnia, popularized by Trousseau, I present Hammond's method, from his Treatise on Nervous Diseases. He makes a solution of strychnia one-half the strength of the liquor strychniæ of the P. Br.; thus: ℞ Strychniæ, gr. j.; aquæ, ʒ ss. Dose, five drops t. i. d. to a child from ten to fifteen years of age. The dose should be increased by one drop daily till the physiological effects of the medicine are manifested, as evidenced by stiffness of the legs and neck. When this takes place the dose should be reduced to five drops and increased as before.

[2] Aniline or phenylamine (C^6H^7N) is the first term of a series of aromatic alkaloids; it was formerly obtained from indigo. It is now obtained from coal-tar. In toxic doses aniline produces eclamptic attacks, and first excites, then paralyzes the nervous system.

Turnbull gives aniline in doses of from three to five grains, increasing gradually the dose up to fifteen grains. (*a*)

[3] In the London Lancet (reprint) for 1879, p. 352, is an interesting report of cases treated in the Samaritan Hospital by hypodermic injections of curare (service of Dr. Day). One-sixtieth, one-fortieth, then one-tenth of a grain, daily, was injected. The latter dose calmed and improved the patient in every way for thirty hours. Dr. Day followed up the benefit derived by giving sulphate of zinc, three grains, t. i. d. Dr. Drummond, of Newcastle-on-Tyne, had previously treated and cured an obstinate case of chorea by the subcutaneous injection of curare. (British Medical Journal, June 15, 1878, p. 857.) The curare was in small square discs of 1-60th grain, prepared by Savory & Moore; these discs were soluble in three or four drops of water. Dr. Day remarks that chorea, which has hitherto been regarded as a spinal disease, seems, in consequence of the association of mouth movements with movements of the limbs, to have a decided cerebral aspect. The experiments of Hitzig and of Ferrier show that the centres for movements of mouth and limbs lie close together in the motor area of the brain. The hypothesis then suggested itself that chorea might be the result of a rippling discharge from the motor centres lying around the fissure of Rolando. The possibility that this may be the case renders the therapeutics of this affection still unsettled and unsatisfactory.

[4] Bouchut has employed sulphate of eserine in 437 cases of chorea and of convulsive neuroses in infants from seven to twelve years of age. In 205 cases the medicament was introduced into the stomach in the form of pills of $\frac{1}{30}$ to $\frac{1}{12}$ of a grain. In 232 other cases it was administered hypodermically in the same doses. When sulphate of eserine is injected under the skin in doses varying from $\frac{1}{30}$ to $\frac{1}{12}$ of a grain, you first observe nausea and

(*a*) Turnbull, on the Physiological Properties of Sulphate of Aniline and its Use in the Treatment of Chorea (Lancet, 1861). Filiberti, on Aniline in Chorea (Gaz. Med. de Lyon, 1864). D. Beaumetz, Art., Aniline, in Dict. de Ther.

Eserine has been recommended in the treatment of chorea by Bouchut. It is to him that we owe the greatest number of observations, some 437 cases of chorea having been treated with eserine by this practitioner. Despite the advantageous results claimed for this method, since, according to Bouchut, an average of eight days of treatment suffices in the majority of cases for a cure, this medication has not been received with favor, and I know of no one at the present day who employs it. It is, in fact, a dangerous treatment, nausea and symptoms of paralysis of the diaphragm following the absorption of this alkaloid; and, although no grave accident was observed in the cases reported by Bouchut, serious evil is likely to result from the use of this powerful toxic agent.

The same dangers attend the use of hyoscyamine, the favorable effects of which in the treatment of tremblings in general, and of chorea in particular, Oulmont has taught us.[5] The danger results chiefly from the unreliability of the preparation; there exist, in fact, in commerce, hyoscyamines of variable intensity, and one obtains different effects according as he uses the preparations of different pharmacists. Recently, at the Societé des Hôpitaux, our colleague Empis reported grave toxic symptoms following doses of 5 milligrams of hyoscyamine.

All these alkloids, whose action is so energetic, ought to be discarded in chorea, for the risk attending their use is out of proportion to the problematical benefit derived from them, in the case of a disease which runs a definite course, with predominating tendencies toward recovery.

Our second class of medicaments is constituted of those which are addressed particularly to the spinal cord, whose excito-motor power they diminish. At their head is placed bromide of potassium, a precious medicament, which we have already seen employed with so much success in the treatment of

malaise, then sweat rolls from the face, there are cramps in the stomach, vomiting, and paralysis of the diaphragm. The action of eserine introduced into the stomach is much less marked than by subcutaneous injection, and $\frac{1}{12}$ of a grain by the mouth corresponds to $\frac{1}{30}$ of a grain under the skin. Bouchut has compared the results in animals and in men, and has shown that they do not agree. In the treatment of chorea by eserine, Bouchut obtained a cure in an average of ten days; should the eserine lose its effect, he caused the injection to be repeated three or four times a day, giving each time from $\frac{1}{20}$ to $\frac{1}{12}$ of a grain, so that every day the patient would receive $\frac{1}{4}$ to $\frac{1}{3}$ of a grain. Cadet de Gassicourt has repeated this experiment in four cases, and has obtained no result whatever, therefore he discards this treatment. (*a*)

[5]Oulmont has treated five patients affected with chorea and aged from 20 to 36 years, by hyoscyamin, and has obtained favorable results. He administers hyoscyamin in pills of $\frac{1}{60}$ of a grain, until amelioration is produced, but never exceeds 10 pills a day. According to Oulmont, chorea is one of the neuroses which seems to be the most favorably influenced by this medicament. (*b*)

(*a*) Bouchut, Therapeutical Researches on the Action of Eserine in Chorea (Bull. de Ther., t. 88, 1875, p. 89, and t. 89, p. 541). Cadet de Gassicourt, note on the Employ of Sulphate of Eserine in Chorea, Jour. de Ther., 1875, p. 541).

(*b*) Oulmont, on Treatment of Chorea by Hyoscyamin, Bull. de Ther., t. 89, 1875, p. 145. Brochin. Treatment of Chorea by Hyoscyamin, (Gaz. des Hôp., 1875, p. 1018).

epilepsy and hysteria. It has also found a place in the treatment of chorea, and Kohn has shown us what to expect from the bromide in this affection.[1]

For my part, I believe it is in the hysterical choreas that the bromide treatment does the most good. You know, in fact, that chorea is often a manifestation of hysteria, and the happy influence of the bromide in these cases is easily understood. In the chorea of children, however, the bromide is very far from being as efficacious, and, notwithstanding the facts presented by Gubler, Gallard, Hough, Worms, and Tarchetti, I share the opinion expressed by Ziemssen, Steine, and Dally, and believe that bromide of potassium is not of utility in ordinary chorea, unless, indeed, administered in doses sufficient to produce bromism, and here the disadvantages are out of proportion to the advantages derived.

In England and the United States sulphate of zinc is much used in the treatment of chorea. Barlow at Guy's Hospital, West and Butlin, in England, and Hammond, of New York, speak highly of this medicament, which is given in doses of a grain or two, gradually increased till as much as fifteen or twenty grains are taken three times a day. As this salt is very irritating to the stomach, it has been proposed to give it largely diluted.[2]

In France we rarely use this medicament, which in many points bears a resemblance to internal metallotherapy; and just as to the treatment of certain hysterical symptoms it has been of late customary to apply magnets and metallic armatures, so also it has been proposed to treat chorea by this method, and Burq, in 1859, reported cases of St. Vitus' dance cured by metallotherapy. I refer to these facts without comment, for they are not yet sufficiently numerous to warrant us in drawing conclusions from them as to the utility of metallotherapy, or even of zinc sulphate in chorea.[3]

Picrotoxine, which we have already seen used in epilepsy by Planat, has

[1] Kohn in his treatise cites ten cases of chorea treated successfully by bromide of potassium. He urges the importance of giving large doses, and he himself gives from one to two drachms a day. These doses, he thinks, have no injurious effect. (*a*)

[2] *Vide* Wad. Clinical Lectures on Chorea and its Treatment. (British Medical Journal, 1827). Dr. Wad favors the large doses in chorea. Barlow, On the Treatment of Chorea by Zinc Sulph. (Medical Times and Gazette, 1857.) Butlin, Cases of Chorea Treated by Sulphate of Zinc. (Lancet, 1871.) West on Diseases of Children, article Chorea.

[3] It may be thought that the author, who is a recognized leader in therapeutics in the old world, is too much of a nihilist in treatment, and that he has rather summarily disposed of—as of little value—some of these medicaments, much employed in chorea. Certain it is that multitudes of practitioners all over this country, as well as elsewhere, are using bromides and zinc in this affection. It is always proper to ask the reasons for our cherished be-

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(*a*) Kohn, on the Treatment of Chorea by Bromide of Potassium in Large Doses, Thése de Paris, 1870. Gubler, Chorea Treated by Bromide of Potassium (Gaz. Hebd., 1865). Dumont, Chorea in a Pregnant Female Cured by Bromide of Potassium (Bull. de Thér. Feb., 1865). Gallard, Rheumatic Chorea Treated and Cured by Bromide of Potassium (Bull. et Mem. de Soc. Med. des Hôp. de Paris, 1869). Worms, Intense Rheumatic Chorea Treated and Cured by Bromide of Potassim (Gaz. des Hop. 1869). Hough, Chorea of Thirty Years' Standing Cured in Six Weeks by Bromide of Potassium (Phil. Med. and Surg. Reporter, May, 1869). Axenfeld and Huchard, Traité des Neuroses, Paris, 1882.

also been tried in chorea; but these are trials which have not been repeated. I may say the same of nitrite of amyl, employed by Winfield–Ziegler.[4]

Electricity has been made use of under two forms, as galvanism and as galvanic baths. Remak and Onimus have recommended constant currents, applied along the spine; these, which ought to be descending currents, according to Onimus, diminish sensibly the motor incoördination and the duration of the disease.

Constantin Paul has eulogized the galvanic baths, which, if they do not give very positive results in chorea, seem at least to modify in a happy manner choreas of long standing, and choreic tremblings. You ought then to know how to give these baths, whose practical application is very simple. The electric bath is composed of three parts; a bath-tub, a battery, and an electric coil. The bath-tub ought to be insulated, and should rest on glass legs, or its inner surface should have an enamel coating of glass or some other non-conductor. The battery consists of a single Bunsen cell; as for the helix, it is furnished with an interrupter and a graduator which enable you to increase or diminish the intensity of the current; it is constituted by a single wire sixty meters long and three millimetres in diameter. This is the way you manage this apparatus: The positive and negative poles of the battery communicate with the helix; then after having formed part of the coil, they terminate in two stops destined to receive the two other wires. These last terminate in the bathing-tub, the one at the foot, the other near the head; they end in two carbon plates which are fixed to the two extremities of the tub. The tub being well filled with water at a temperature of 35° to 37° C. (95° to 98° F.), the patient immerses himself in the water, with his back against the carbon plate where ends the negative pole, while his feet rest on the plate that represents the posi-

liefs, and therefore it is proper to demand of those physicians who have the most faith in these remedies in chorea, if their faith is well grounded.

The darkness in which the etiology of this disease is enshrouded ought to lead us to hesitate before we treat chorea as a neurosis whose essence is spinal excitation, pouring in the bromides till reflex excitability is well-nigh abolished and the blood is seriously impoverished; this, too, in the case of a disease characterized by anæmia and debility.

As for sulphate of zinc, when it does good in chorea, I am persuaded that it benefits not as a spinal medicament but as a general tonic, and hence deserves to be placed by the side of iron and arsenic. Nor do I believe in the large doses advised, despite the high authority of the late Dr. Thomas Watson. (*Vide* Braithwaite's Retrospect, Part 80, page 54. TRANS.)

[4] Winfield-Ziegler has employed nitrite of amyl in chorea, and has thus effected cessation of movements after one or two weeks. This medicament is given by inhalation and the dose varies from three to ten drops, three times a day. The dose may be increased after several days; no harmful results have ever been observed. As for galvanic baths, Constantin Paul has applied them to the treatment of alcoholic trembling, of multiple sclerosis and chorea. In two cases of chorea he obtained in the one a rapid cure, in the other no result. These galvanic baths had a favorable effect on tremblings in general, from whatever cause.(*a*)

(*a*) Winfield Ziegler, on the use of Nitrite of Amyl, especially in Chorea (Phil. Med. Times, July, 1876). Constantin Paul, in Bull. de Ther., t. 99, p. 193, on the Treatment of Tremblings and Other Troubles of Coördination of Movement by Galvanic Baths.

tive pole. Then the current is regulated so that the patient supports without too much difficulty the successive discharges which result from the extra current. The baths have a variable duration of from fifteen to twenty minutes, and have a decided sedative effect on the choreic movements.

I have dwelt at some length on these galvanic baths, because they have been of precious value to us, not only in relieving the trembling of chorea, but also those that accompany paralysis agitans and disseminated scleroses, and I have seen many practitioners fail in the attempt to give these baths properly.

Beard and Rockwell have proposed a new method of employing electricity in these cases, which they call general electrization, and which resembles the method above described. The feet of the patient are placed on a moist copper plate, or he is made to sit on a wet sponge; this plate or this sponge is connected with one of the poles of a faradic battery, while the other pole is moved back and forth over different parts of the body.

Lubelski was the first, in 1867, to advise the use of ether spray along the vertebral column. The pulverizations are made by means of a Richardson hand atomizer (or a Codman and Shurtleff spray-producer); the duration of the operation need not exceed five minutes. I have used this method of treatment (which is perfectly safe) with considerable benefit; certainly with diminution of the choreic movements. Zimberlin, Mazade, Jaccoud, Rose, Fabry and Marsiglia have reported cases of chorea cured by the ether spray.

The third class of medicaments applicable to the treatment of chorea is constituted by those remedies which produce sleep, and therefore cause cessation of the choreic movements. In this group we place opium, chloral and chloroform. Before the introduction of chloral into therapeutics, great use was made of opium in large doses, and inhalations of chloroform. Trousseau, Benazet and others had advised opium in chorea, while Grey, Dacier and Pollock highly recommended inhalations of chloroform as a means of attenuating the intensity of the choreic manifestations. But these two medicaments have given place to a substance every way as active, and which produces the same effects without having the inconveniences of chloroform and opium, namely, chloral, which is admirably borne by children.

Bouchut has given the most precise directions for the administration of chloral in chorea. He gives in the morning after breakfast forty grains of chloral in one dose, and so produces a sleep which lasts till noon; food is then administered, and forty grains more of chloral; then about tea-time, when the child wakes up, a full meal is given and generally the child goes to sleep again and sleeps all night long. In this way the young patient is kept asleep most of the time for several successive days. Cadet de Gassicourt employs another method. He prescribes every two hours a tablespoonful of a four-ounce solution containing one dram of chloral, and continues the administration till deep sleep is produced.

Whether you make use of the large dose of Bouchut, or the smaller doses of Cadet de Gassicourt, it is necessary always to administer the chloral in a considerable quantity of some diluent, and the best preparation is evidently that

which consists in adding a proportion of syrup of chloral to a cup of egg and milk. [The syrup of chloral of the French Codex contains one gramme to the tablespoonful.—TRANS.]

Chloral can hardly be called a curative medicament, yet it renders great service when the disease attains considerable intensity, for it enables the patient during the sound sleep procured by this remedy to obtain cessation of the fatiguing and painful choreic movements. You ought then always to employ this remedy where you see the strength of your little patient becoming exhausted, and especially where you see the skin becoming excoriated by reason of the intensity of the muscular disorder.

The last group of medicaments is composed of remedies which are addressed more particularly to the general condition, and here we have to study one kind of treatment which is debilitating, and another which is tonic.

Debilitating medication is represented more especially by tartar emetic. Gillette is the most ardent defender of this kind of treatment, which has received a certain amount of favor, since we have seen Cadet de Gassicourt attribute to it a very beneficial influence in cases of grave chorea. These were Gillette's rules for the administration of this medicament: The first day hourly doses were given, till three grains were taken. The next day the dose was doubled; the third day it was tripled. Then the child was allowed to rest for three or four days, and if he did not get any better, the medicine was recommenced in the dose of four grains the first day, eight grains the second, and twelve grains the third day. Then there was another interval of three or four days, and the medicine was renewed in doses of five grains the first day, ten grains the second, and so on.

Whatever may be the value of the facts cited by Bouley, Gillette, Bonfils, Marcotte and Peslerbe, I am a most bitter opponent of this kind of treatment. I consider tartar emetic a very dangerous remedy, especially in the case of children. I expressed myself freely on this subject when lecturing on pneumonia,[1] and am persuaded that under any circumstances it is impossible to find in a hypothetical amelioration a sufficient compensation for the disorders which tartar emetic, administered in these large doses, determines in the digestive organs.

Tonic medication, as in the case of all diseases which tend spontaneously toward recovery, occupies the first place in the treatment of chorea. At the head of the list of tonic remedies we must put arsenic, which is administered by mouth and by hypodermic injection. In this country it was Aran and his pupil Siredy who first showed the advantages of arsenic in the treatment of this neurosis.[2]

[1] Vol. II. of Clinical Therapeutics.

[2] The arsenical medication is very much in vogue in France at the present day. Siredy employs the solution of Boudin, which contains a milligram of arsenic in each gramme, and of which this is the formula:

℞ Arsenious acid,..... 1 gramme (15 grains).
Water..... ..... 1,000 grammes (about one quart).

If you prefer to give it by mouth, you may make choice of Boudins' liquor (preferred by Siredy) of arseniate of soda, which Cadet de Gassicourt employs, or of Fowler's solution, and you may gradually increase the dose from one milligram to ten milligrams of arsenious acid per day; watching of course, the effects of the medicine on the digestive tube. I much prefer the hypodermic method, for this enables us to obtain the good effects of arsenic with quite small doses. Fowler's solution is marvelously adapted for subcutaneous injection, for it occasions no irritation of the skin, or cellular tissue; you may boldly inject from one to four drops of the liquor potassæ arsenitis, and you may even exceed this quantity. This mode of treatment by subcutaneous injections, employed for the first time by Radcliffe in 1866, has been brought into general use by the school of Lyons, and Perraud and Garin have pointed out the advantages of this mode of treatment.

By the side of the arsenical treatment we must place, almost in the same rank, the use of sulphur baths, hydrotherapy, and gymnastics. Hydrotherapy gives excellent results in chorea, and you ought always to resort to it when there is no cardiac complication. It is well to rely on the jet douche, the shower bath being of doubtful utility; you should, as Beni Barde[3] counsels, begin with the tempered douche, and accustom your patient by degrees to the cold douche. When the patient cannot have the benefit of an establishment for hydrotherapy it is well to rely much on wrappings in wet sheets. Sulphur baths are inferior to hydrotherapy in chorea; nevertheless in the rheumatismal forms it is a good mode of treatment. Finally, gymnastics, as Blache has shown, who out of one hundred and eighty-eight cases obtained by this method one hundred and two cures in thirty-nine days, is an excellent method of treatment; but the gymnastic exercises must be directed after a special manner, and Laisné has given the best rules for their performance.

Laisné is one of those who have done the most to raise gymnastics to a practical art in its application, not only to the physical training and development of youth at schools, but also to our hospital service, as a therapeutic means. He several years ago instituted at the Hôpital des Enfants, the gymnastic treatment of chorea, following the directions of Blache. It is necessary that the movements shall be rhythmical, and regulated by chanting ; some cases are speedily benefited, others not at all, by reason of the extreme incoördination, which will not allow the child to stand erect. There are, moreover, choreic children so impressionable that their disorder augments the moment

M. Begin with ten grammes a day [3 ijss] of this solution, in the case of an adult, and increase by five grammes [3 j and gr. xv] each day till thirty or thirty-five grammes [an ounce and over] are taken daily. In a child you should begin with two grammes [3 ss] and increase by two grammes each day. Bouchut, Archambault and Cadet de Gassicourt employ arseniate of soda; they begin with five milligrams and increase to twenty, twenty-five and thirty milligrams each day. Perraud employs subcutaneous injections of Fowler's solution, in the dose of four or five drops once a day, or even once in two days. (Cadet de Gassicourt, Traité des Maladies des Enfants. Pomel on Arsenical Medication in Chorea. Thésé de Paris, 1879), Garin on the treatment of chorea especially by arsenic, and hypodermic injections of Fowler's solution. Thésé de Lyon, 1879.

[3] Beni Barde, Hydrotherapy, p. 645. Paris, 1874.

that you endeavor to make them execute co-ordinated movements before spectators.[1]

In these cases (and here I partake of the opinion of Cadet de Gassicourt) gymnastics can have no good effect. You can aid these gymnastic exercises not a little by massage, which is especially applicable to the muscular groups the most affected by chorea.

Such, gentlemen, are the therapeutic measures the most employed in chorea. It remains for me, in conclusion, to sum up the main points in the management of this affection. From a therapeutic point of view, you will divide the choreas into two groups: those which are relatively benign, and those which are relatively grave.

In the case of the benign choreas ("St. Guy's dance") which do not require the patient to keep his bed, but allow him to walk about and perform certain movements, notwithstanding the motor incoördination, you should employ, above all, gymnastics and hydrotherapy, and administer arsenic by mouth or hypodermically.[2]

If cardiac complications exist, you may apply a blister over the region of the heart; you must eschew hydrotherapy, and be chary of gymnastics; here

[1] Laisné trains choreic children in this way: The patient (supposing it to be a little girl) stands before the tutor, being held by his knees; the latter seizes her hands and requires her to make regular movements with each arm, counting, with loud voice or chanting, one, two, three, four, etc., with each movement. The child is told to listen, and to make no effort on her own account, for if encouraged too much to make voluntary efforts, her attempts would be likely to end in abrupt and disordered movements, which would defeat the object intended. Vigilance is required in these first manœuvres, in order to be always ready to yield to the sudden spasmodic contraction of a member so likely to result in some children after these forced movements. The child is held as firmly as possible by the arm, and the endeavor is made to produce movements more or less rapid but always rhythmical with the legs. From time to time the child is allowed a brief rest; finally the patient is placed with its back against a ladder, called orthopædic ladder, and is made to grasp with its hands the rounds above the head; the legs are supported while the child is kept suspended, as long as can be done without pain or fatigue; after a little rest this manœuvre is gone over again. During the intervals frictions are practiced of the extremities and other parts. The tutor must use the utmost judgment and patience and not demand more of the child than it has strength to perform. When a little improvement is noted and the child is getting wonted to its tasks, new gymnastics are attempted, and the little patient is now urged to use its powers of volition. Among these exercises we may enumerate the use of the dumb-bells, the arm-swing, the horizontal ladder, the parallel bars, etc. After a time the patient can control her movements sufficiently to go through these exercises without any assistance, engaging with her companions in these sports.

In choreic persons who are bad cases, the exercises ought to be very frequent, as often indeed as twice a day. Caution must be taken that they do not injure themselves, and that sufficient intervals of rest are allowed. One is often obliged when patients are extended on a cot or long chair, to hold their arms and legs so that they may not injure themselves by the blows which they inflict, or may not slide off onto the ground.—Laisné, "On the Application of Gymnastics to the Treatment of Certain Diseases.")

[2] Probably no remedy is more used in this country in the treatment of chorea than arsenic. Fowler's solution is the form generally chosen; beginning with three we gradually increase to eight or ten drops after each meal. The great majority of cases can be cured in from four to eight weeks by arsenic. TRANS.

massage and the ether spray along the vertebral column will do good. In the grave choreas, those which produce by reason of confinement in bed (necessitated by the extreme motor incoördination) excoriations of the skin ; and general troubles of nutrition, you may use chloral, bromide and massage. Chloral will enable you to procure sleep, and at the same time arrest of the choreic movements ; bromide of potassium will act in the same way, and the combination of these two medicaments makes an excellent sedative remedial agent. Massage methodically practiced will prove a powerful auxiliary, and you can complete your treatment by subcutaneous injections of Fowler's solution. But do not forget that the success of your medication depends more on the period in the evolution of the malady when you render assistance than on the medicines which you employ, and it is necessary when you are treating chorea, always to have in mind that you are dealing with a disease which regularly passes through definite periods,[1] and spontaneously tends toward restoration. Your treatment, then, should have for its end not to cause sudden cessation of the symptoms, which is impossible, but only to obtain a diminution in their intensity, and duration, and this is all that in the present state of therapeutics one can hope to accomplish.

Thus far we have been occupied only with neuroses; we now come to a more difficult subject, namely, the treatment of the ordinary affections of the cerebro-spinal axis, and I shall describe successively the therapeutics of meningitis, cerebral apoplexy, and myelitis.

[1] In accordance with this well-known law of spontaneous recovery, Gray and Tuckwell, (*vide* articles by these authorities in the Lancet for 1876, on the "Expectant Treatment of Chorea") advise expectancy in this disease and recommend only hygiene. Of twenty cases which came under their observation, the average duration was sixty-nine days, and these are the figures which Prof. Sée obtained in an analysis of the 117 cases.

THE TREATMENT OF MENINGITIS.

SUMMARY.—Varieties of Meningitis—Tuberculous Meningitis—Its Curability—March of Tuberculous Meningitis—Symptoms—Prophylactic Treatment—Influence of Heredity—Hygienic Treatment—The General Treatment—Revulsion—Cold Applications—Blood Letting—Internal Treatment—Calomel—Quinine—Calmatives—Butternut Leaves—Iodide of Potassium—Difficulties of Diagnosis—Acute Meningitis—Chronic Meningitis.

GENTLEMEN—This lecture will be devoted to the treatment of inflammations of the meninges[1] with special reference to tuberculous meningitis. The latter is undoubtedly one of the most formidable diseases which you will ever be called upon to treat, and one of the most hopeless.

Inflammation of the meninges may affect different points; sometimes the

[1] The cerebral membranes or meninges, are three in number, named as follows, beginning from without: dura mater, arachnoid and pia mater. *A. Dura mater:* This envelope presents for consideration, in the first place an external surface which adheres in certain places to the skull cap, the inside of which it lines. The adherent portions are of the nature of prolongations, the principal of which are 1st, the external investments of the olfactory nerve (as far as the pituitary body); 2nd, the sheaths of the superior and inferior maxillary nerves (as far as the periosteum of the zygomatic fossa); 3rd, the sheaths of the facial and auditory nerves (as far as the bottom of the internal auditory foramen); 4th, the sheaths of the glossopharyngeal, pneumogastric and spinal accessory nerves (as far as the foramen lacerum posterius); 5th, the sheath of the hypoglossal nerve; 6th, a reflection of this membrane upon the jugular vein. But the dura mater does not form the sheath of the optic nerve nor the periosteum of the orbit. From its internal surface smooth, polished, lined by the outer portion of the arachnoid, are given off, first the falx cerebri, which connects the crista galli and the coronal crest with the sides of the groove (superior arm of crucial ridge), of the occipital bone; second the tentorium cerebelli which separates the cerebrum from the cerebellum; third, the falx cerebelli; fourth, the pituitary fold. The dura mater is formed by fibres of laminated tissue inter-crossing each other without order. It is composed of a single layer, and the processes are duplicatures. Its arteries come from the internal carotid, the vertebral and the external carotid (pharyngeal branch). The veins empty into the sinuses. According to Sappy there are no lymphatics in this membrane. Its nerves are derived principally from the ophthalmic. *B. Arachnoid*: Of a tenacity which is very great and of greater transparence than the dura mater, this serous membrane presents for consideration two layers; first a visceral layer, separated from the pia mater by the cerebro spinal liquid. Where it is in contact with it; a loose cellular tissue unites them. In passing over the various anfractuosities, the visceral layer transforms the sulci into trigonal grooves, and forms towards the central parts of the base of the brain, veritable confluent cavities. The visceral layer, moreover, accompanies the sheaths which the dura mater furnishes to the nerves. Second, the parietal layer, a simple epithelial coat which, as we have said, lines the internal surface of the dura mater. Like all serous membranes the arachnoid constitutes a shut sack, and the two layers of which I have spoken are reciprocally continuous. This membrane is composed of a stratum of laminated tissue in which Marc See has noted the presence of elastic fibres and an epithelial covering; the first of these layers (the parietal) is extremely thin. The arachnoid contains no veins, arteries or nerves. *C. Pia Mater*: The most internal of the three cerebral membranes, it is constituted almost entirely of blood vessels. It is the nutrient membrane of the brain. It follows regularly all the undulations of the encephalon, whence it results that this membrane has more extensive relations with the cerebrum than either of the others;

membranes of the encephalon alone are inflamed, sometimes those of the spinal cord, sometimes both simultaneously, constituting cerebral, spinal, and cerebro-spinal meningitis, any one of which may be either acute or chronic.

I can not here trace for you the pathological history of these different meningites, and, as in previous lectures, I shall devote myself to treatment, beginning with the inflammations of the meninges of the cerebrum, the tuberculous form of which claims our first attention, by its frequence, its gravity, and its peculiar march, resulting as it does from the presence of tubercle granules in the encephalic envelopes.[2]

dipping down into the convolutions. It sends down into the interior of the brain a prolongation called the choroid plexus. In relation by its external aspect with the cerebro spinal liquid, it furnishes investments to the nerves (neurilemma) which, differing from the membrane from which they arise, are more fibrous than vascular. By its internal aspect, it is in relation with the encephalon, to which it is united, by a great multitude of little blood-vessels. In structure the pia mater is constituted of connective tissue and blood vessels, especially veins. Superiorly the connective tissue is in minimum quantity, but in the lower and posterior portions it predominates. It is to be remarked that in the pia mater the veins do not accompany the arteries and that the presence of lymphatics has not been detected; the nerves are chiefly from the carotid plexus.

[2] The disease described to-day under the name of tuberculous meningitis, and which the English and Germans often designate as an acute hydrocephalus, has long been the subject of observation, as is shown by the reports of Duverney (1701), Andre, of St. Clair (1732), of Paisley (1733), and the work of Sauvages (1763), which makes it a form of eclampsia. Several years later in 1768, Robert Whytt studied the disease, more thoroughly setting forth the symptoms and dividing it according to the character of the pulse into three periods. In his opinion (an opinion endorsed by other authorities, as Fothergill in 1771, Ludwig in 1774, Odier in 1779), the watery effusion into the ventricles, constitutes the disease in its entirety. According to other authorities coming after him, Quin in 1789, Goelis, Coindet 1807, Brachet, Du Chatelet, Senu and Martinet, etc., the immediate cause of the hydrocephalus is an inflammation, but none of them described the veritable diathetic cause of the disease. With Guersant, the question enters into a new phase. Struck by the appearance of granules in the meninges, of tubercles in the lungs or other organs in children dying from acute hydrocephalus, Guersant proposed to call the disease granular meningitis. The way was now opened, and soon appeared theses and memoirs affirming or demonstrating the tuberculous nature of these granulations. In 1830 Papavoine designated the disease under the name of tuberculous arachnitis. Then appeared the treatises of Rufz, Fabre and Constant, Gerhard Green, Piett, Becquerel, Barrier, Rilliet and Barthez, and Legendre which have sanctioned the name of tuberculous meningitis. In 1837 Lediberder discovered in the adult the same lesions as in the infant, and Valleix in 1838 published an important memoir on the tuberculous meningitis of adults. Since this epoch numerous treatises have been published on the same subject, as may be seen from the bibliographic indications given below. Some physicians, even at the present day, repudiate the epithet of tuberculous and substitute that of granular. According to their view the granulations are not tubercles and consist only of fibro-plastic tissue; according to others there may be tuberculous granulations and granulations not tuberculous giving rise to the same symptoms. (*a*)

(*a*) Coignet, Essay on the meningitis of infants. These de Paris 1837, Valleix, On the tuberculous meningitis of the adult 1838 (Arch. Gen. de med); Becquerel, clinical researches on the meningitis of infants, 1838, and Note on a case of tuberculization of meninges in an adult 1846—Legendre, Study of the two forms of tuberculous meningo encephalitis 1846—Rilliet, On tuberculous meningitis in the infant (Gaz. Med., 1846)—Pivent, on tuberculous meningo encephalitis, These de Paris 1852, Bichet On simple and tubercular meningitis, These de Paris 1852. Faivre On meningeal granulations. These de Paris 1853. Bouchut On dilatation of the veins of the retina and retinal hemorrhage in a case of tuberculous meningitis. Gaz. Med., 1865. Hayem, Study on the different forms of encephalitis, These de Paris 1868. Liouville, facts of tuberculous cerebro spinal meningitis. (Comptes de la Soc. de biol 1869). Archambault art meningitis in Dict encyclop. des sç med.

From the special point of view with which we are concerned we have only to insist on these two points, the presence of tubercles, and the disorders which they occasion in the meninges and in the substance of the cerebrum, and ask ourselves if these lesions are curable and compatible with life. The curability of tuberculous meningitis is a question which has been much discussed of late years; it has been denied by some and asserted by others. The problem is a difficult one; it is so easy to confound the tuberculous phlegmasia in its acute manifestations with simple cerebral or fibro-purulent meningitis, which only differs from the other in the absence of the specific granulations. Moreover, there are certain convulsive phenomena, of reflex nature, which may simulate inflammatory meningeal troubles. These former affections being curable, it is easy to understand that, when a mistake in diagnosis has been made, and the supposed tuberculous child recovers, the medical attendant would naturally claim a demonstration of the curability of the disease under consideration.

To-day this question is definitely decided, and the facts published by Archambault, Roger, Blache, Bonamy, etc., justify the affirmation that the evolution of tubercles and the accidents of phlegmasia developed thereby may be arrested in their march. The proofs are of two kinds, the one furnished by pathological anatomy, the other by ophthalmoscopic examination.

As for the first class of proofs, we have the facts noted and reported by Roger, when a child recovers from a first attack of tuberculous meningitis to succumb to another, months or years afterward, and the autopsy reveals traces of the old phlegmasia and those of the new. As for the second class, you all know the importance of Bouchut's ophthalmoscopic studies in tubercular meningitis. The ocular examination with this instrument really enables us to make an autopsy before death by showing us the presence of tubercle granulations in the fundus oculi, so that, in an individual affected with meningitis, and presenting visible granulations in the choroid and retina, you may positively affirm the tuberculous nature of the meningeal inflammation; and, if the patient gets well, you have evidence of the curability of the disease. It was precisely this that happened to me in the case of the hospital patient which I reported to the Société des Hôpitaux in 1878.[1]

This patient was a young man, twenty-three years of age, occupying No. 21 of Ward St. Lazare. He had presented all the symptoms of tuberculous meningitis; his father, a drunkard, had died of phthisis; his mother had died of phthisis following diabetes, the examination of the fundus oculi by Dr. Meyer, one of our most competent oculists, revealed neuro-retinitis and tubercles in the choroid; my diagnosis certainly seemed to be well-founded. This young man, I assure you, recovered perfectly from his brain trouble, and for four months has not had a return of the disease.

Moreover, why should tuberculosis of the meninges follow a different course from tuberculosis in other serous membranes? Do we not see tuberculous pleurisies get well? The remarkable investigations of Grancher have made clear the tendencies of tuberculosis in many instances toward recovery.

[1] Dujardin-Beaumetz, "Tubercular Meningitis; Arrest of the Disease; Recovery from all the Symptoms," Union méd.," 1878.

In others, however, the march is characterized by progressive fatal invasion. There is, then, gentlemen, no doubt of the possibility of the arrest of this disease, even when the membranes of the brain have undergone inflammation; and this consoling idea ought to direct all your efforts in the treatment of this grave affection. Of course, the chances of cure are lessened as the disease advances. Possible at the onset, recovery is exceptional when, by reason of the presence of tubercle granules in the meninges, inflammatory disorders have arisen, entailing profound lesions in the encephalon.

You know, in fact, that the pathological anatomy[1] of tuberculous meningitis shows us, besides the granules, hanging from branches of the Sylvian artery like clusters of grapes, all degrees of phlegmasia from simple thickening of the membranes to the production of pus. We also see *ramollissement*

[1] At the autopsy of a child that has died of tuberculous meningitis, you observe the following encephalic lesions. The dura mater does not ordinarily present any alteration, only the sinuses being gorged with blood. The arachnoid may be healthy, but it is generally dry, less transparent than ordinarily, somewhat opalescent, thickened, and covered with plastic exudation, and the alterations are especially marked at the base of the brain.

The cavity of the arachnoid contains a small quantity of transparent or yellowish turbid serosity; the sub arachnoid tissue and the meshes of the pia-mater are infiltrated with a fibro purulent effusion of a yellowish, sometimes greenish, color, forming patches more or less extensive, especially abundant at the base of the brain, in the vicinity of the olfactory nerves, the fissure of Sylvius, whose borders they agglutinate, the optic commissure, and the blood-vessels at the base which this exudation surrounds as a sort of sheet.

The pia-mater is injected throughout, or partially in the anfractuosities, or in the fissure of Sylvius; its veins are gorged with blood; it is thickened and intimately adherent to the brain, from which it can be removed only by taking with it a thin stratum of softened cerebral substance (the result of a hyperplastic encephalitis, according to Hayem). In the sub-arachnoid tissue and in the meshes of the pia mater, are found tubercle granulations which present themselves under the form of roundish corpuscles of variable size, white, opalescent, gray or yellow. Their number is variable also; sometimes few, scarcely visible, hardly appearing above the level of the surrounding tissue, difficult even to detect, at other times, they are dissemminated, forming a crop of small white spots or agglomerated in bunches like grapes. These granulations are met everywhere, but their favorite site is the base of the brain, along the fissure of Sylvius, over the cerebellum, the pons, the medulla oblongata, following the course of the blood vessels. They occupy the lymphatic sheaths of the vessels, and are produced by proliferation of the nuclei of the sheath and the adventitia of the arterioles of the pia mater; their presence provokes arteritis, the coagulation of blood in the vessels (thromboses), whence result foci of softening. The brain appears more voluminous; the convolutions are flattened and the superficial part presents a certain degree of ramollissement, and a punctiform redness. The ventricles are the seat of a constant effusion (from whence the name "acute hydrocephalus," given to the disease by the old authors); the quantity of liquid is variable and ordinarily oscilates between 60 and 100 grammes; its appearance is clear, limpid or turbid, opalescent, flocculent, containing debris of the ventricular membrane, or of the cerebral substance more or less softened. In the substance of the striate bodies, thalami or crura, there are sometimes spots of capillary softening, and of apoplexy, which are due, according to Rendu, to obliteration by thrombosis of arteries which terminate in these foci. On the part of the spinal cord similar lesions are observed, according to Liouville. As complications of granular meningitis we sometimes observe cerebral or meningeal hemorrhages, tubercles in different organs, the lungs, the glands, the mesentery, the intestine, the liver, the kidneys—on the part of the eye (Bouchut) pigmentary atrophy of the choroid and tubercles in the choroid.

of the peripheral cortical strata, and finally that intraventricular exudation and that softening of the fornix which have long characterized this disease, to which the name of acute hydrocephalus was early applied.

These different lesions have different symptoms,[1] and you know that, from

[1] The symptoms of meningitis have been divided into three periods. The first or prodromic period is characterized by troubles of the intelligence. The child is cross and peevish, his disposition shows a marked change; he may even become better natured; in the midst of his sports he is often dizzy; he complains of fatigue, and frequently has a desire to go to sleep. The digestive functions are performed poorly; there is want of appetite; sometimes retchings and vomitings; obstinate constipation. This prodromic period is of variable duration. West fixes it at from four to five days, but it may be much longer, and for weeks and even months, digestive troubles and disturbances in the sphere of intellect may be noted, the attention of the physician and family being called thereto. In the second period the child keeps his bed; is in a stupor and does not readily reply to questions; the light disturbs him, and from time to time he utters plaintive cries; cries which have quite a peculiar character, and to which Coindet gave the name of hydrencephalic. Sometimes the headache is very severe, and the child does not cease to indicate with his hand the seat of suffering. The pulse is frequent, but very irregular, and the least fatigue increases it in a marked manner. The vomiting may cease at this period, but the constipation continues and the abdomen takes that boat like form which characterizes meningitis.

The third period is characterized principally by the appearance of convulsions and paralysis. The paralyses are partial and correspond to the points of the brain where are accumulated the tubercle granules or inflammatory products. Like the paralyses the convulsions are not general, they affect one side more than the other. To these periods of paralysis and convulsions succeed periods of coma, and nothing is more characteristic than the aspect of the infant at this moment; it seems like a figure of marble; the eyes are closed, the skin is cold and the appearance is that of a corpse. You scarcely see it breathe and there is nothing to indicate movement but the precipitate beating of the pulse. To this extreme pallor succeeds all at once an intense flushing of the face, the pulse becomes energetic and more frequent. The child utters plaintive cries, then relapses into the same state as before, and it is as much as ever that you are able to arouse him so as to obtain any reply to questions asked him. Then death occurs in convulsions or in the stage of coma.

Apart from these periods the disease presents variable forms; we have first the typhoid form which has been more especially described by Legendre, and for a week or so it is very difficult to establish a diagnosis between meningitis and dothinenteritis; but at the end of this time the symptoms of the second and even the third period appear, and the diagnosis is easily made. Moreover the symptomatology of tuberculous meningitis is very variable, and it is difficult to give a description applicable to all cases, for the symptoms vary according to the parts of the brain affected. It is difficult to fix the duration of the disease; these are the indications which Barthez has laid down:

1st. When the meningitis is preceded by regular prodromes it rarely lasts more than fifteen days, and ordinarily varies between fifteen and twenty days.

2d. When it commences without prodromes in a sudden manner its duration is ordinarily from twenty to thirty days. Sometimes it may even extend to forty-two days, or even two months.

3d. When it develops in the course of confirmed phthisis its duration is very short, varying from three to eight days.

Green has given the following statistics:

31	patients	died	before	7th	day.
49	"	"	"	14th	day.
31	"	"	"	20th	day.
6	"	"	after	20th	day.

the standpoint of semeiology, tuberculous meningitis has been divided into several periods, corresponding to the various anatomo-pathological phases of the malady. In the first periods we observe only the symptoms belonging to the evolution of tubercle granulations. In the latter stages we see unfolded the complex phenomena which result from the inflammatory alterations determined in the brain and its membranes by the presence of the tubercles.

All our therapeutic efforts, as must now be apparent to you, ought to be directed toward preventing the production of these inflammatory manifestations, and whatever may be our chances of success in the initial periods of the disease, those chances will be well nigh nil in the terminal periods. It is sufficient to add that prophylactic treatment ought to occupy the first place.

There is a fatal law which presides over the evolution of tubercles in different parts of the economy. I refer to the law of heredity, and tuberculous meningitis is no exception to this law. Therefore, we sometimes see all the children which spring from the union of tuberculous parents succumb successively to these first manifestations of tuberculosis, while the parents offer much longer resistance to the diathesis which they have transmitted to their offspring. Moreover, as there is a hereditary phthisis, an innate phthisis, and an acquired phthisis, so also it may be affirmed that there is a meningeal tuberculosis corresponding to these three kinds of causes. If, as West has shown, in twenty-seven out of every forty-two cases of tuberculous meningitis this diathesis is found in the parentage, in other cases it is easy to trace the influence of two other important factors—bad health of the parents on the one hand, and faulty hygienic training of the children on the other.

The bad sanitary condition of the parents explains to us how alcoholism, diabetes, scrofula, excesses, cerebral troubles, disproportion in the ages of father and mother, etc., may be invoked as causes of tuberculous meningitis in the offspring. But we must also give due credit to bad hygienic conditions of the children. In our infant wards we find every day a striking confirmation of what I have just said. When in a little child we have diagnosticated miliary granulations of the meninges, we always observe, as determining causes, either tuberculosis or alcoholic excesses in father or mother, or, on the part of the child, an infancy passed amid the most deplorable hygienic surroundings. Hence indications are plain enough from the point of view of prophylactic treatment.

In all families where you have the occasion to apprehend the appearance of meningeal granulations, either because one of the children has already fallen a victim to the disease, or because the parental antecedents lead you to fear an outbreak of the kind, you ought to insist upon the utmost care in the rearing and education of the child. The tuberculous mother must not nurse her own infant; the child should, if possible, be brought up in the country and kept much in the open air; prolonged and fatiguing intellectual tasks must be strictly forbidden. By gymnastic exercises you should endeavor to establish a just equilibrium between the muscular functions and those of the cerebro-spinal axis. By hydrotherapy you may calm the cerebral excitement of these young children, who almost always display a precocious intelligence. You

should have a careful supervision of the food, and be ready to oppose the least disorder of the digestive organs, for here, as in the evolution of pulmonary tuberculosis, it is the failure of nutrition in general which predisposes to cerebral granulations.

You should, then, have a surveillance of all the periods of early life, with these two ends in view: to favor in every way the nutritive functions, and to avert excitation of the cerebro-spinal axis. I have said *early life*, for if the tuberculous brain affection oftener attacks children in the first years of their life (from three to six), it also finds its victims among youths between the ages of fifteen and twenty years.

But, unfortunately, you are not often called till the advanced periods of the disease, when the meningeal inflammation has commenced its ravages. The prodromal periods have passed unnoticed, and the guardians of the child have placed to the account of peevish disposition, or to irritation of the digestive organs, the changed character of the child, the constipation, the vomiting, etc. When you are called in, meningitis is pronounced. What are you going to do? The treatment is the same whether the meningitis be tuberculous or simple.

The revulsive medication has been employed in all its rigor, and just as pleuritic, peritoneal, pericardial, articular inflammations have been treated by vesicatories, so also blisters have been applied to the shaved head of the hydrocephalic child. This revulsive treatment has been varied, and irritant inunctions have been advised with tartar emetic, or with croton oil; the actual cautery has been recommended, and even the moxa.[1] These revulsive measures have been applied in all their rigor, not only to the shaved head, but also to different parts of the body, and in particular to the inner aspect of the thigh. Without absolutely denying the good effects of the revulsive medication in meningitis, it must be admitted that this method of treatment has been abused, and, for my part, I have more than once seen the condition of the patient rather aggravated

[1] Hahn, of Aix la Chapelle, has vaunted the efficacy of strong tartar emetic ointment in the treatment of meningitis. He discards all internal treatment, shaves the head and rubs in the stibian ointment every two hours. Henrietti, of Brussels, prefers inunctions with croton oil, and Turner, of Edinburgh, and Watson, of Southampton, commend this practice. Trucy, of Marseilles, has reported cases of recovery by the use of the actual cautery. Mongenot and Nysten have returned to the moxa and the cautery in the treatment of meningitis in the Hopital des Enfants. Smith in his treatise on hydrocephalus recommends rubbing into the scalp of the sinciput two hours at a time, a caustic pomade which excites violent derivation. Durr, of Hall, applies to the shaved head of the child a caustic plaster size of a two franc piece, consisting of tartar emetic and blistering cerate; this is kept on from four to six hours till the epidermis is raised when another dressing is applied of the same ointment, after which the vesicated surface is dressed with an irritant ointment. Bellaige reports the case of a child three years old, affected with meningitis, which was cured by an issue of caustic potash on the top of the head. (*a*)

(*a*) Hahn: On he efficacy of tartar emetic ointment in tuberculous meningitis (Bull. de Ther. t. xxxvii., p. 54). Henrietti: On the treatment of acute meningitis by croton oil, rubbed well into the shaved scalp (Presse Md. Belge, Dec. 1857). Turner: On the treatment of meningeal inflammations by frictions of croton oil (Edinb. Md. Jour. Nov. 1868). Constant: On the emply of cauteries and moxas in the treatment of meningitis and encepholstis (Bull. de Ther. 1835 t. ix p. 303). Bellaige: Concerning the meningitis of infants, and its treatment by caustic issues on the top of the head (Bull. de Ther. 1838 t. xv., p. 181).

than benefited by the irritation and pain provoked by severe vesication in this disease.

Therefore I warn you to be chary in the employment of these violent measures, and to prefer the constant application of ice to the head, which seems to me to have quite as much influence as the most energetic revulsion. If you resort to the ice-cap, it should be made to cover the whole head, and its application should be continuous. You may also make use of cold affusions to the head, as Schützenberger[1] advises, and, better still, the apparatus recommended by Dumontpellier, whereby a constant current of cold water is maintained. The head should previously be shaved. To complete what I have said as to local treatment, it has been advised to leech the patient behind the ears; some, as Torci, have gone farther, and have proposed, not only bleeding from the temporal veins, but even abstraction of blood directly from the longitudinal sinus. [Torci opened this sinus from the anterior fontanelle, and withdrew eight ounces of blood. The child, a nursing infant, singularly enough, recovered, but nearly a month afterward succumbed to a second attack.] For my part, I am opposed to these emissions of blood in meningitis, and particularly in tuberculous meningitis; they weaken the child, without any sufficient compensatory advantage.

The internal treatment of meningitis comprises a great number of medicaments; unhappily, the very fact that the number is so great indicates how inefficacious, often, they all are. These medicaments may be ranged in several groups; some are directed to the phlegmasia, some to the symptoms which it produces, others especially to the tuberculous cause of the affection. Meningitis, considered as a simple inflammation, has been combated by the ordinary antiphlogistic treatment. Mercurials, and especially calomel, have been advised in small and often-repeated doses. This practice has received the sanction of Trousseau, and at one time hardly a child was attacked with meningitis that was not mercurialized to salivation. At the present day the calomel treatment is much in vogue, but the mercurial is given in fractional doses. A grain of calomel is rubbed up with a drachm of white sugar, and divided into ten powders; of these, one powder is given every hour. Unfortunately, it is not proved that the mercurial medication of meningitis which is really tuberculous has ever done any good, and it is probable that the success which has been claimed for this treatment is attributable to faulty diagnosis—I mean to say, that it is probable that the meningitis was of syphilitic rather than of tuberculous nature. That an inflammation of the meninges due to syphilitic neoplasms might be benefited by a course of mercurials, there can be little doubt. The good results which have been ascribed to quinine in meningitis are probably explicable on the supposition of errors in diagnosis. There are, in fact, two affections whose symptoms are almost identical with those of meningitis: such are, attacks of pernicious fever of the cerebral form, and typhoid fever in infants. In the first class of cases quinine has a marvelously happy effect. I have even

[1] Schützenberger advises to place the child's head over a bucket at the edge of the bed, and to play upon it streams of water from a watering-pot ("Des affusions froides dans l'hydrocephalie aigüe."

known children, given up to die from tuberculous meningitis, to get well under quinine, for their brain disease was simply the cerebral congestion of malignant remittent fever. These facts ought to be well impressed on your minds, and, whenever you have reason to suspect the toxæmic influence of malaria, you should hasten to give quinine, and as the stomach is often irritable, you may have to administer the quinine in suppositories, or in the form of hypodermic injections of the bromhydrate.

The same remarks are applicable to typhoid fever, and recently Barthez has called attention to this point, and recommended that whenever, in the case of a young child, you are in doubt as to whether you ought to call the disease meningitis or typhoid fever, you should give very large doses of quinine, say a scruple in four doses (which may advantageously be administered in coffee). If marked amelioration follows this medication, you may, with good reason, suspect the disease to be typhoid fever, and not meningitis.

There is a second group of medicaments addressed to the nervous symptoms developed by the meningeal inflammation. To calm the delirium, the agitation, and the convulsions which occur at different periods of the disease opiates have been given ; but chloral and bromide are especially to be recommended. Chloral, in combination with bromide, is here as useful as we found it to be in whooping cough ; if it does not cure, it alleviates. In cases where cures are reported from this treatment, it is more than probable that the disease was not meningitis, but the eclampsia of childhood, dependent on peripheral or toxæmic and not on central lesions.

Two medicaments have been prescribed, from empirical considerations, in this affection—the extract of walnut-leaves and iodide of potassium.

Luton, of Reims, was the first to vaunt the curative efficacy of the extract of the leaves of walnut (known as extract of Grandval); this medicament was directed to the tuberculous cachexia, and not to the inflammation. Luton seems to have had some little success, but no one at the present day has any confidence in this treatment.

It is not so with iodide of potassium. Experimented with first by Blache, then by Bourrouse, and lauded by Bonamy, iodide of potassium counts many earnest advocates. In fact, I think that, considering the testimonials in its favor, and the perfect safety of this medicine, it is well always to have recourse in hydrocephalus to the iodide, of which as much as two grammes (ʒ ss.) may be given to children daily in divided doses.[1] It is possible that the cases where this treatment does good are of syphilitic character, and that it is ineffective in real tuberculous meningitis. I am unprepared to decide this difficult question.

You see, gentlemen, that, notwithstanding the premises which I laid down at the beginning of my lecture relative to the curability of tuberculous meningitis, I am obliged to admit that we have no certain curative means, and, unhappily, when we see little patients get well whom we have treated for this malady,

[1] The formula of Burrouse, of Lafiore, is as follows : ℞ Iodide of potassium, five grammes ; water, sixty grammes. M. A teaspoonful every three, four, or five hours, well diluted. Never exceed two grammes a day ("Moniteur des sciences méd.," June, 1861).

we are in doubt whether the recovery is not rather the result of an error in diagnosis than of anything which we have done.

Therefore, these two facts—the possibility of the resorption of the inflammatory and tuberculous products, or the possibility that you have mistaken for a malignant tuberculous one that is benign and curable—should encourage your efforts in the treatment of this formidable disease.

Moreover, even in tuberculous hydrocephalus you will often observe marked remissions which are misleading, and ought always to keep you on the watch. After passing through the most severe phases of the disease, after the delirium, convulsions, and coma, one sees the child suddenly revive, intelligence comes back, the convulsions cease, and the family are ready to exclaim that a miracle has been wrought. Unhappily, this treacherous remission is short; the cerebral symptoms return, and the fatal event soon comes.

Among the various affections which may be confounded with tuberculous meningitis[1] there is none more deserving of mention, because more common—

[1] Tuberculous meningitis, described for the first time in a complete manner by Whytt under the name of dropsy of the ventricles of the brain, and designated also at the present day under the name of acute hydrocephalus, has its maximum of frequency in children from 2 to 7 years of age, and in adults from 20 to 30. It is often hereditary, being derived from parents who have had tuberculous affections or cerebral disorders. It is, indeed, not an uncommon event to see the children of perfectly healthy parents succumb at an early age to tuberculous meningitis. The disease may begin suddenly; it is generally, however, preceded by a prodromic period of greater or less duration. The child complains of frequent headaches, and of being weary; there is a notable change in the character as before remarked. The child ceases to take any interest in its sports or studies. There is loss of appetite, occasional vomiting and emaciation. There are frequent remissions followed by exacerbation. The headache becomes more violent, vomiting comes on during fasting or after meals, and at the same time there are fever fits. At this period of the inception of the disease, one often observes some inequality of the pupils, intermittent strabismus, slight convulsion of the facial muscles, grinding of the teeth during the night in the midst of a troubled sleep; some children manifest a sort of periodical lameness in their walk. Little by little the malady progresses, the symptoms are more pronounced (period of cerebral excitation); the headache is more exasperating, with occasional remissions, the vomiting of greenish and glairy mucosites occurs more frequently when the stomach is empty; the constipation is obstinate. The little patient becomes more and more fretful, refuses to play, and insists on keeping its bed, where it lies stretched out on its back, with closed eyes, wrinkled brows and anxious expression, avoiding the light and the sight of brilliant objects, which seem to increase the headache. It remains in a stupor, and replies to questions in monosyllables, and angrily resists any attempts on the part of the physician to examine into the condition.

Hydrocephalic children dream frightful dreams, mutter to themselves, are often heard to moan, and frequently carry their hand to their heads with the exclamation, "My head, oh, my head!" At other times they utter mournful cries (hydrencephalic cries), which are characteristic. The night is more disturbed than the day, the pulse more accelerated, above 100, the skin is hot and dry. The delirium is often less calm, and you will observe grinding of the teeth, winking of the eyelids, alternation of redness, and pallor of the face, inequality of the pupils and diplopia. The opthalmoscopic examination, when it can be made, shows peripapillary congestion, dilatation of the vessels of the retina, and papillary deformity, (Bouchut). Then at the end of several days the infant complains less than before, no longer turns away his eyes from the light, vomits rarely, or does not vomit at all. The pulse, which was accelerated, is slower, falls to 90, 80, 60, 50, and even 40, and becomes

attacking as it does both adults and children—than simple acute meningitis. This disease, within certain limits, is curable ; ætiologically, of course, it is distinguished from the strumous meningeal inflammation by the absence of tubercle granulations.[2] For this simple meningitis the treatment is the same as for the tuberculous ; you should especially insist on cold applications, revulsives, and calmatives. But in this form of meningitis our success will depend on the degree of the inflammation and the extent of the lesions. In respect to this latter point, the brain is sometimes strangely tolerant. We now and then see tumors of considerable size develop in the interior of the cerebrum, or even at its periphery, with a latency such that scarcely any symptoms reveal their pres-

irregular. At the same time the temperature falls from 1 to 1½ degrees. As with the pulse, the respiration presents inequalities and irregularities ; to a deep sighing respiration succeeds at times an interval of rest, a long suspension of breathing. It seems as though the patient forgot to breathe for a few moments, then he makes several rapid inspirations, and the same respiratory phenomenon is reproduced. The belly becomes flattened, is retracted, is hollowed out (boat belly). If you pass the finger over the abdomen marking out traces on the skin, you cause red lines to appear (meningitic spots or rays), to which Trousseau attached an exaggerated importance. One also observes convulsive movements in the limbs, grimaces, a working of the lower jaw, gnashing of the teeth during sleep, fugacious and partial contractures of the different muscles, (muscles of the neck, hand, forearm, leg, foot); there is at times tetanic stiffness of the muscles of the nucha. After an attack of convulsions it is not rare to find one side paralyzed completely or incompletely. Like the contractures, the paralyses are either temporary or permanent. The temporary paralyses almost always succeed convulsions ; they may disappear more or less quickly or change to the other side. The permanent paralyses are due to spots of softening in the striate bodies or cerebral peduncles, or to compression of the base of the brain and cranial nerves by the meningeal exudation. One of the most frequent paralyses is that of the third pair ; next in frequency comes paralysis of the muscles of the face, of the eye (strabismus), of the arms, and of the inferior extremities. After an attack of convulsions, or gradually, as a result of the disease, the infant falls into a state of drowsiness and coma, from which it cannot be aroused. It lies on its back, one leg extended, the other bent on the abdomen, much of the time motionless, face of waxy paleness. The eyes are closed or else opened wide, the eyeball has a constant movement of rotation, pupils are dilated, unequal, sluggish, and often half hid under the upper lid.

The pulse increases in frequency, 140 to 180 ; it is never so frequent as the day of death ; the temperature rises to 104 or 105 F. Retention of urine is observed towards the close of life. An abundant and viscous sweat covers the emaciated body of the infant, respiration is embarrassed, and the patient succumbs to the progress of asphyxia, unless carried off by a convulsion.

[2] The diagnosis of tuberculous meningitis, easy in many cases, is often beset with difficulties. The practitioner will be guided in his investigation by the mode of invasion, ordinarily slow and insidious, the vomiting of pultaceous biliary matters, the obstinate constipation, and the irregularities of the pulse and respiration.

Simple acute meningitis, cerebro spinal meningitis, the eruptive fevers, may lead him astray for a moment, but these diseases generally present very marked points of difference from the disease under consideration. In acute meningitis the disease manifests itself suddenly in the midst of health, the fever is high, the cephalalgia is severe, the attacks of vomiting near together, the phenomena of excitation more accentuated, the delirium at times is very early, being noisy and even furious.

In cerebro spinal meningitis the *debut* is also sudden. The delirium, the contractures, and all the disturbances of sensibility are early. Moreover, the patients complain of pain

ence. On the other hand, we frequently observe, from the moment that the cerebral cortex is effected, even if the lesion be quite circumscribed and of little depth, the most pronounced disorders in the sphere of intellect or motility owing to irritation of the nerve-cells of the peripheral strata. It is for this reason that these meningeal inflammations are accompanied by grave symptoms, even when the phlegmasia is not extensive.

The greater part of mental disorders which are grouped under the general name insanity are only chronic meningites, and the mental disturbances, so numerous and so similar, which alcohol produces, result from the pachymeningitis which the presence of alcohol determines in the cerebral envelopes. I can not enter into the treatment of these chronic meningites—treatment little understood, and which belongs to the domain of the expert in mental diseases rather than that of the ordinary practitioner.

I must, before concluding, speak of the treatment of infantile convulsions. It is an interesting subject not yet well elucidated, for the convulsions of infancy are only symptoms, which may be produced by a variety of causes. They may depend on inflammation of the brain or its membranes, or on certain conditions of dyscrasia (uræmia, for instance), and belong to the group of eclampsias, or else they are simply reflex manifestations, generally of little gravity, which appear in the course of various affections, as dentition and diarrhœa.

In eclamptic convulsions, or in those which have for their point of departure reflex action, the best mode of treatment consists in the internal administration of bromide of potassium, or chloral, or in inhalations of chloroform or

along the spine, increased by pressure and by movements. The invasion of the eruptive fevers is also sudden, and there is a high febrile temperature. At the onset of scarlet fever, measles and small-pox, you observe vomiting and sometimes delirium, but soon after symptoms appear which point to the true disease. In these fevers, moreover, as in simple acute meningitis, and cerebro spinal meningitis, you have not the obstinate constipation, the retraction of the belly, the irregularities of the pulse and respiration.

Like tuberculous meningitis, typhoid fever and gastro-intestinal irritation (*embarras gastrique*), often have an insidious commencement. But if typhoid fever, particularly the ataxic form, may lead into error, you soon note characteristic symptoms, which remove all doubt: epistaxis, rose-colored lenticular spots, meteorism, the increasing march of temperature, the frequency of the pulse, etc ; there is, besides, absence of vomiting. Moreover, you will remember that if you have the care of a young child, that typhoid fever is very rare under five years, while meningitis is frequent.

In *embarras gastrique* there is vomiting, constipation, headache ; but the disease appears in a time of full health, the tongue is coated and not moist, as in meningitis, the pulse is regular, and under the influence of treatment—a purgative, for instance—the constipation ceases along with the cephalalgia.

Intestinal worms, by their presence, sometimes provoke divers nervous troubles ; there may be inequality of the pupils, vomitings, even convulsions, with slowing and irregularity of the pulse. You apprehend meningitis, but if there be headache, it is slight, the constipation does not continue, and the symptoms all disappear with the administration of a vermifuge.

Ophthalmoscopic examination ought to be made when possible. According to Bouchut, in 75 per cent. one observes important alterations on the part of the optic nerve and retina, such as neuro-retinitis, peripapillary œdema, phlebo retinal thrombosis, tubercles of the choroid, etc.

ether. All medicaments which anæmiate the brain seem to do good in these cases ; it is from this consideration that Trousseau proposed compression of the carotids. I warn you to be chary in the use of revulsives—such as sinapisms and blisters—in these cases, for severe cutaneous gangrenes, more difficult to cure than the convulsions themselves, have more than once been produced by the prolonged action of even a mustard cataplasm, and this in consequence of the insensibility which results from the fit.

THE TREATMENT OF APOPLEXY.

SUMMARY.—Apoplexy—Definition—Causes—Apoplexy by Rupture—Apoplexy by Anæmia—Apoplexy by Congestion—Treatment of Apoplexy by Hæmorrhage—Treatment before the Attack—Treatment of the Attack—On Blood Letting—Its Rôle—Inefficacy of Blood Letting—Treatment after the Attack—Pharmaceutical Means—Arnica—Strychnine—Electricity—Treatment of Apoplexy by Anæmia—Before, During, After the Attack—Treatment of Apoplexy by Congestion—The Apoplectic Temperament—Pathogeny of Cerebral Hyperæmia—Hygienic Treatment—Bad Influence of the Alcohols—Obesity and Apoplexy—Utility of a Normal Functional Condition of the Digestive Tube — Constipation — Purgatives — Aloes — Hæmorrhoids in Apoplectic Patients—Diagnosis—Conclusions.

GENTLEMEN—To devote a lecture to the treatment of apoplexy may seem to some of you useless, or even behind the times. This old word, apoplexy, to-day well-nigh obsolete, belongs rather to tradition than to clinical medicine; nevertheless, I persist in my resolution, and I will tell you why. If by reason of the progress of pathological anatomy we are able to know the pathogeny of the various cerebral apoplexies, and follow step by step the hæmorrhage from the production of the miliary aneurism to the rupture of the same, and even the necrobiotic alterations of the encephalon determined by emboli or thrombi, we are unfortunately unable in the living subject to establish a clear distinction between the effects of hæmorrhage and those of migrating or autochthonous clots, which give rise to symptoms so similar, although the causes are so dissimilar.[1]

Between the apoplectic attack resulting from hæmorrhage into the cerebrum, and that resulting from cerebral anæmia, there exist, from a clinical point of view, shades of difference but slightly marked, and save in exceptional cases, we are reduced, in making our diagnosis, to conjectures; conjectures which are often falsified by the post mortem examination. As this apoplectic ictus has been the subject of numerous discussions which have deeply concerned therapeutics, it has seemed to me desirable to retain the word, and to set forth the treatment, which is likely to give you the best results. But before going farther, let us come to an understanding about the signification of the word apoplexy.

That sudden suspension of cerebral action, complete or incomplete, persistent or transient, which characterizes apoplexy,[2] has had different interpreta-

[1] Recamier has established the following diagnostic signs:

In the case of hæmorrhage: Contracture of the paralyzed members, diminution of sensibility in the paralyzed parts, alteration of the intelligence.

In the case of ramollissement: Complete resolution of the paralyzed members, conservation and augmentation of sensibility, conservation of intelligence.

[2] Apoplexy, known from the most remote antiquity, described by Hippocrates, Galen, Celsus, Paul of Egina, Bœrhaave, etc., called *siderato*, *morbus attonitus*, *attonitus stupor*, etc.,

tions according to the prevailing medical doctrines. Under the domination of the doctrines of Hippocrates and Galen, the cause of the apoplectic phenomena was ascribed to sudden arrest of the vital spirits, or even to the presence of pituitous humor in the ventricles of the brain. But from the commencement of the seventeenth century the progress of pathological anatomy demonstrated that it was rupture of blood vessels which, in the majority of cases, caused the apoplectic stroke, and Morgagni brought clearly to light the preponderating importance of cerebral hæmorrhages. At the same time, authorities, while admitting the frequency of hæmorrhage in the pathogeny of cerebral apoplexy, did not, at the end of the last century, consider that as the sole cause, and while granting sanguineous apoplexies, they also affirmed the existence of serous apoplexies, and even certain essential apoplexies, called *apoplexiæ sine materia.* But from the beginning of this century, and especially since the work of Rochoux in 1814, apoplexy was regarded as nothing but the manifestation of cerebral hæmorrhage or congestion, and the notion of essential apoplexy was given up. The study of circulatory disturbances, and especially of the vascular changes produced by embolism, soon modified the exclusive view of Rochoux, and to apoplexy by rupture of blood vessels was now added apoplexy by embolism, or by cerebral anæmia. Therefore, I shall adopt with some modification the definition given by Schützenberger, and shall call cerebral apoplexy the

is constituted by an assemblage of cerebral phenomena, characterized by sudden loss of consciousness, with resolution or paralysis of the members, without arrest of the circulation or respiration.

It has been considered as the effect of the arrest of the circulation of the vital spirits in the veins, arrest of the vital force, repletion of the ventricles by a pituitous humor (Hippocrates, Galen), arrest of the sensitive or motor spirits (Avicenna), obstruction of the vessels by phlegm or atrabile; it is due to relaxation of the nerves, spasm of the meninges, (obsolete views).

In more recent times, by reason of anatomical examinations, apoplexy has been referred to compression of the brain and nerves by dilatation of the blood vessels, by effusion of blood or serum, etc.

Morgagni, Hoffmann, ascribe the principal cause to cerebral hæmorrhage; Hoffmann, at the same time, recognizes two forms:

Sanguineous apoplexy and pituitous apoplexy.

According to Rochoux and his pupils, apoplexy becomes the synonym of cerebral hæmorrhage, and for a long time this view has been adopted, and even now many authorities are of the same opinion as Rochoux, considering apoplexy as the equivalent of hæmorrhage, whether cerebral, medullary or pulmonary, etc.

This is to give an erroneous sense to the word apoplexy; as in the first place, all cerebral hæmorrhages are not accompanied by apoplexy, and the apoplectic ictus has been noted in many other maladies without the occurrence of cerebral hæmorrhage. The phenomena of apoplexy may manifest themselves in cases of effusion of serum in the ventricles (serous apoplexy); in other cases no appreciable encephalic lesion is found, as in apoplexies called nervous, the essential apoplexies (sine materia); the patients fall as if suddenly smitten down, just as in cases of epilepsy, or of eclampsia, and at the same time there is no cerebral hæmorrhage.

As has been seen, apoplexy may arise from many causes, and clinically, it must be considered only as a symptom; it is the expression of a cerebral perturbation, of a sudden suspension, temporary or permanent, of certain functions of the brain.

sudden suspension of cerebral action, produced by an internal cause affecting the circulation (vascular rupture, congestion or anæmia) acting directly on the encephalon.

I shall not enter here into the description of the symptoms of apoplexy, for which I refer you to your text-books,[1] but shall discuss the proper methods of treating this disease, unfortunately so common, giving reasons for such therapeutic hints as I shall offer But in order to understand the bases of our therapeutic endeavors, it is necessary that we should examine, as rapidly as possible, the pathogeny of the disease in accordance with the above definition.

[1] Cerebral apoplexy is rarely ushered in by prodromes; when these exist they consist in headache, vertigo, dazzling sensations, *muscae volitantes*, tinnitus aurium, formications, numbness; at times there is weakening of the memory, hesitation of the speech, etc.; often the invasion of the disease is sudden.

The patient is taken with vertigo, sensations of flashes of light; he makes several staggering steps, then falls suddenly, deprived of consciousness, of power of movement, of sensibility; he is in a state of complete resolution, but the beatings of the heart and the respiratory movements continue. The pulse is full, strong, regular; the breathing is painful, often embarrassed and stertorous; the face is often congested, the features drawn to one side; at each expiration the muscles of the cheeks and lips are puffed out; the eyes are turned to one side, like the head, and towards the sound side (conjugated-deviation of the head); the pupils contract under the influence of light, unless the hemorrhage affects the tubercular quadrigemina, the corpora geniculata or the optic commissure.

The patient is not always completely insensible; he groans in a characteristic manner when one pinches him; moreover, on lifting up the two limbs, lower or upper, it is observed that if one falls heavily and passively, the other falls less suddenly and its descent seems retarded by an instinctive, unconscious muscular contraction.

Often there are at the moment of the attack or a little after, involuntary evacuations of urine or fecal matters. Sometimes death is quite sudden, but this is quite rare; there is no such thing as *fulminating* apoplexy (apoplexie foudroyante), except in bulbar hæmorrhages. Generally in the apoplectic form of cerebral hæmorrhage, however considerable may be the loss of blood, the patients live several hours, sometimes days, and succumb either to the progress of the initial hæmorrhage or to the asphyxia brought on by the respiratory disorders.

In other patients one sees, at the end of a certain number of hours, consciousness gradually return, and the patient wakes out of his stupor, but he is hemiplegic, and the paralysis is seated on the side opposite to the lesion, *i. e.*, on the right side, when the hemorrhage is on the left, and *vice versa*.

With the paralysis there is sometimes anæsthesia more or less extensive; taste and smell are more or less altered. The hemiplegia is partial or total.

With respect to the face, the paralysis is often seated on the same side as that of the limbs, or it may be crossed and seated on the opposite side (crossed or alternate hemiplegia). One side of the face and of the forehead is immobile, without expression; the mouth is distorted, and the commissure of the lips is drawn in the direction of the sound side. At each expiration the cheeks are seen to be puffed out; the patient can neither blow nor whistle. The point of the tongue when projected from the mouth is often turned towards the paralyzed side, and sometimes does not seem to be touched by the paralysis. The speech of the patient is generally broken and confused.

The limbs are often unequally paralyzed; the arm is the most so. At first the temperature is higher on the paralyzed side; later the equlibrium seems to be restored; unless there be atrophy, in which case the temperature seems to be more elevated on the sound side.

The muscles of the pharynx, as well as all other muscles concerned in deglutition are

Cerebral apoplexy is the result of three great factors: congestion, more or less intense, of the brain; sudden arrest of the blood destined to nourish a more or less extensive department of the encephalon, or, lastly, rupture of one of the blood vessels supplying a region of the brain; the latter constituting what used to be called sanguineous apoplexy. Once these affections were pathologically classed in the group of hæmorrhages, and supplementary, congestive, dyscrasic apoplexies were described. To-day we can expunge all these divisions, thanks to the discovery of miliary aneurisms made by Bouchard and Charcot. These pathologists have pointed out this capital fact, that rupture of the cerebral vessels is always preceded by the alteration of the walls of those vessels, veritable aneurisms, and that it is the rupture of these aneurismal portions which causes irruption of blood into the mass of nervous tissue, and all the consequent symptomatic and anatomo-pathological disorders which characterize the intracranial hemorrhage.[2]

paralyzed. Troubles in micturition and defecation are also frequent (retention, sometimes incontinence of urine and fecal matters).

The muscles of the abdomen and of the thorax do not, as a rule, participate in the paralysis.

Hemiplegia may supervene without any apoplectic stroke; it comes on during the waking hours and developes more or less rapidly; the patient, in full possession of his consciousness, has a little vertigo, observes flashes of light before him, then complains of formication and numbness and sees the paralysis gain, in whole or in part, one half of the body; at other times, having gone to bed well, he wakes out of sleep hemiplegic, without having lost consciousness and without having had any troubles of the intellect.

The duration of the hemiplegia is variable; sometimes it disappears after several days, weeks or months. Some patients even get completely well. In other cases we note the development of contracture of the paralyzed muscles, first of the lips, then of the leg, the flexors being affected rather than the extensors. There is at the same time atrophy of the limbs.

The hemiplegia does not often go away completely, and it may remain stationary indefinitely. When recovery takes place, movement reappears first in the leg, then in the arm, and restitution may be permanent. But in other cases, and especially when three weeks after the attack one notes exaltation of the tendinous reflexes, atrophy of the limbs is seen gradually to supervene, contractures of the paralyzed muscles and especially the flexor muscles, the extensors being rarely affected.

When the patients do not succumb to the progress of the central hemorrhage or as the result of a new attack, they are carried off, either by a consecutive cerebral affection, or by an intercurrent disease (such as pneumonia), or by the exhaustion consequent on the eschars, which so often form over the sacrum or trochanters in hemiplegic patients. (*a*)

[2] These aneurisms are undoubtedly the most frequent causes of cerebral hæmorrhages, especially in the hæmorrhagic apoplexies of old age. Charcot and Bouchard found them in *foyers* and in the ochreous cicatrices of ancient hæmorrhages, in the convolutions, corpora striata, optic thalami, and the pons. Visible to the naked eye, they appear in the form of

(*a*) Todd, Clinical Lectures on Paralysis, London, 1856. Grisolle, Pathologie interne. Monneret, Pathologie interne. Hardy and Behier, Pathologie interne. Durand Fardel, Traité Clinique des Maladies des Viellards, 1854. Rokitanski, Lehrbuch der Fatherlogischens Anatomie, 1856. Gendrin, Traite Philosphique de Medicine Pratique, 1838. Rochoux, Recherches sur l' apoplexie, 1814. Bennet, Pathological and Histological Researches on Inflammation of the Nerve Centres. Paget, on Fatty Degeneration of the Small Blood-vessels of the Brain, and its Relation to Apoplexy, London Medical Gazette, t. x. 6, 1850). Bouchard, Recherches sur la Pathologenie des Hemorrhagies Cerebrales, 1866.

Apoplexy by anæmia or necrobiosis, produces the same effects as sanguineous effusion, but by a mechanism altogether different. It occasions sudden cessation of the functions and death of a more or less circumscribed region of the brain, by reason of the arrest of the arterial circulation. We have here something comparable to the local gangrenes which accompany the ligature of the arteries of limbs, and this comparison is, moreover, so exact, that you know that the ligature of the carotid very often gives rise to an attack of apoplexy, with resulting hemiplegia of the opposite side.

This sudden stopping of the circulation in one of the arteries or arterioles of the brain, may have one or two origins: either it results from an alteration *in loco* of the arterial twig; chronic endarteritis of the vessel causing an autochthonous clot to be formed, which completely obliterates the lumen of the vessel: or else the vessel is sound, while the clot that obstructs it comes from a more or less distant point of the arterial system, or from the heart itself, being an embolus.

Between these two states, apoplexy from effusion of blood, and apoplexy from necrobiosis, or anæmia, is placed another group of apoplexies thus far badly defined, and which result from sudden and intense congestion of the brain, congestive apoplexy, or *coup de sang*. It is easily understood how an

little globular granules, whose diameter varies from two-tenths of a millimetre to one millimetre, and even more. They have a violaceous color, more or less deep, if the wall of the blood-vessel is thin, and the blood liquid; reddish brown or ochreous, or even black, if the blood is concrete; bluish or brownish, if the parietes are thickened by proliferation of the connective tissue elements of the adventitious membrane.

They are met with everywhere, but especially in the convolutions, either on the surface or at the point of reunion of the cortical and medullary substance, and at the same time in the pons, and great basal ganglia.

The number of these aneurisms is very variable; from one or two to a hundred or more.

Bouchard believes that these aneurisms (which are seldom or never seen before the age of sixty) are only the concomitant of an alteration of the blood vessels much more general, a sort of arterial sclerosis analogous to that which Rokitanski describes under the name of chronic periarteritis, but differing essentially from simple atheromatous and fatty degeneration. This vascular change affecting the entire arterial system of the encephalon, is especially conspicuous in the smaller intra-cerebral arteries, although the large trunks of the meninges and at the base of the brain may be pervaded by the same alteration, an alteration which consists in an exaggerated and often enormous multiplication of germinal elements in the interstices of the arterial trunks, and in the lymphatic sheath, and in atrophy of the muscular tissue. At the same time there is general dilatation of the vessel, with constrictions at various points where the circular fibres remain intact. In fine, we meet with abrupt dilatations in arteries thus modified, veritable aneurisms, whose rupture produces cerebral hemorrhage.

In the opinion of Charcot and Bouchard, the principal lesion in cerebral hemorrhage is peri-arteritis, or external sclerosis, while in the case of ramollisement, the lesion is endarteritis. or internal sclerosis. Zenker mentions an opposite view: that the lesion always commences by alterations of the adventitia. (*a*)

(*a*) (Cruveilhier, Anatomie. Pathologique—Bouchard and Charcot, Nouvelles Recherches sur la Pathogenie de l'hemorrhagié cerebrale, Arch. de Phys. 1868, p. 110—Bouchard, de la Pathogenie des hemorrhagies. These de Paris, 1869—Liouville, des anevrysmes miliaires, Th. de Paris, 1871.)

afflux of blood, in great quantity, to the encephalon, or sudden stasis in the intra-cranial vessels, gives origin to a sudden but temporary arrest of the cerebral functions.

Having once these divisions well in mind,let us see how we can intelligently act when we have to deal with apoplexy from any one of these causes. I am assuming that we are in a condition to diagnosticate the particular lesion, a matter which I told you before is often involved in great difficulty.

As for cerebral hæmorrhages we are to take into consideration prophylaxis and the treatment during and after the hæmorrhage.

The rôle of prophylactic treatment is to prevent the production of these alterations of the walls of arteries which result in miliary aneurisms. It would seem that we are well nigh impotent in this regard. It is as much as ever if we can anticipate these aneurisms by heredity, and according to the laws which Dieulafoy has established, which go to show that the greater part of cases of cerebral hæmorrhage are witnessed in persons belonging to the same family.

In the majority of instances these miliary aneurisms do not reveal themselves by any symptoms, and their rupture is the first indication which we have of their existence. The most that we can do, in persons predisposed, in order to avoid the rupture of these aneurisms, is to make use of all those hygienic and medicinal means, which moderate the cerebral circulation; but I shall have more to say on this point when I come to speak of apoplexy from congestion.

The vascular wall gives way, the blood invades the cerebral mass, the patient has what is termed "a shock," he looses consciousness and becomes hemiplegic; you are called in haste; what are you to do? Twenty years ago the response would have been forthcoming; you would have made haste to take your lancet and bled the patient freely. This was one of the rules of therapeutics concerning which there was little or no variance of opinion.

Since the time of Aretæus, Paul of Ægina, Cœlius Aurelianus, Avicenna, Baglivi, down to Rochoux, Bouillaud, Monneret, Valleix, Grisolle, etc., the whole world was agreed that bleeding (or rather bleedings) was the proper way to treat apoplexy from blood effusion, and it was as much as ever if any extenuation of this procedure was granted in the case of anæmic and debilitated subjects.[1] The divers indications were pointed out for general bleeding, and

[1] In ancient practice, as soon as the patient has had an apoplectic shock, he was bled on the spot, and this was considered the only proper treatment. Blood letting was divided into general, derivative, and revulsive.

General blood letting was practiced from the arm, the jugular vein or the saphena. It was a subject of debate whether they should take blood from the sound side or the paralyzed side.

Aretæus used to bleed from the sound side. Baglivi from the paralyzed side.

Valsalva recommended to take blood from the jugular vein, but it was soon recognized that bleeding from this vein was dangerous practice.

Chauffard preferred the saphena, claiming that derivation from this vein has a revulsive as well as a spoliatory action.

The number of general blood lettings was often considerable; it was directed to continue them till the pulse was no longer hard and bounding.

Derivative blood letting.—This consists in the application of wet cups and leeches to the

for derivative and revulsive bleeding. It was a matter of serious discussion whether it were preferable to practice phlebotomy in the jugular, as Valsalva taught, or in the saphenous, as Chauffard advised, or even in the pituitary membrane, rather than at the end of the elbow, as Cruveilhier had proposed. One bleeding was not enough; you must bleed several times; at the same time Rochoux advised not to bleed more than four times in the generality of cases. They also discussed whether it were not better to bleed the paralyzed side than the sound side. Finally, they even went farther, and Bell, Nyemann, Zuliani and Gatherwood, taking their stand on hydraulic principles, more or less disputable, substituted arteriotomy of the temporal arteries for phlebotomy. Claudius Barbier, of Lyons, went ahead of all his contemporaries and predecessors in this practice; comparing the cranium to a tight cask, he advised that when the vein was to be opened the skull should be trephined.[2]

To-day, knowing better the mechanism of apoplexy, we ought to repudiate this kind of treatment, because nothing goes to show that we can at once arrest the hæmorrhage which results from rupture of some blood vessel, and to accomplish this result by bleeding, you would have to bleed the patient to syncope, a very dangerous procedure. Moreover, who is the physician that would now think of checking hæmorrhage from a small artery by blood letting? So then blood-letting is not to be thought of in the apoplectic seizure, for it is useless, and may be dangerous. It cannot prevent the consequences which result from rup-

occiput or to the angle of the jaws. As many as twenty leeches would be placed over the tract of the jugulars; these were repeated two or three times after general bleeding. (Monneret.)

Cruveilhier advised to bleed from the pituitary vein, and for this purpose he used a special instrument which he invented.

Revulsive blood letting.—This consists in the application of leeches to different parts of the body, more or less distant from the seat of the hæmorrhage, as the malleoli, the thighs, anus, etc.

Attempts have been made to formulate the application of blood letting in apoplexy. Hints were obtained from the state of the pulse. When the pulse was full but intermittent, it was necessary, according to Shauffer, to refrain from blood letting. The same precaution was necessary in the case of feeble old men. VanSwieten cautions against bleeding in grave cases, for, he says, if the patient dies after the blood letting, the physician would be blamed for his death.

It was generally admitted that in hæmorrhages which seemed to accompany active cerebral congestion bleeding was especially indicated, as being palliative and preservative. (*a*)

[2] Sir Charles Bell believed that arteriotomy was preferable to phlebotomy in the case of extravasation of blood in the brain; reasoning from doubtful hydraulic principles, he thought that the former operation diminished, while the latter increased the afflux of blood to the brain. Barbier would even bore a hole in the cranium, by means of a simple drill, to avail himself of atmospheric pressure in depleting the brain. (Bell—The Different Effects of Arteriotomy and Phlebotomy in Apoplexy—British Medical Journal, January, 1843. Barbier—A New Mode of Treating Apoplexy—Jour. des Conn. Med., Juillet, 1843.

(*a*) Aretæus, De curatione apoplexiæ. Chauffard, Des avantages de la saignë revulsive dans la plupart des maladies de la tête. (Arch. Gén. de Med., Mars, 1832, p. 2871.) Monneret et Fleury, Compendium de Medecine Pratique, t. 1 p. 278. Cruveilhier, Dict. de Méd. et de Chir. Pratiques, t. III, p. 255.

ture of the miliary aneurisms; it weakens the patient; places him in conditions of hydræmia and anæmia which oppose the clotting of the blood in the ruptured vessels and the obliteration of those vessels, and on this very account favors new hæmorrhages. It is plain then that we are impotent at the moment of the attack to combat the effects of the rupture of the cerebral arteries, and that our rôle consists in attending to symptoms as they arise. Observe if the alvine evacuations are free, if the functions of the bladder are regularly performed, place the patient in the best hygienic conditions possible.

Either the hæmorrhage is considerable and will prove fatal, or has affected only a limited part of the encephalon; the ensuing paralysis, then, is sharply defined, and, according to the extent of the hæmorrhagic *foyer*, it gradually disappears. In cases of this kind we may do much to prevent the inflammatory phenomena which accompany the disorders produced by the presence of the clot in the brain, and also to hasten the resorption of the clot.

To fulfill the first indication blood-lettings may do us some service. Much as I am opposed to this spoliative treatment at the moment of the attack, I am quite prepared to recognize its utility in the case of encephalitis. So, whenever after an apopleptic seizure, you note the appearance of fever and the other symptoms which characterize inflammation of the cerebral substance, you ought to apply leeches over the mastoid processes, or even take blood from the arm.

You may also apply ice to the head. Lallemand thinks that cold applications may do good during the attack itself. I do not agree with him, and believe that the only benefit which you can derive from this means is obtained in the inflammatory stage which succeeds the hæmorrhage.

In order to avert new hæmorrhages, and with this end in view, to combat congestive tendencies, drastic purgatives are indicated. It has been advised to give iodide of potassium on the ground that this medicament in small doses has the property of diminishing congestion of the encephalon; on data, more theoretical than practical, is also based the employment of ergot of rye in such cases.

As for the paralysis, consequent on destruction of cerebral tissue, it decreases in the ratio of absorption of the products of the hemorrhage. Many measures have been counselled to hasten the return of muscular movement. Some have proposed massage and stimulating frictions; others, from purely empirical considerations, certain medicaments, such as arnica; others still, in accordance with more exact physiological data, have proposed the use of strychnia and electricity.

I will say but little of frictions and massage, and I see little that is disadvantageous in the employment of these means, except it may be the danger of provoking traumatism of the paralyzed parts, already the seat of trophic disturbances often sufficiently intense to cause phlegmons and gangrene. As for arnica and all stimulating medicines, such as melissa, mentha, and lavender, they do not play any active part. It only remains to consider strychnia and electricity.

Strychnia was especially employed by Magendie and by Bradsley. It was hoped that the contractions determined by this medicament would hasten the return of muscular movements. You should be very careful in the employ of

strychnia in hemiplegia, for this alkaloid produces congestion of the cerebro-spinal axis; a congestion always injurious when the patient is suffering from the effects of cerebral hemorrhage.* On the whole, it is better to rely on electricity.

Electricity accomplishes two purposes; it opposes the trophic disturbances which accompany hæmorrhages into the brain, and above all it combats the consecutive alterations in nerves which find their central termination in the part of the brain which has been destroyed. Bouchard has described for us the march of these secondary scleroses, which engender persistent disorders in the paralyzed parts. You can employ here the galvanic current, or the faradic current. When you wish particularly to influence the nutrition of paralyzed parts, you employ galvanism; when you wish to provoke muscular contraction and prevent atrophy in paralyed muscles you use faradisation. But you should exercise great caution in the use of electricity and not resort to this therapeutic agent till all the congestive or inflammatory symptoms have disappeared. Electricity, when too long applied (or in too strong currents) induces in the corresponding parts of the brain an excitation more injurious than useful.

In the case of apoplexy from embolism or thrombosis, we can do little in the way of prophylaxis before the attack. It is necessary to avoid all circumstances which favor the production of an embolus in the left heart and in the arterial system, or those alterations of the encephalic vessels which give origin to autochthonous clots. Here, however, we are well-nigh powerless. When the apoplectic seizure has taken place, and a clot has caused obstruction of an important blood vessel, inducing necrobiosis of the part of the encephalon supplied with its nutrient blood by that vessel, our rôle is still an impotent one, We cannot by any therapeutic measure re-establish the interrupted circulation, and we are just as powerless to hasten resorption of the necrosed parts. As you see, then, when we are concerned with cerebral necrobiosis, we can only be spectators of the disorders produced without the ability by modes of treatment, more or less energetic, to arrest the evil at its commencement or modify its evolution.

It remains to consider apoplexy due to cerebral congestion. Here we can accomplish much more, and we can in a measure successfully oppose cerebral hyperæmia. It is to this group of apoplexies that we have seen applied the name apoplectic temperament or constitution. You know the description that has been given of typical cases; you have heard described the flushed countenance, the injected eyes, the short, thick, massy neck and large shoulders of apoplectic subjects who experience under the influence of slight excitements bursts of heat and flashes which bespeak the imminence of dangerous cerebral congestions.

[*In American practice, strychnia is much given in hemiplegia, but with most physicians, more from routine, and from some vague idea that it may be useful to arouse dormant motor power than from any experience of its utility. If given, it should be given very cautiously and in a commencing dose not exceeding one-twentieth of a grain. The dose may be gradually increased till some jerking or tension is felt in the paralyzed muscles. (Vidè Stillé, Therapeutics, vol. 2, p. 155.) A good form is the liquor strychniæ; dose five to ten drops. TRANS.]

There are a great number of affections of which cerebral hyperæmia is a symptom. The description above given applies to arthritic patients with congestive tendencies, to individuals affected with mitral diseases, to certain emphysematous subjects, in all of which cases you will observe the congestive or apoplectic facies above set forth. Cerebral hyperæmia arises from a great number of causes, and the treatment ought to vary according to the affection of which it is an expression.

Already when treating of diseases of the heart I told you what you ought to do to combat congestive cerebral tendencies, and I need only remind you that the most of the therapeutic measures which have been proposed for apoplexy are directed not to the hæmorrhage, but to the hyperæmia, and this is the end of both hygiene and prophylaxis. A long time ago Lancisi showed the importance of hygienic therapeutics in these cases, and your attention ought to be directed principally to these two points: diet on the one part, and regularity of the bowels on the other.

As for diet you ought rigidly to proscribe all those aliments and all those beverages which are likely to induce cerebral excitation. Your patients must abjure altogether wines, generous liquors, in fact alcohols in general, which have a doubly deleterious action in apoplexy, for they not only produce hyperæmia of the brain, but they also engender alterations of the blood vessels, the result of which is rupture of those vessels or obturation. You should caution your patient not to use too highly-seasoned food, and should put him on a regime consisting principally of white meats and fresh legumes and other vegetables; fatty and feculent matter should be excluded, and, in short, everything which can augment the production of fat in the economy.

Do not forget that the hyperæmia, and the apoplectic tendencies which are its consequences, are often connected with obesity. Polysarca in hindering the play of the diaphragm, and especially in opposing the regular functionating of the heart by fatty accumulation around that organ, and by the alteration of the heart muscles which attends it, almost constantly, gives rise to hyperæmia of the brain; and it is for this reason that the hygienic treatment of obesity is quite applicable to congestive apoplexy. Therefore, you should establish by daily exercise a relation always exact between nutrition and combustion, and you should combat by appropriate means all the symptoms produced by slackened nutrition.

You should also endeavor to promote a healthy state of the digestive tube. Constipation ought to be avoided at any cost, and you ought always to keep up a certain state of diarrhœa in these congestive and plethoric patients. Here the purgative mineral waters are indicated—Pullna, Freiderichshall, Hunyadi Janos, Ems, Sprudel. Here you may give aloes with excellent effect, which, besides unloading the intestines, causes congestion of the rectum and produces hæmorrhoids. A great many apoplectic patients have piles, and these latter act as safety valves to the head, both by reason of the congestion which they determine in the region of the anus and the fluxes of which they are the seat.

The alkaline waters[1] are good in these cases, not because they anæmiate

[1] Carriere has proposed the internal use of alkaline medicines as a rational treatment

the patient, but because they regulate nutrition.[2] You should watch the urine of your patient, for many apoplectics are gouty, and you ought always to keep the urinary secretion abundant.

As a pharmaceutical means, besides purgatives and diuretics which are always of some utility, you may make use of arsenic, iodide of potassium and aconite. The latter diminishes in a notable manner cerebral congestion. Dry and wet cups, leeches, and sometimes even venesection may be valuable auxiliaries. With regard to venesection: much as I am opposed to blood-letting in the period of hæmorrhage, I am convinced that in cases of great hyperæmia of the brain, with flushing and lividity of the countenance, blood-letting may temporarily do some good.

Such are the therapeutic rules applicable to the three varieties of apoplexy to which I have called your attention. Our treatment would be more accurate and scientific were we always able to distinguish the one from the other of these three varieties. Unhappily this is not an easy matter.[3] If we can generally diagnosticate cerebral hyperæmia, it is really impossible to distinguish hæmor-

in cases of predisposition to apoplexy. He employs the bicarbonate of soda, of which he gives nearly two drachms a day. But when there is apoplectic congestion, he replaces the bicarbonate of soda by ammonia, giving from five to ten drops of the spirits every hour. (*a*)

[2] Picquot in Bull. de Ther. t. 61 lxi., p. 321, has advised the arsenical treatment as prophylaxis. This is the formula:

R	Arceniate of Potash	00.05
	Tinct. Aconite	10.00
	Tinct. Digitalis	5.00
	Distilled water	300.00

M. Dose, a tablespoonful morning and evening in half a tumbler of sweetened water two hours before meals.

[3] The diagnosis of cerebral hæmorrhage is sometimes attended with difficulty, by reason of the number of diseases which may present similar symptoms at the commencement; apoplectic and hemiplegic symptoms. Meningeal hæmorrhage, cerebral congestion, acute ramollissment, saturnine and uræmic encephalopathies and pernicious fever with comatose symptoms may be accompanied with apoplexy. In uræmia and pernicious fever the study of the temperature will help to clear up the diagnosis; in the commencement of the hæmorrhage the temperature is lower than natural, then it goes on increasing till the fatal termination; in pernicious fever, the central temperature is always superior to the normal; in uræmia, with comatose symptoms, there is a progressive lowering of the central temperature.

In cerebral congestion the diagnosis is determined by the march of the disease; at the end of a variable period, all the morbid symptoms disappear.

Syncope, asphyxia, alcoholic intoxication may lead into error. But in syncope, the suspension of respiration and circulation; in asphyxia, the respiratory troubles; in alcoholic intoxication, the odor from the breath, will serve to clear up the diagnosis.

In intraventricular hæmorrhages, or in those which take place in the substance of the pons, there are often convulsive seizures simulating epilepsy; the aspect of the patient, the tongue which presents fissures or cicatrices, the dilatation of the pupils, the temperature and then the march of the disease will remove all doubts. It is the same for certain apoplexies which are only attacks of epilepsy and to which Trousseau called attention.

The diagnosis of meningeal hæmorrhage is more difficult: according to Boudet, this

(*a*) Carriere, on the rational treatment of cerebral congestion and of apoplexy by alkalies and in particular by bicarbonate of soda. Paris, 1854.

rhagic apoplexy from apoplexy by anæmia, and we can only make hypotheses and conjectures when we come to actual experience at the bedside. This very circumstance should lead us to be chary with regard to any active treatment during or after the apoplectic seizure. Better always to do nothing than to do harm.

In my next and final chapter, I shall consider the treatment of spinal myelitis.

kind of apoplexy is likely to be attended with contracture as an initial symptom. In the ordinary form of hæmorrhagic apoplexy, contracture is a late symptom.

Chronic ramollissement is distinguished from cerebral hæmorrhage by its march. During its progress it is accompanied by cephalalgia, vertigo, intellectual enfeeblement, numbness which is habitual, and sometimes by contractures.

More difficult is the diagnosis of acute ramollissement. The *debut* may be apoplectiform, and without prodromes. At the same time the loss of consciousness is apt to be more transient and less complete in ramollissement. Moreover, in ramollissement by embolism, lesions may often be noted in other organs, which, produced by the same cause, shed light on the diagnosis (pulmonary apoplexy, infarctus of the spleen, hematuria, etc.) After the attack the hemiplegia is alike in both diseases, and it is almost impossible to distinguish them. You must be guided by the evolution of the disease.

In softening, and especially senile softening, from endarteritis, the symptoms often present oscillations; the paralysis is less complete at certain hours of the day. Aphasia is a symptom less common in apoplexy from hæmorrhage than in ramollissement.

According to Charcot, conservation of consciousness with sudden invasion, belongs rather to ramollissement; variable hemiplegia belongs to it exclusively, and aphasia almost exclusively.

Hæmorrhage often coincides with hypertrophy of the heart and Bright's disease. Cerebral ramollissement by embolus occurs in the same patients, and accompanies visceral infarctus.

Ramollissement by thrombosis is seen especially in individuals who are a prey to tuberculous or cancerous cachexia. Ramollissement by senile endartitis is frequently accompanied by atheromatous degeneration of the arteries of the extremities.

ON THE TREATMENT OF CHRONIC MYELITES.

SUMMARY.—On Diseases of the Spinal Cord—Progress of Pathological Anatomy—The Different Inflammatory Processes—Myelites, Acute or Parenchymatous—Myelites, Sclerous and Interstitial—Their Varieties—General Treatment—Blood-letting, Local and General—Revulsion—Utility of Revulsion—Experimental Researches on Revulsion—Reflex Paraplegias—Paraplegias from Cold—Hydro-therapy—Cold Douches and Warm Douches—Electricity—Ergot—Empirical Medication—Nitrate of Silver—Phosphorus—How to Give Phosphorus—Treatment of the different Varieties of Myelitis—Treatment of the Hyperæmia—Influence of Decubitus—Treatment of Meningo-myelites—Treatment of the Consecutive Paraplegia—Electricity—Hydrotherapy—Thermal Treatment—Strychnine—Indications and Contra Indications—Treatment of Myelites by Compression—Anti-syphilitic Treatment—Treatment of Sclerosis of the Posterior Columns—Its Progressive March—Its Incurability—Bad Effects of Hydrotherapy—Thermal Treatment—Treatment of the *Douleurs Fulgurantes*—Injections of Morphia—Effect of Temperature—Nerve-stretching—Electricity—Treatment of the Atrophic Paralysis of Infancy—Electricity.

GENTLEMEN: If it were incumbent on me to give the history of the diseases of the spinal marrow, this lecture would be far too long, for on no subject has so much study been spent the past few years as on these spinal inflammations. Clinical medicine and pathological anatomy, based on physiological and anatomical studies which have had the spinal marrow for their subject, have enabled us to trace not only the tableau of diseases of the spinal cord and of its membranes, taken collectively, but also the various alterations which affect the different bundles composing the medullary axis.[1] Unhappily, therapeutics has

[1] If we make a section of the cord near its middle portion, we see that it is composed of two substances—one, the enveloping substance, the white medullary matter; the other, the substance enveloped, the gray matter.

The disposition of the gray matter has been compared to a capital H; the vertical lines are represented by the lateral parts of the gray substance, which, curving outwards, by their extremities take the form of a crescent; the horizontal line is a portion of gray substance which contains within itself the canal of the ependyma, and bears the name of gray commissure. The parts of the crescent situated in front of the commissure are the anterior horns; those situated behind are the posterior horns.

As in the nervous system generally, this gray substance is in greater part composed of cells, which form the nuclei of origin of the spinal nerves.

The cells of the anterior cornua are much more voluminous than those of the posterior cornua. It is in these groups that the anterior or motor roots take their origin by three bundles of fibres. Add that they seem to possess a trophic besides a motor function; it is these cells, in fact, that are diseased in progressive muscular atrophy and in the wasting paralysis of infancy.

The posterior horns are invested (coiffed) at their free extremity by a substance composed of a connective tissue framework, and of cells concerning the nature of which nothing is definitely known (gelatinous substance of Rolando).

The cells of the posterior horns are more irregularly disseminated than those of the anterior horns; they are grouped together in only one place, situated quite near the anterior horns (column of Clark). The posterior or sensory roots take origin from different points of the posterior cornu, and some even cross over to the cells of the anterior horn. It is by this disposition that the muscular atrophy which accompanies posterior sclerosis is explained.

not followed the unceasing progress of clinical study, and we are still obliged, as far as treatment is concerned, to make use of the same medicinal means heretofore employed, and which are most generally inefficacious, so that, in a great number of cases, the idea of incurability accompanies the diagnosis of affections of the spinal medulla.

Nevertheless, as the medullary diseases are frequent; as, moreover, they have a long and progressive course, and will often claim your care, I have thought best to set forth the kinds of treatment most in use, recognizing at the same time their inefficacy. This inefficacy is easily understood when you take into account, on the one hand, the position of the spinal cord, which, surrounded by its membranes, is with difficulty reached by direct treatment, and, on the other hand, the very structure of the cord, which, in such small volume comprises nerve-centres and conductors that establish a direct communication between the brain and the mixed nerves.

The least alteration in the histological integrity of the spinal axis must then profoundly modify the functions of the parts over which this portion of the cord presides; and notwithstanding that we see tumors, even of considerable size, develop without apparent symptoms in certain portions of the cerebral mass, the least disorder, scarcely appreciable to the sight, in the substance of

If now you examine the spinal cord when deprived of its envelopes, you observe in the middle line, before as well as behind, a fissure which separates it into two parts—an anterior fissure, quite large; and a posterior, more narrow, but deeper. In separating the edges of these fissures you notice, at the bottom of the first, a bridge of white substance called the white commissure, and at the bottom of the second a bridge of gray substance called the gray commissure.

Laterally we see, on the posterior aspect, at each side of the posterior median fissure, another fissure which corresponds to the insertion of the posterior roots—the posterior lateral fissure, whose extremity is prolonged into the bulb to correspond with the cineritious tubercle of Rolando and the roots of the pneumogastric and glosso-pharyngeal nerves.

Anatomists have described an anterior lateral fissure corresponding to the anterior roots; this fissure is purely imaginary, and, while the posterior roots take their origin on a line perfectly vertical, the anterior roots intercept by their origin a band of substance three or four millimeters in width.

These fissures divide the spinal cord into a certain number of columns, three for each half of the cord—admitting an anterior lateral fissure—(anterior, lateral and posterior columns); generally, however, only two are described, the antero-lateral and posterior.

Beside these principal fissures, note the *posterior intermediate fissure*, situated two millimeters from the median posterior fissure; it divides the posterior columns into an internal portion, the column of Goll, zone of ascending degeneration, and into an external posterior root zone, or column of Burdach, seat of the lesions of progressive locomotor ataxia.

Such are the divisions perceptible to the sight, of the white substance of the cord. Besides these, experimental physiology, and especially clinical medicine, have made other divisions. The antero-lateral columns have been subdivided into several zones. At the internal portion, bounded on the one side by the anterior median fissure and on the other by a line proceeding from the antero-internal group of cells of the anterior cornu to the periphery of the cord, we see the direct pyramidal column of Turck (seat of descending degeneration). Externally to this column is the anterior root zone, seat of the lesions of progressive muscular atrophy.

In front of the lateral posterior fissure, just anterior to the apex of the posterior horn and near the periphery of the cord, is a small zone, seat of ascending degeneration,

the spinal cord, will make itself manifest by symptoms of great gravity. This fact explains why it is only since the application of histology to medicine that we have been able accurately to diagnosticate the affections of the medulla, since in most cases the pathological alterations, invisible to the naked eye, can only be studied by means of high powers.

Standing, as we do, on therapeutic ground, our study of the myelites may be considerably abridged; for, directing our attention to the processes which determine medullary diseases, therapeutics need not distinguish the different myelites which are called systematic myelites, such as sclerosis of the posterior columns, sclerosis of the lateral columns, sclerosis of the anterior cornua, which clinical medicine and pathological anatomy have described as special morbid entities. What we have really to oppose is the connective tissue induration which produces these pathological changes, and the therapeutic means to employ are the same in sclerosis of the posterior columns, and in sclerosis of the lateral columns.

When we take a general survey of the diseases of the spinal marrow, we find that they may be referred to three principal types. In the first group are placed the different degenerations which affect the medullary axis and its envelopes (cancer, syphilis, etc.); in the second, we meet the same alterations which we have studied in the preceding chapter on apoplexy, *i. e.*, the rapid and sudden disorganizations of the spinal cord (spinal hemorrhage, spinal *ramolissement*), produced by rupture, or serious lesion of the spinal bloodvessels. These are veritable medullary apoplexies. All the alterations of the third group have for their origin a hyperæmic and inflammatory process. It is with this last group, which is the most frequent, that we are now especially concerned; and if, in the anatomo-pathological details on which I am about to enter, I seem to vary somewhat from my customary method, it is because these details have, from the standpoint of therapeutics, a preponderating importance.

called the direct cerebellar column, and between that and the body of the posterior horn there is an ovoid mass of fibres called the crossed-pyramidal column (zone of descending degeneration).

What is the upward destination of the columns, anterior and posterior and lateral?

The anterior columns, which decussate the whole length of the cord (anterior white commissure), do not cross in the medulla oblongata, but become posterior.

The lateral columns decussate incompletely and become anterior to form the superficial parts of the anterior pyramidal bodies. The non-decussating portion continues its course to form the lateral columns of the bulb.

The posterior columns decussate completely; taking the same direction as the lateral columns, these columns lose themselves superiorly in the deeper strata of the corpora pyramidalia.

As for the columns of Goll, they do not decussate; they only change their direction and separate at the beak of the *calamus-scriptorius*, taking an upward direction obliquely and externally along the internal border of the restiform bodies, to penetrate with them into the cerebellum and assist in the formation of the inferior cerebellar peduncles (*a*).

(*a*) Charcot, Leçons sur les maladies du systéme nerveux.—Herschfeld, Anatomie du systéme nerveux.—Sappey, Anatomie descriptive.—Fort, Leçons sur d'anatomie du systemé nervoux.—Jaccond, Traité des paraplégies, Nouveau Diction., art. Nerfs.—Diction. encyclopédique, art. Moelle.

Inflammation of the spinal medulla presents itself under two distinct forms: in one, the hyperæmia affects all the constituent parts of the cord, and causes their speedy disorganization; in the other, the inflammatory process, whether primitive or secondary, attacks only the connective-tissue element, determining a hyperplasia of the neuroglia, which speedily chokes out and destroys the nervous elements.

Here, then, we again meet with that great division of inflammations which we have already seen produce so much mischief in the kidneys and in the liver, and just as we have interstitial and parenchymatous nephritis and hepatitis, so also we have interstitial and parenchymatous inflammations of the spinal cord.

As for parenchymatous myelitis, I have shown in my *thèses d' agregation* on acute myelitis[1] the march of the inflammatory process, and I have dwelt especially on the first period called the stage of tumefaction, and which results not only from the vascular hyperæmia, of which the medulla is the seat, but also from the swelling of the neuroglia and the nervous elements.

In interstitial myelitis, the neuroglia appears alone to be affected. By the organization of its cellular elements, under the influence of an indurating process, it chokes out the nerve-cells or tubes. Vulpian, in his remarkable lessons on the diseases of the spinal cord, has dwelt at great length on the pathogeny of this sclerous process, especially under the head of locomotor ataxia, and he adopts the view that the proliferation depends on primitive irritation of the nervous elements. But this is not the only opinion advanced: some, as Ordonez, maintain that the vascular alterations are the primitive cause of the sclerosis; others affirm that the hyperplasia of the neuroglia is primitive. I believe that both hypotheses are correct, and that, from a therapeutic standpoint, we ought to make a great account of them.

What can medicinal agents accomplish in cases of parenchymatous or interstitial myelitis? In parenchymatous myelitis we cannot do much, except in the period of tumefaction, and as we cannot influence either the neuroglia or the nerve-tubes, we can only hope to modify on the circulation of the cord. When, however, the exudation has taken place, and the medullary substance is destroyed, it will be impossible for us to repair the disorders which result

[1] In his work on acute myelites (*thèse agreg.*, Paris, 1872) Dujardin-Beaumetz studies the pathological anatomy of this disease; he describes three states corresponding to divers degrees of the inflammation; these are swelling, ramollissement, resorption.

1. The swelling results from augmentation of the circulation, from tumefaction of the connective-tissue framework, and from modifications effected in the nervous elements themselves and which are chiefly characterized by dilatation of the axis cylinders and great increase of size of the multipolar cells. (Charcot.)

2. The ramollissement is produced by the exudation which transudes from the vessels, and which causes disintegration of the constituent parts of the cord determining in certain cases veritable hemorrhagic foci. When the softened portions are examined by the microscope there is found debris of cells and nerve tubes, hyperæmic vessels whose lymphatic sheath is gorged with cells, little drops of myeline, granular bodies and fatty and pigmentary granulations.

3. The resorption of these parts constitutes foci of cicatrization, or lacunæ which are observed when acute myelitis does not cause disorders incompatible with life, and which are especially noted in localized myelites.

from the softening. In the case of interstitial myelitis, we are impotent to arrest the hyperplasia of the neuroglia, and the disorders which are its consequence, and all that we can do is to diminish the nervous irritation which this hyperplasia determines, or the hyperæmia of which the latter is the result.

To sum up, then, our therapeutic endeavors must first be directed to combating the primary causes of the inflammation;[1] secondly, to opposing the hyperæmia of the cord. Apart from this twofold duty, we are powerless, and the utmost that we can do is to mitigate the consequences which result from the medullary changes, and which are so detrimental. I shall briefly review the various therapeutic agents which we can employ, then make special application of them to the different spinal affections.

To fulfil the first of these indications is often easy, and in the case of myelitis by traumatism or by compression, it will be sufficient to remove the foreign body which irritates or injures the cord to cause disappearance of the resulting inflammatory symptoms. In the case of Pott's disease, with lesion of the vertebræ, special surgical appliances are necessary to remedy the spinal deformity which produces compression of the cord, and causes paralysis. In

[1] According to Vulpian the different causes of acute myelitis are as follows: 1. *Myelitis by propagation;* this kind of myelitis begins in meningitis and affects at first the superficial strata of the cord and may propagate itself toward the centre and even reach the gray substance; this invasion may take place with great rapidity; to the symptoms of meningitis are added those of myelitis and the lower limbs are paralyzed.

2. *Myelitis by tumors, intra or extra medullary;* these are the acute or sub-acute myelites which accompany tubercles, gummata, cancer, sarcoma, etc., of the cord.

3. *Myelitis by traumatic violence;* these result from wounds, commotions or contusions of the cord. It is this kind of myelitis which is produced artificially in animals.

4. *Myelitis by excess of fatigue;* this kind of myelitis is produced by excess of functional activity of the medullary elements; it sometimes results from overwork.

5. *Myelitis from cold.* Cold may determine myelitis. Frinberg succeeded in thus producing it in hares by spraying the shaved backs of these animals with ether; the resulting paralysis was well marked. The autopsy revealed diffuse myelitis. Vulpian explains the myelitis *a frigore* by the special irritation determined by cold on the peripheral extremities of cutaneous nerves, an irritation which troubles the trophic functions of the parts of the cord from which spring the sensory and sympathetic fibres, destined to the meninges, thus causing perturbation of the nutrition of the anatomical elements of these membranes; phenomena of a similar kind take place in the medullary substance also.

6. *Myelitis by irritation of peripheral nerves.* These are the myelites which are habitually described under the name of myelitis by reflex action; they result from the alteration effected in the cord by the irritation of certain nerves; this myelitis has been reproduced experimentally by Tiessler, Frinberg, Klemm, Hayem, by irritating with mechanical or chemical excitants the sciatic nerves.

7. *Myelitis of toxic origin.* These myelites are chiefly met in lead poisoning and poisoning by alcohol and phosphorus.

8. *Myelitis by general diseases.* It is in this group that are found those myelites determined by small-pox, typhoid fever, diphtheria, syphilis; those which are observed as a sequel of acute diseases and which have been described by Gubler as consecutive to dysentery and puerperal affections. (*a*.)

(*a*) Vulpian, Maladies du systeme nerveux (Maladies de la Moelle, Paris, 1879, p. 160).

the case of syphilitic gummata and exostoses, the specific treatment will sometimes remove the inflammation and its products.

In other cases, we can do much to prevent inflammatory mischief by hygienic measures. Whether the medullary sclerosis be primitive and the result of repeated congestions of the spinal cord; whether it be secondary, from irritation of the nervous elements (Vulpian), it is not the less true that every excessive exercise of function on the part of the cord and its integral divisions may be a predisposing cause of sclerosis. Therefore, forced marches, too prolonged muscular labors, may determine veritable myelites, which are described under the name of myelitis from *strain* (*surmenage*), and which are observed in animals as well as in men. The abuse of the genital functions, and, in particular, coitus while standing, enter into the same group, and have often been invoked as the determining cause of *tabes*. You readily see, then, how much may be done by hygienic measures of prevention when once these causes are known; and I pass to the second indication, which is to combat the medullary hyperæmia.

The circulation in the spinal cord is very active; a multitude of venous and arterial vessels from numerous sources form around its bony canal and membranes a rich vascular plexus, which it is difficult for us to reach by any direct means. As, however, the spinal vessels and the vaso-motors which innervate them can be affected reflexly (vide Vulpian, *Appareil Vaso-Moteur*, t. ii. p. 49), you readily understand that by an action limited to points more or less distant from the spinal axis we may modify the circulation in the cord, and it is on this action that revulsive medication is based; a kind of treatment which is first in importance in spinal affections.

Although tradition from the dawn of medical history has affirmed the beneficial influence of energetic revulsion in diseases of the spinal cord, in our time certain physicians have denied this favorable action, and have maintained that revulsion increases the suffering of patients without ameliorating their condition. This, gentlemen, is a mistake, and facts of experimental physiology confirm most unequivocally the results which clinical medicine has accumulated during the ages.

What, then, has experimental physiology taught us on this point? From a great number of conclusive observations I select the following: You are all familiar with the results which Vulpian obtained in electrizing a nervous branch communicating with the intra-thoracic chain of the great sympathetic; there was most marked contraction of the blood-vessels of the region of the spinal cord, from which was derived the intercostal nerve with which the nervous filament electrized was in relation. In his numerous and remarkable researches on the circulation of the spinal cord, Brown-Séquard, after tying or irritating the nerves of the kidneys or suprarenal capsules, observed a contraction of the blood-vessels of the cord on the side which was irritated.[1] Frinberg obtained a paralysis *a frigore* in a hare, on

[1] Brown-Sequard, Lessons on the Diagnosis and Treatment of the Principal Forms of Paralysis of the Inferior Extremities, Paris, 1864.—Frinberg, Ueber, Reflexlähunungen (Berlin, Klin. Wochensch, 1871, Nos. 41, 42, 44, 45.)

spraying with ether the skin of the back which he had previously shaved. As you are well aware, on this very reflex action the theory of so-called *reflex* paralysis has been based, also of myelitis and meningo-myelitis *a frigore*. Without entering into the long discussions which have arisen on this subject, it has been determined both by experiments on animals and by clinical experience that external excitations made on the skin do modify the circulation in the spinal cord and its envelopes. Let us now examine the agencies utilized in revulsive medication in these affections. Everything has been employed, from frictions with irritant ointments to the cautery and moxa. The latter revulsives, which were till recently the most in use, are to-day being abandoned, being advantageously replaced by punctiform galvano-cauterizations. The use of caustic potash or Vienna paste is likely to be attended with certain inconveniences, and in particular that of producing suppurating sores over the vertebral column ; these last some time, and are not without danger to patients who are obliged to maintain the dorsal decubitus, and whose skin performs its functions badly by reason of trophic disturbances determined by the medullary affection.

The electrical points, on the contrary, rendered so easy of management by the invention of the cautery of Paquelin, present all the advantages of energetic cauterization without the least inconvenience. Moreover, these cauterizations, which do not cause troublesome sores, may be renewed every eight days. You practice them along the spinal column, right and left of the middle line, punctiform cauterizations in parallel series, and in number varying according to the exigency of the case. These cauterizations are preferable to vesication by the cantharidal blister, for the vesicatory, besides removing the epidermis, determines troubles in micturition, a function generally more or less disturbed in diseases of the spinal cord. In certain cases the seton may be employed; this is one of the most powerful revulsives that I know of, but it is of especial utility in affections of the brain and upper portions of the spinal cord.

To the revulsive treatment we may join the application of cold, which also, as we have seen by the experiments of Frinberg, may modify the circulation in the spinal cord. But in order to obtain durable effects it is necessary to prolong the applications of ice, and this is always inconvenient. Pulverizations of ether by the spray apparatus, if they could be continued sufficiently long, would be indicated in these cases where the physiological effect of cold is desired.

Hydrotherapy applied to the treatment of medullary affections, is a two-edged sword, which must be managed with great prudence. In fact, it does not cause anæmia of the spinal cord. In the majority of cases it congests it, and this it is which explains the successes and the aggravations which have been obtained. Successes, when one has to do with those paralyses, *sine materia*, which appear in the course of neuroses, or those which have a dyscrasic origin, and which accompany diphtheria and other acute diseases, also those paraplegias observed in anæmia and chlorosis; aggravations, when the indication is to combat inflammatory and sclerous processes, for in these cases hydrotherapy, by

inducing congestion of the cord, favors rather than opposes the hyperplasia of the medullary neuroglia.

To avoid these disadvantages, warm douches have been advised, or tempered douches, as Beni Barde has recommended, but it is always important when you employ either cold douches or tempered douches, to examine with care the cutaneous sensibility, often strangely perverted in patients affected with spinal diseases.[1]

We have seen that electricity applied over the bony canal of the spinal cord modifies the medullary circulation; from this has resulted the employment of electricity in the treatment of congestions and inflammations of the cord. Two methods are in current practice. In the one you make use of faradic currents (here the portable battery does good service), and with the electric brush you make energetic revulsion along the vertebral column. I have seen happy results from this faradic treatment in tabes dorsalis. In other cases you apply galvanic currents up and down the spine; there has been much dispute about the direction of these currents, some being of opinion that ascending, others that descending, currents are preferable. I believe that the direction is a matter of little consequence, and that one may use indifferently either ascending or descending currents.[2] To cauterizations, to applications of ice, to

[1] Beni Barde observes with justice that the sense of temperature in tabetic patients is sometimes so perverted that they cannot distinguish cold from hot water; the feelings of such patients would not be a safe criterion as to the heat to which the water might be raised. (Beni Barde, Traité theoriqué et pratiqué d'hydrotherapie, Paris, 1874, p. 808.)

[2] Faradic currents have been employed in ataxia by Duchenne, but this treatment has not given very satisfactory results; at the same time, in the first periods of the disease, faradisation of the skin may help the lightning pains.

Constant currents have been much more employed. Remak has even affirmed that they may have a direct action on the sclerosing processes, but this is a mistake, for the currents have never caused a complete cure, but simply occasional amelioration—as Erb's statistics show, who out of 66 cases of locomotor ataxia treated by galvanism, has noted 41 ameliorations and 21 failures.

As for the direction of the currents, opinions vary; Rosenthal employs currents directed across the cord and ascending currents.

Onimus insists on the necessity of employing ascending currents, and he often places the positive pole in the lumbar region, and the negative pole in the cervical region.

Benedict proceeds in the following manner: He electrizes the cord every day for from three to six minutes. If the troubles of motility predominate, he electrizes at the same time the cord and the nerves and muscles. When there are no phenomena of excitation and of spasm, he electrizes the cord, without concerning himself with the direction of the currents, and by putting the two reophores over the spinal cord.

To combat the ocular troubles, electricity has also been used. Benedict recommends centripetal electrization of the trifacial. Erb, on the other hand, advises the employ of a centrifugal current. Leon Le Fort, Reynolds, Boucheron, affirm that the direction of the current is a matter of no importance, and they place one of the poles on the nucha, and the other on the forehead. (*a*)

(*a*) Onimus et Legros, Traité d'électricité médicale, Paris, 1872, p. 430—Hammond, Traité des maladies du systeme nerveux, trad. de Labadie Lagrave, p. 712.

electricity, we must add certain internal medicaments, of which the purpose is to diminish the congestion, or the connective-tissue hyperplasia which results from it. As for certain of these medicines, their application is the result of the knowledge of their physiological properties; as for others, empiricism has led to their adoption and usage. We will pass rapidly in review the greater part of these remedies.

The curious property which ergot of rye possesses of causing contraction of the capillary net-work has been utilized in affections of the spine; and Brown-Séquard is one of the most strenuous partisans of this therapeutic employment of ergot. The results which I have obtained from this medicament in spinal sclerosis have not answered my expectations, and I believe that the use of ergot in these diseases is based on theoretical considerations rather than on sound clinical experience.

Ergot is given in substance or in the form of ergotine or ergotinine. The hypodermic method of administration may be adopted, injections being made over the spinal region with ergotine or ergotinine. The dose of the latter ought not to exceed two milligrammes (one-thirtieth of a grain), and one milligramme is enough for an ordinary dose.

Strychnia has been recommended in the treatment of the diseases of the spinal cord, but, as Vulpian remarks, the therapeutic action of this alkaloid having no influence on the morbid process, the cause of the paralysis, and strychnia, moreover, being incapable of removing the disorders which result from the inflammation, no curative effects can be expected from this medicament in acute or chronic spinal affections. I go further, and add, that often the action of this drug is injurious by reason of its irritating influence on the medullary axis. It is best, then, to be very chary in the use of strychnia; and even to discard it altogether in congestions of the cord, and never to use it except in the case of paralysis called essential, or *sine materia*.[1]

It has been claimed that iodide of potassium has also an action on the circulation of the spinal cord, and that it is capable of anæmiating it. I believe that the good effects which have been obtained from this medicament are not the result of the influence of the iodide on the circulation, but of its specific and resolvent action on products of a syphilitic nature. A great number of tabetic patients are syphilitic, and are therefore likely to be benefited by the iodide.

Bromide of potassium has an important *rôle* in the treatment of diseases of the spinal cord, not because it has any direct effect on the phlegmasic process acute or chronic, but because it tends to diminish the excito-motor power of

[1] Fouquier has remarked that when strychnine is given to paraplegic patients, convulsive manifestations in the paralyzed members often ensue. When the spinal cord is no longer in communication with the brain, its excito-motor power is augmented, and strychnia greatly enhances this reflex excitability. When, in a frog, you cut the spinal cord transversely, and inject strychnia, it is in the inferior members that the first effects of the poison are seen; but as Vulpian well observes, in order that this action may be produced in paraplegic persons, it is necessary that reflex excitability be preserved in the paralyzed limbs. (Vulpian, *Substances toxiques et médicamenteuses*, Paris, 1882, p. 580.)

the cerebro-spinal axis; the bromide, then, is indicated whenever signs of irritation or excitation of the spinal medulla supervene.[1]

Empiricism has made great account of two medicinal agents in the treatment of medullary sclerosis, nitrate of silver and phosphorus.

Nitrate of silver was recommended for the first time in 1861, by Wunderlich,[2] but it is especially to Charcot and Vulpian that the employment and popularity of this remedy in locomotor ataxia are to be ascribed.

Nitrate of silver is given in pills of one centigramme; at first one, then two, then three, then four of these pills a day, the last dose never to be exceeded. This medication, which is only of utility after the inflammatory symptoms have subsided, may give you in some cases amelioration and even cure, if the observations reported by Wunderlich, Rosenthal, Hammond, etc., may be relied on; but it is well to bear in mind that these are exceptional cases, and for my part I have to confess that I have never obtained, even from the prolonged use of nitrate of silver, any results worth mentioning.

Do not forget that the medullary sclerosis for which nitrate of silver is employed, does not progress in a uniform manner, and that it presents periods of ascension, and periods of arrest; it is easy then to understand that according to the precise time in the evolution of the disease in which the medicament is administered, amelioration or aggravation of the symptoms may be observed.

How does the remedy act? We are wholly ignorant. Does imbibition of the silver salt by the neuroglia hinder the proliferation of the latter? Does the medicine act on the nervous elements themselves? These are questions which we cannot answer.

[1] Siredy noted the good effects of bromide of potassium in a case of locomotor ataxia, effects already witnessed by Vulpian. His dose was two grammes, gradually increased to six grammes each day.

[2] Wunderlich was the first to administer nitrate of silver in this disease. Out of five cases treated by him, in 1861, there was one recovery. The year following Charcot and Vulpian published a monograph on the subject. They administered the nitrate in pills of one centigramme each; at first two, then three, and seldom more than four pills a day. Of five cases treated by them with this remedy, there was in all great amelioration; the lightning pains disappeared, and the muscular movements gained in force and precision.

After the publication of Charcot, Moreau, then Beau reported cases of cure by nitrate of silver. In Germany, Küchenmeister reported observations in which the medicament produced no effect. In 1863, Wunderlich published in *Archiv der Heilkunde*, another memoir in which were recorded cases of amelioration and cure under medication by nitrate of silver. Rosenthal. Hammond, etc , have also noted recoveries in ataxia from nitrate of silver.

Teissier, of Lyons, after showing that the locomotor ataxia described by Duchenne of Boulogne, and the tabes dorsalis of Romberg, are one and the same disease, is emphatic in his praises of nitrate of silver in this malady. The results are variable, sometimes there is improvement in the power of muscular coördination, sometimes only the painful manifestations are relieved.

(Wunderlich, *Archiv der Heilkunde*, 1861–1863; Charcot and Vulpian, *Bull. de Thér.*, t. 62, p. 481; Moreau de Tours, *Union Méd.*, Oct. 1862; Beau, *Bull. de Thér.*, 1863, t. 64, p. 315; Trousseau, *Bull de Thér.*, t. 64, p. 82; Hammond, *On Diseases of the Nervous System*, p. 709; Tessier, *De l'ataxie loc. et de son traitement*, 1864.

I was the first (in 1868) to propose the use of phosphorus in locomotor ataxia.

Delpech had several years before (in 1863) applied phosphorus to the treatment of certain paralyses from chronic poisoning, and in particular to that produced by sulphide of carbon. I have continued this phosphorus medication, and, although I have never obtained a cure by this remedy, I have in many instances noted amelioration, characterized by a sensation of increase of force, and diminution of incoördination. But the same reservations which I made *à propos* of nitrate of silver, ought to be made here, and one may well ask if in many cases the amelioration obtained is not rather the consequence of the natural march of the disease than of the action of the medicine. My pupil, Dr. Eugene Lemaire, has published in his remarkable thesis on the employment of phosphorus the greater part of those observations.[1]

This phosphorus medication needs to be closely watched, and I am going to enter into certain details which appear to me to be necessary. When I commenced my experimentation with phosphorus, I immediately stumbled against a difficulty, the unreliability and the danger of the preparations in use; and I proposed to substitute for the phosphorated oil of the codex,[2] solutions of phosphorus in chloroform, of definite strength, and I also had capsules made containing one milligramme ($\frac{1}{60}$ grain) of phosphorus. But attention was awakened on this point, and thereupon successively appeared the monographs of Mehu and Vigier.

Mehu showed that while the *oleum phosphoratum* of the codex, as ordinarily prepared, is of uncertain strength, a sufficiently good solution might be had by heating the oil very hot, and henceforth unalterable capsules of phosphorated oil might be obtained, each containing one milligramme of phosphorus. Vigier, by his studies on the metallic phosphides, showed the advantage which might be derived from these preparations, and he introduced phosphide of zinc into therapeutics.[3] These capsules of phosphorated oil, and Vigier's pills of phosphide of zinc, are to-day the preparations of phosphorus most in use.

When you prescribe phosphide of zinc, do not forget that four milligrammes represent one milligramme of phosphorus. Whether you make use of granules of phosphide of zinc containing four milligrammes, or capsules of phosphorated oil containing one milligramme, you ought to observe the following rules: Commence with one pill, or one capsule, and increase gradually till ten are taken in the twenty-four hours; continue this dose three or four days,

[1] Dujardin-Beaumetz, sur l'Emploi du phosphore en médeciné et en particulier dans l'ataxie locomotrice progressive. *Bull. Gén. de Thér.*, 1868, t. lxxiv. pp. 16, 157, 203, 302.

N. Gueneau de Mussy, On the Treatment of Mercurial Trembling by Phosphorus. *Gaz. des Hôp.*, 1868, Nos. 48 and 50.

Lemaire (Eug.), On the Therapeutic Employment of Phosphorus in Certain Affections of the Nervous System. *Thèse de Paris*, 1875, No. 143.

[2] The phosphorated oil of the codex contains two grammes (ʒ ss) of phosphorus to one hundred grammes (ʒ iij, ʒ ijss) of oil of sweet almonds, and is an uncertain preparation.

[3] Vigier, On the Therapeutic Employment of Zinc Phosphide (*Bull. Gen. de Ther.*, t. lxxiv. p. 268).

then suspend the medicine for five days, to renew the treatment by commencing with one capsule. These interruptions in the phosphorus medication are necessary in order to avoid accumulation of action, and to permit the medicine to be eliminated. In following these rules the phosphorus treatment can be continued with safety for months or for years. I add that in order to render the medicament more tolerable to the stomach, you would do well to order the phosphorus to be taken at meal time, you will then avoid in great part the eructations of *lucifer-match* taste which follow the administration of this remedy. There is another caution to be observed in prescribing phosphorus in tabes. It will not do to give it when there are any symptoms indicating any considerable degree of congestion or irritability of the nervous system, nor in the case of gastro-intestinal troubles; moreover, to get any good from the phosphorus treatment it must be continued a long time.

On what is this action of phosphorus in locomotor ataxia based? Here, as in the case of nitrate of silver, we are obliged to make hypotheses. My own theory is the following: Ranvier, in his experiment with phosphorus, has shown that when this metalloid is inserted under the skin of animals, you do not provoke inflammatory disorders, but you determine arrest of the formative and nutritive operations of the histological elements. It is possible that in the spinal cord phosphorus thus opposes the proliferation of the neurolgia; but, I repeat, this is only a hypothesis, and I give it for what it is worth.

Now that we have taken a general survey of the different modes of treating medullary affections, let us study the indications of treatment in the different forms of myelitis. I cannot here speak of all the varieties of spinal inflammation—their number is considerable. You will find in the work of Grasset a table (see next page) which gives a good summary of all the kinds, and which will enable you to judge of their number. I shall only call your attention to those cases which you will oftenest be called to treat, the congestions of the spinal cord, the meningo-myelites, the myelites by compression, sclerosis of the posterior columns, disseminated sclerosis, and, in fine, that form known as atrophic paralysis of infancy, or sclerosis of the anterior cornua.

The congestions of the spinal cord are frequent, and their causes are multiple;[1] they do not generally entail anything more than a relative incapacity

[1] The causes of congestion of the spinal cord are numerous; the most frequent are:

Exposure to a very cold temperature, the incipient stage of fevers, especially paludal fevers, small-pox, and typhoid fever. Next in order of frequency come alcoholic excesses, venereal excesses and a too prolonged standing posture, extraordinary muscular fatigue, violent exertion, sometimes convulsive attacks; even the suppression of an habitual flux, menstrual or hæmorrhoidal, etc.

Traumatisms, blows, or falls injuring the vertebral column, may produce spinal congestion; also sudden changes in the exterior atmospheric pressure on the body. Rabington, Cuthbert and Clark have published instances of congestion so produced in laborers who, working in diving-bells, had been in the habit of abruptly entering or leaving these compartments of compressed air.

Passive congestion has for its cause venous obstruction, as is observed in cirrhosis of the liver, pregnancy, abdominal tumors, and diseases of the heart or lungs.

The symptoms of spinal congestion consist especially in lumbar or dorsal pains, rarely

CLASSIFICATION OF THE MYELITES.

(From Grasset's "*Maladies du Système Nerveux.*")

- **Myelites systematized, or parenchymatous (beginning and propagating themselves by the nervous elements, localizing themselves in a particular system).**
  - **Of the white columns (fasciculated sclerosis).**
    - **Of the posterior columns.**
      - (1) Of the external part of the posterior columns (posterior root zones).
        - (*a*) Primitive. Progressive locomoter ataxia.
        - (*b*) Secondary.
      - Of the internal part of the posterior columns (columns of Goll).
        - (*a*) Primitive. Sclerosis of columns of Goll.
        - (*b*) Secondary to a lesion of the cord. Secondary ascending sclerosis.
    - **Of the lateral columns and pyramids of Turck.**
      - (1) Primitive. Lateral, symmetrical sclerosis.
        - (*a*) Without muscular atrophy. *Spasmodic tabes dorsalis.*
        - (*b*) With muscular atrophy: lateral amyotrophic sclerosis.
      - (2) Secondary to sclerosis of the cerebrum or of the cord; secondary descending sclerosis.
  - **Of the gray substance.**
    - **Of the anterior horn.**
      - Primitive.
        - (1) Chronic. Progressive muscular atrophy.
        - (2) Acute
          - In the child—atrophic infantile paralysis.
          - In the adult—acute spinal paralysis.
      - Secondary to another myelitis. (*Secondary spinal amyotrophy.*)
    - **Of the bulbar nuclei.**
      - Primitive. Labio-glosso laryngeal paralysis.
        - Simple.
        - With muscular atrophy.
      - Secondary to different myelites. Bulbar symptoms in amyotrophic lateral sclerosis, the diffuse myelites, etc.
- **Myelites diffuse or interstitial, beginning and propagating themselves by the connective tissue; invading indiscriminately all the regions of the cord.**
  - **Acute.**
    - **Not invading; circumscribed, more or less extensive.**
      - Apoplectiform type (foudroyant).
        - Varieties: Dorso lumbar or cervical.
        - Complete or hemilateral.
        - Central or peripheral.
      - Acute and sub-acute types
        - Mortal, with recovery; with relapses; with passage to a chronic stage.
    - **Invading (acute ascending paralysis).**
      - Sub-acute type.
      - Acute type.
  - **Chronic.**
    - **Not invading, circumscribed.**
      - Complete
        - Dorso-lumbar.
        - Cervical.
      - Hemilateral.
    - **Invading. Sub-acute spinal paralysis of Duchenne, generalized diffuse myelitis of Hallopeau.**
      - Type with ascending march.
        - Complete lesions. Lesions predominating in the gray substance (anterior spinal paralysis of Duchenne, peri-epididymary myelitis of Hallopeau.
        - Lesions predominating in the white substance. *Annular cortical myelitis* of Trousseau and Vulpian.
      - Type with descending march.
    - **Special forms.**
      - *Sclerose en plaques*, (multiple sclerosis).
      - General progressive paralysis.

or paresis of the lower extremities, a paralysis in its nature curable. As in every hyperæmia, the first indication is to suppress the cause of which it is a manifestation; and whether the medullary hyperæmia depends on rheumatism, on uterine or hæmorrhoidal congestion, on too prolonged dorsal decubitus, on exaggerated fatigue, or on sexual excesses, your therapeutics should be varied to meet the causal indications. Rheumatism is one of the most frequent causes of congestion of the spinal cord, and, for my part, I remember to have observed, with Lasègue, during my earlier student days, a very curious case of sudden paraplegia in a kitchen maid; it was a result of acute articular rheumatism, and disappeared when the joints became affected. In these cases you understand the utility of dry or wet cups along the spine, of steam baths, and salicylate of sodium. At other times you will have to deal with simple paralysis *a frigore*, reflex paralysis from the impression of cold on the cutaneous surface. Here the treatment is different; besides the ordinary revulsives, such as blisters to the spinal region, you may employ sudorifics, and particularly pilocarpine, which, by the cutaneous congestion which they produce, have a favorable effect on the paralysis. Prolonged fatigue, by reason of the physiological congestion which it occasions in the spinal cord, is a factor in the etiology of this affection; here you must enjoin absolute rest, as well as revulsion. This word *rest* leads me to speak of the effect of dorsal position in the affections of the cord. Lying a long time on the back induces, as you well know, passive congestion of the spinal medulla, and it is probably to this congestion that we are to attribute the nocturnal erections which take place during sleep. You understand, then, that this fact has a certain influence in affections of the cord, and you will see patients predisposed to spinal congestion who, by reason of the dorsal decubi-

acute, accompanied by a sensation of numbness and formication in the legs. The patients complain also at times of an intense feeling of heat in the back.

When the inflammation is seated in the dorso-lumbar region, the inferior members present troubles of sensibility and motility; there are sensations of pricking, crawling, or tingling, in the limbs, numbness in the toes; the skin also presents anæsthetic points existing concurrently with hyperæsthesia.

Motility is more or less affected. There is always paraplegia, generally, however, incomplete; the patient walks with difficulty, dragging his legs along; at a more advanced stage he can no longer walk, he keeps his bed, but even then he can move his legs when he is lying down or sitting up.

The muscles of the bladder and rectum are often paralyzed; there is retention of urine or incontinence, and sometimes retention of fecal matters.

In active congestion of the cord, the invasion is sudden and the course is rapid; the pains are more severe, and the paraplegia complete.

In passive congestion the symptoms develop more slowly, appear more tardily, and the pains sometimes precede by several days the appearance of the paraplegia which remains incomplete.

In the active form the reflex movements are often exaggerated; they preserve their integrity in the passive form.

The duration of the disease is variable. Passive congestion lasts as long as the causes which originate it.

Congestion caused by traumatism, by an eruptive or paludal fever, disappears in the course of a few days. When the inflammatory state persists with fever for several days there is reason to fear the development of a more serious affection.

tus of the night can scarcely support themselves on their feet in the morning. This paresis disappears after standing a short time, with disappearance of the congestion which caused it.

This fact has a certain importance, and Brown-Séquard has derived from it therapeutic hints. In anæmia of the spinal cord, he directs the patient to lie on his back, while in spinal hyperæmia he is to lie prone on his abdomen

Thus far I have said nothing of bloodletting, which has been much employed in affections of the spine. Very much vaunted formerly by Ollivier, who advised in these cases, besides general bleeding, leeches to be applied in great number to the dorsal region, and wet cups, this antiphlogistic treatment is to-day well-nigh abandoned.[1] At the same time wet and dry cupping may render considerable service in active congestions of the spinal cord, and it is a therapeutic measure not to be neglected.

Meningo-myelitis, whatever may be the cause, is one of the medullary affections the most frequently observed. It is characterized by two marked symptoms; first, by pains, often severe, coming in paroxysms, and bearing considerable resemblance to the *douleurs fulgurantes* of ataxia and to sciatic neuralgia; secondly, by impotence, more or less complete, of the inferior extremities, with conservation of sensibility, the external portions of the medullary columns being alone affected. Here energetic revulsion is indicated, preferably by cauterizations along the spine.[2] You must also assuage the pain, for this is one of the symptoms of which the patient most complains. All the various remedial measures which I spoke of under the head of the neuralgias will have

[1] It is especially in the case of spinal meningitis and concussions of the spinal cord that Ollivier has recommended copious blood lettings; these, to be general or local. He advises that when general blood letting is preferred this should be done thoroughly, and he insists on its repetition where the patient is young and vigorous; where local bleeding is chosen he advises the application of wet cups the whole length of the spinal column, and each side of the spinous processes.

With regard to cupping, Gosse of Geneva proposes that deep incisions should be made in the muscles along the vertebral grooves in order to open the veins which communicate directly with the spinal canal.

Ollivier condemns this practice. (*a*)

[2] Debove has recently proposed in these obstinate cases a mode of treatment, especially applicable to sciatica, which consists in spraying the seat of pain with chloride of methyl. In sciatica the gas is projected over the tract of the nerve from a siphon bottle, furnished with suitable stop-cock and beak. Intense refrigeration is produced, followed by smarting and even vesication; the latter may be very troublesome if the spraying be too prolonged. Rightly managed, this mode of treatment is said to be of singular efficacy, and superior to any other. Debove claims astonishing cures where everything had failed. Desnos, Rendu, Lallier, Legroux, Sevestre, Robin, Letulle and Dujardin-Beaumetz have all tried this process with varying success. It seems to do good rather by revulsion than by refrigeration; the innervation of multitudes of sensory nerve terminations is modified by the methyl-chloride spray, and some marked sedation in the central nuclei of these nerves in the cord seems to follow; at least it is substantially in this way that Debove accounts for the success of this new treatment.—TRANS.

(*a*) Ollivier Traitè des maladies de la moelle epinière, Paris, 1837, t. II, p. 299.
Gosse, Des maladies rheumatoïdes, Geneva, 1826, p. 231.

their place. Double sciaticas ought always to make you suspect meningo-myelitis. But the most effectual means for allaying the pain is the subcutaneous injection of morphia, and, in fact, this alone will in many cases bring relief. You must also watch the functions of the bladder and intestines, which are often profoundly disturbed in these cases of paraplegia due to spinal disease.

As for the condition of the bowels, we have either obstinate constipation or fecal incontinence. The constipation will yield to drastic purgatives; these medicaments not only restore regular stools, but they act as revulsives and may thus modify the circulation in the cord and its membranes. In certain cases the most violent purgatives cannot overcome the constipation; this is because the rectum is paralyzed and allows itself to be distended beyond measure by fecal accumulations. Here you will have to break up the fecal mass with the finger, or scoop it out with a spoon in order to clear the rectum.

As for fecal incontinence, the most scrupulous pains must be taken for cleanliness; nothing is more important in myelitis, for trophic troubles are of common occurrence, and often, in spite of all your care, extensive bed-sores will form over the sacrum, and even around the anus, as a consequence of dorsal recumbency. In these cases the fracture-bed will render great service; it enables you readily to dress the bed-sore, and to vary the position of the patient.

The disorders which meningo-myelitis inflicts on the urinary organs are still more serious. At first the patient often experiences some tenesmus due to spasm of the bladder, tenesmus which soon gives place to retention or to incontinence. For the retention, you will be obliged to use the catheter, notwithstanding the liability to cystitis with purulent urine which it occasions. For the latter evil, and to prevent putrid absorption, it will be necessary to wash out the bladder with solutions of carbolic, boracic acids, resorcine, etc., at the same time giving internally benzoic acid, oil of sandalwood, turpentine, copaiba, boldo or buchu, which are antagonists of fermentation.

If retention of urine has inconveniences, incontinence has quite as grave; the incessant flow of urine irritates the genitals, soils the bedclothes and the clothing, and augments causes already existing of local gangrene and erysipelatous inflammation of the skin. In the case of male patients, urinals have been perfected by the use of which they can escape these accidents, but it is not so with the paraplegic female, who must suffer all the ill consequences of the incontinence.

When the inflammatory symptoms have subsided, then much can be done to restore the power of movement to the lower extremities. Here hydrotherapy, massage, frictions, electricity, may render real service; but these measures should never be employed in the acute stage of the affection, for they would cause aggravation of the disease.

Myelitis by compression demands the same local treatment as meningo-myelitis; it demands also a special treatment directed to the removal of the cause. If the latter be cancer of the cord or its membranes, we can do nothing but alleviate pain by hypodermic injections of morphia. If it be Pott's disease,

we can by an appropriate plaster jacket, as Sayre, of New York, recommends, do much toward straightening out the vertebral column, and removing the deformity which is the cause of the compression. If the cause be syphilis, nothing can be more serviceable than the injections of peptonate or albuminate of mercury, which not seldom cause the myelitis and paraplegia rapidly to disappear.

I come now to the treatment of the medullary sclerosis, and especially of the typical form oftenest met with in practice, progressive locomotor ataxia.[1] This word *progressive*, by which Duchenne characterized the pathological entity

[1] Locomotor ataxia, described under the names of tabes dorsalis, spinal paralysis, atrophy or gray degeneration of the posterior columns of the cord, was scarcely known in France, before the researches of Duchenne de Boulogne, and our knowledge of the pathological anatomy of the disease, dates especially from the memoir of Burdon and Luys.

It is a chronic disease with slow and progressive march; seeming at times to be arrested in its progress it presents periods, more or less long, of quiescence; it takes four, five, six years and even more for its evolution. It is primitive or secondary; it commences ordinarily between the ages of twenty and thirty years and seems to be more common in men than in women. It is often hereditary, the family history revealing ataxia or other diseases of the nervous system.

Articular rheumatism, venereal excesses, nervous affections, traumatisms of the cord, may cause the development of the disease.

The influence of syphilis, denied formerly, seems to-day indisputable, and according to Prof. Vulpian, out of twenty patients afflicted with locomotor ataxia, at least fifteen of them were old syphilitic cases.

The evolution of the disease presents three periods: a first, or painful period; a second, or period of ataxia; a third, a period of paralysis.

The first, or period of lightning pains and ocular troubles, may manifest itself suddenly, but this is somewhat rare. In this event there are violent paroxysms of pain in the limbs, the head and the trunk; these attacks subside to return again at variable intervals.

Oftener the invasion has not this suddenness and the pains do not present so much violence; the patient complains of transient, rapid pains. These pains, often quite severe, shoot downward through the lower limbs like lightning shocks (douleurs fulgurantes of Romberg). At other times they resemble bites, pricks, pinchings; they may be accompanied by sudden starts. Of variable intensity, they are ordinarily transient, but may also be persistent and localize themselves in different points. When situated in the trunk the pains are constrictive (douleurs en ceinture) and their violence sometimes impedes respiration. In the face they affect the fulgurant type and the persistent or continuous type; the patient complains of constant pains, with exacerbation, and exaggerated sensibility of the skin about the orbits, at the root of the nose, or around the infra-orbital foramen; sometimes even the patient says that it seems as if his eyes were being plucked out. On the part of the organs of vision you note troubles consisting of paralysis or paresis of the third or fourth pairs of cranial nerves, fall of the upper eyelid, strabismus (often alternate strabismus) amblyopia, or diplopia more or less marked. These disturbances may, however, be but temporary. Besides these symptoms, the first phase of the disease presents also troubles of the general sensibility, functional derangements of the genito-urinary apparatus, partial paralyses, rarely hemiplegia.

The troubles of the general sensibility consist in anæsthesia, analgesia, hyperæsthesia and divers paræsthesias.

When the skin of the sole of the foot is affected with anæsthesia, the patient loses the sensation of resistance and of hardness in the ground on which he treads; he seems to himself to walk on down or on soft and yielding earth.

On the part of the genito-urinary apparatus, you may note retention or incontinence of

which he described, indicates the little control which therapeutics has over this morbid condition, and in so designating it, Duchenne pronounces a sentence of incurability. Since then, therapeutics has not lifted this sentence, and it is best to bear in mind that this affection is almost always above the resources of our art. Nevertheless, ataxic patients have been cured, and are now being cured; but these are exceptional cases, and despite periods of calm and respite which may last months and even years, the ataxic individual sees his disease progress slowly or by bounds.

These cases of cure concern more especially syphilitic patients. Without adopting altogether the opinion of Fournier, who will have it that all ataxic patients are syphilitic, it is nevertheless well to remember, that in a great number of cases syphilis is the cause of tabes, and when the affection is taken at the commencement, an appropriate anti-syphilitic treatment may cure it. But it will not do to take for granted that it is always so; and in a great many in-

urine (the latter generally nocturnal) satyriasis, then later, anaphorodisia and sometimes spermatorrhœa.

The painful crises may affect the viscera and determine gastralgic paroxysms with vomiting, vesicular and urethral pains, or lumbar pain simulating renal colic. Féréol has remarked laryngo-bronchial troubles with spasm of the glottis and convulsive cough and hyperæsthesia of the laryngeal mucous membrane.

As for the second phase of the disease, it is characterized by the appearance of ataxic movements. The incoördination of movements is developed progressively, slowly, little by little, sometimes even insidiously.

The ataxia begins in the lower limbs; the patient remarks first of all that he is very easily fatigued, that he cannot take long walks; then he observes that he is becoming clumsy in his legs, he stumbles and falls easily; it is difficult for him to start off when he attempts to walk, then after several hesitating steps he walks to better advantage. Later the incoördination makes progress, the patient cannot direct at will the force, the direction and the extent of his movements, he cannot take a step without looking at his feet; the leg is lifted up and then thrust forward with force and stamped on the ground heel first; he can no longer walk without a cane or some other support; in the night time the incoördination is still more marked, and walking and even standing becomes almost impossible.

If a patient is lying down he performs quite easily the movements demanded, but sometimes he performs them too violently and overdoes it.

The muscular force is intact, as one can convince himself by means of the dynamometer; coördination alone is wanting.

Like phenomena may be observed in the upper limbs, and little by little manual exercise becomes impossible.

Sensibility also presents disorders; diminution, abolition or perversion of the sensations of touch and of pain. Moreover, a notable retardation in the perception of an impression is observed. A patient, when pricked, does not feel the pain till four or five seconds later; there are mistakes of place, the ataxic with his eyes shut cannot indicate the point pricked. At the same time impressions produced by the contact of a cold body are more rapidly perceived, and the mistakes of place are less obvious.

The sensibility of the muscles (the muscular sense), of the bones, of the joints, is equally affected, the patients lose the notion of position; that is to say, with their eyes shut, they cannot indicate the position of their feet in the bed.

There are often observed at the end of the first period or beginning of the second, arthropathies, well described by Charcot, which occupy preferably the large joints, knee, hip, shoulders; the joints much swollen, puffed out by the liquid, are little or not at all painful, and voluntary movements are made with difficulty, but only by reason of the swelling;

stances in which, in syphilitic patients, there exists some form of medullary sclerosis, the most energetic and the most violent treatment will not favorably modify the march of the disease. However, the fact of syphilis coexisting with tabes dorsalis, always gives a hope and a chance for your patient, which you ought to improve.

There are neuropathies which sometimes present ataxic symptoms; these false ataxies are often completely cured by hydrotherapy, or a course of treatment at the thermal springs.

The first condition of treatment of sclerosis of the posterior columns, is to avoid all circumstances which tend to provoke congestion of the cord, a congestion which almost always precedes the hyperplasia of the neurolgia. You should then prohibit, in the case of these patients, prolonged muscular fatigue (a fatigue which is the more easily induced the more voluntary force the patient is obliged to expend in his movements); sexual intercourse ought also to be forbidden. You should also have recourse to energetic revulsion, and in particular to punctiform cauterizations along the vertebral column, and this especially when signs of irritation or congestion of the cord appear. You can also use in the periods of remission nitrate of silver or phosphorus, following, in the case of phosphorus, the rules which I have laid down. You will almost always obtain with this phosphorus medication an amelioration, more perceptible to the patient than to yourselves; he will tell you that he feels stronger, and that he has a better command of his limbs, at the same time that an examination does not disclose any real progress. I have never observed genital excitation following the administration of phosphorus, and I very much doubt the aphrodisiac properties which have been ascribed to this medicament.

The lightning pains are among the most formidable complications of the disease; here our "sheet-anchor" is hypodermic morphia, despite the fact that ataxic patients are very likely to become morphomaniacs (a great many at the present day are such). Sometimes extremes of temperature diminish notably

at the end of a certain time, which is variable, destruction of the cartilages and bony tissue takes place.

The reflex excitability of the cord is sometimes considerable in the ataxic patient, and the contact of a foreign body, especially of a cold object, on the skin produces reflex movements more or less extensive.

Forced flexion of the foot on the leg, produces the phenomenon of reflex trepidation, so also does percussion over the tendo-achillis or the patella tendon, the latter giving the characteristic knee jerk. The "patellar reflex" is, however, often wanting.

The trophic troubles observed in the course of the second period, consist in cutaneous eruptions, in emaciation of the limbs, atrophy of the muscles, and a rarefaction of the bony tissues which results often in fractures.

Intellectual troubles are somewhat rare, at the same time there may be delirium more or less temporary, sometimes dementia.

The motor incoördination makes progress; by and by the patient can no longer walk, and is obliged to keep his bed.

Every movement becomes impossible, and the paralysis invades progressively the upper limbs, sometimes even contracture of the affected members is noted (third period).

Purulent cystitis, or incontinence of urine, or of fecal matters soon results in the formation of eschars on the sacrum, or in other regions and the patient succumbs.

this pain; I have lately had under my care a French engineer, who, when constructing railroads in Russia, could succeed in calming the *douleurs fulgurantes* of his disease only by surrounding his feet and legs with ice. In some patients heat has the same effect. In these cases Chapman's rubber bags for pounded ice or hot water will be useful. Nerve-stretching has been proposed for these *douleurs fulgurantes.*[1] This elongation of the sciatic nerve, practiced for the first time in Germany by Langenbuch, in 1879, in France, by Débove and Gillette, in 1880, and since repeated by Esmarch, Erlenmeyer, Sury-Bienz, Hirschfelder, Rzehaczek, has not given any definite results, and though causing a temporary amelioration, it is often accompanied by trophic disturbances of great intensity. Balneotherapy and thermal treatment have an important *rôle* in the therapeutics of ataxia. For my part, I have abandoned hydrotherapy in the treatment of medullary sclerosis. I believe that cold douches can only augment or provoke spinal congestions, and I am happy to see that most of my colleagues of the Society of Hydrology are of the same opinion.[2]

If hydrotherapy has rather inconveniences than advantages in the treatment of ataxia, it is not so with thermal treatment. Three stations claim preëminence, Neris, Balaruc, and Lamalou; the thermal establishments of the latter seem to be most efficacious in chronic myelitis.

Finally, to these balneotherapic means we must add electricity. Onimus and Rosenthal have insisted on the curative action of continuous descending currents in the affections of the spinal cord. It is a means which you ought always to employ, without expecting always to obtain much amelioration.

On the other hand, electricity has a preponderating *rôle* in the atrophic paralysis of infants, which, as the recent researches of Roger and Damaschino and of Laborde have shown, is to be attributed to central myelitis affecting the anterior horns, and destroying the large multipolar cells of that region.[3] These

[1] The first case of nerve stretching for locomotor ataxia was practiced in 1879, by Langenbuch; this operation was performed for the relief of the lightning pains, affecting chiefly the left sciatic nerve; this nerve was stretched on the 13th of September; the 25th of September the right sciatic was stretched and the two crural; the pain disappeared completely, but afterward, in consequence of new pains appearing in the arms, elongation of the median nerve was attempted. The patient, unfortunately, died from chloroform during the operation, January 6, 1880.

Since then the operation has been performed by various surgeons—Esmarch, Erlenmeyer, etc. In December, 1880, elongation of the sciatic for the *douleurs fulgurantes* of ataxia was performed by Gillette under the direction of Debove. Gillette twice performed nerve-stretching for ataxia in 1881, and other continental surgeons have practiced in numerous cases of ataxia this elongation of nerves and with variable results.

[2] Langenbuch, Berliner klin. Wochensch., No. 48, 1881. Esmarch, Deutsche med. Wochensch., 1880, No. 19. Erlenmeyer, Centrablatt für nerv. und psych., No. 21, 1881. Débove. Gaz. des Hôp., 11 Dec. 1880 Gillette, Union Med., No. 17, Jan. 1881. Sury-Bienz, Deutsch. med. Zeitung, 1881. Du traitement de l'ataxie locomotrice (Soc. d. hydrologie Med. Sèance du 4 November, 1878.

[3] Infantile atrophic paralysis comes on generally between the ages of one to three years. Cases are exceptional after ten years of age. The mode of invasion is sudden, being announced by an intense fever, with or without convulsions. From day to day you observe paralysis develop sometimes general, affecting the upper and lower extremities, sometimes

alterations have as a consequence the atrophy or destruction of important groups of muscles. Our only means of combating this disease are galvanism, gymnastics, and hydrotherapy, in a word, all these agencies which can excite nutrition in atrophied parts. These means have real efficacy only at the onset of the disease; unhappily the first periods often pass unnoticed, and it is not till the later periods of the malady that our help is demanded, and then little can be done.

The same treatment is applicable to a disease which resembles the atrophic paralysis of early childhood. I refer to progressive muscular atrophy, which in accordance with the pathological studies of the French school of medicine, and I refer particularly to the labors of Hayem, Vulpian, Troisiêr, Charcot, and Gombault, ought to be attributed, like the atrophic paralysis of early childhood, to chronic parenchymatous myelitis, localized in the anterior horns of gray sub-

three members; sometimes localized in a leg or an arm; rarely it affects the two lower limbs only. This paralysis is at first complete, absolute, with flaccidity of the limbs. It often takes on the paraplegic form, but is not accompanied with sensory disturbances or functional troubles on the part of the bladder and rectum.

Very rapidly, on the seventh or eighth day, Faradic contractility is lessened or abolished in a certain number of muscles, while galvanic contractility persists longer. The reflex movements are not always abolished from the first. From the second to the sixth month after the invasion, the paralysis abandons certain muscles, to localize itself in others; muscles of the leg such as the peronei muscles and the anterior tibial; notably the deltoid in the upper extremity. Then appear various special troubles: the atrophy, which according to Duchenne may already be very apparent at the end of one month, affects the muscles in which Faradic contractility is absent; the bony system suffers an arrest of development and the bones of the affected side may be shorter than the corresponding bones of the healthy side.

The side affected presents a remarkable lowering of temperature. The partial atrophies from which the patient suffers are followed by deformity of the limbs and determine vicious attitudes; and it is in this way that club foot often takes its origin especially *varus equinus*, *talipes valgus*, and sometimes a deformity to which Duchenne has called attention, a sort of *hollow-footed talipes*, in which the forepart of the foot is hollowed out by exaggeration of the plantar concavity.

In the upper limbs the most frequent deformity, sometimes only one observed, is flattening of the shoulder. You readily see the head of the humerus under the atrophied deltoid. In certain cases the arm hangs inert along the body, it is wasted, is much shorter than the other arm, the fingers are flexed on the hand which is itself flexed on the fore-arm.

The prognosis, as far as life is concerned, is favorable; from the point of view of function it is bad. The atrophy in fact is incurable and entails with it persistent infirmities.

The anatomical lesions of atrophic paralysis of infancy are primitive and secondary, the latter consisting in trophic troubles of muscles, bones, and blood vessels. The primitive lesions consist in myelitis of the anterior horns of the cord, starting, according to Charcot, in the ganglionic cells. According to Roger and Damaschino the point of departure is in the blood vessels and neuroglia. In two autopsies of infants that succumbed to the disease, the one two months, the other six months after the commencement of the disease, they noted lesions localized in one of the anterior gray horns, consisting in inflammatory red softening with vascular injection and the production of granular bodies.

According to Prof. Charcot, the nerve-cells are the first seat and origin of the irritative process, and there is produced an anterior acute parenchymatous, tephro-myelitis.

stance.[1] In these cases constant currents applied methodically may have a happy influence.

Such, gentlemen, are the principal considerations which I have to offer *à propos* of affections of the spinal cord ; you will find them quite incomplete, but

[1] Progressive muscular atrophy, so-called by Aran and Duchenne de Boulogne, has ordinarily a slow and insidious beginning. Without known cause, after a fatigue, a chill, the patients experience weakness in a limb. Then fibrillary contractions, independent of the will, occur spontaneously, are more or less frequent, and consist in slight starts or shocks of the muscular fibres. To these contractions, succeeds soon a loss of strength which attracts the attention of the patient. Then in the enfeebled parts is observed atrophy of the muscles, diminution in the volume of the part ; the muscular prominences disappear, and little by little with the progress of the disease all the soft parts seem to waste away and only the naked bones are left. As long as there are muscular fibres in a healthy state, electrical contractility remains, and it does not disappear till nothing is left but connective tissue. Duchenne has remarked that along with the atrophied muscles there is lowered temperature and cutaneous anæsthesia.

The disease, sometimes hereditary, more frequent in men than in women, seems to affect more particularly persons of adult age, and in full vigor ; it generally commences in the upper extremities, especially the right arm, and more frequently selects the right thenar or hypothenar eminences and interosseous muscles.

The abductor brevis pollicis is taken first, then the other muscles of the thenar eminence ; the atrophy gaining rapidly, the muscular prominence disappears and the movements of the muscles becoming impossible, the antagonism exerted against the extensors of the thumb is destroyed, the first metacarpal bone is drawn backwards and outwards and the hand takes the aspect of a monkey's hand. When the interosseous muscles are taken, the spaces between the metacarpal bones sink in, the skin shrinks, and the hand seems deprived of flesh.

The fore-arm is taken in its turn, and according as the atrophy affects the flexors, the extensors or the supinators, the corresponding muscular prominences are effaced. The muscles of the arm, those of the shoulder, are stricken in their turn and disappear. The shoulder, is flattened, the head of the humerus and the acromion process are plainly visible ; when the fasciculi of the deltoid are invaded, the movements of the arm become impossible.

In certain cases by the side of all the atrophied muscles, a single muscular bundle remains.

Thus, in an observation of Duchenne, all the muscles of the hand and of the arm were completely atrophied with the exception of the supinator-longus which was intact. It is easy to understand the various deformities which result from these atrophies and from the vicious attitudes which the contractions of antagonist muscles, remaining intact, produce.

The muscles of the trunk are next invaded, the atrophy gains the superior part of the trapezius, the pectorals, the serratus magnus and the respiratory muscles, even to the diaphragm and intercostals. These alterations entail important troubles in respiration, while atrophy of the muscles of the abdominal walls impedes the intestinal functions, micturition and defecation. The inferior extremities are ordinarily the last to be smitten, and those most often affected are the flexors of the foot on the leg, and the hip on the pelvis.

In infants Duchenne has remarked that the atrophy instead of beginning by the upper extremities, begins by certain muscles of the face and the first affected is the orbicularis oris.

The march of the disease is slow (from ten to twelve years) ; it may stop after having destroyed one or two muscles, but more often after a brief respite, the disease progresses anew. The patients succumb, either in consequence of affections of the respiratory passages, by exhaustion, or by reason of asphyxia caused by the penetration of food substances into the air passages (atrophy of the muscles of deglutition.)

from a therapeutic standpoint they are necessarily so, by reason of their very incurability. These diseases of the spinal medulla, in fact, constitute the most gloomy chapter in therapeutics.

To explain the phenomena of progressive muscular atrophy, three theories have been put forth :

1st. That of Aran and Duchenne, adopted by Friedreich, which places the primordial seat of the malady in the muscles themselves which undergo degeneration.

2d. The theory of Schneevogt which has been adopted by Jaccoud, which places the starting point of the disease in an alteration of the great sympathetic.

3d. The theory of Hayem, of Charcot, of Vulpian, the theory to-day considered the most probable, which attaches this affection to the group of central myelites.

PART SECOND.

TREATMENT OF GENERAL DISEASES.

THE BLOOD FROM A THERAPEUTIC STANDPOINT.

SUMMARY.—Composition of the Blood—The Plasma—Its Alkalinity, its Composition—The Globules—The Red Globules—Hæmoglobin—The White Globules—The Hæmatoblasts Enumeration of the Globules—Its Importance Therapeutically—Divers Methods of Enumeration—Hayem's Method—Qualitative Value of the Globules—Chromometric Process—Action of Medicaments on the Globules—Passage of Medicaments into the Blood—The Blood as the Vehicle of Medicaments—Modifications of Medicaments in the Blood—Direct Introduction of Medicaments into the Blood—Intra-venous Injections—Dangers of these Injections—Transfusion; History—Transfusion of Blood from the Animal to Man—Transfusion of Blood from Man to Man—Transfusion of Whole Blood, and Defibrinated Blood—Operative Procedure—Transfusion into the Arteries—Quantity of Blood Injected—Dangers of Transfusion—Results of Transfusion—Indications and Contra-indications—Injections of Blood in the Cellular Tissue—Injections of Blood in the Peritoneum—Intravenous Injections of Milk—Its Dangers—Intravenous Injections of Water and of Saline Solutions.

GENTLEMEN—I propose to devote the present course of lectures to the treatment of general diseases. But first, in conformity to the plan which I have adopted, I must make some general remarks on the blood, considered from the standpoint of therapeutics.

It may be said that, from the most remote antiquity, the blood has ever attracted the attention of physicians, and our ancestors, struck by the grave disorders which supervene as the result of hæmorrhages, assigned to the sanguineous fluid the source of life itself. We see, in fact, this notion expressed in Leviticus xvii, 14: "The life of all flesh is the blood thereof."

Since the time that Swammerdam, and especially Leuwenhoeck, discovered the blood corpuscles, making use of the new instrument which their fellow-countryman Zachary Jans, the obscure optician, of Middelburg, had just invented—thanks to that microscope which was destined to so profoundly revolutionize the study of the natural sciences—the number of works on hæmatology has been considerable. If I were to attempt to enumerate them all, it would take more time than I have to devote to this lecture.

In this great scientific movement France has not been behind, and to the labors of Prévost and Dumas, of Magendie, of Andral and Gavarret, of Denis of Commercy, and of Claude Bernard, must now be joined the important researches of my colleague and friend, Professor Hayem, who has just published his remarkable work on the modifications of the blood under the influence of medicinal agents, a work to which I shall often have occasion to refer in the course of these lectures.

At the same time, despite these so numerous researches, the study of the blood, especially from a therapeutic standpoint, presents still many obscure points; and if we possess precise data concerning the anatomical and physiological constitution of this fluid, we are ignorant, in very many cases, of the modifications which it undergoes under the influence of medicines.

The blood, this "flowing flesh" (chair coulante) of Bordeaux, and which

Claude Bernard has so well defined as the *interior environment* of the organism, presents two distinct parts, a liquid plasma and organized particles.

This plasma contains, as you are aware, fibrin, albumen, water, salts and gases.[1] You know, also, that it is to one of the constituent parts of this plasma, the fibrin, that is due the phenomenon of the coagulation of the blood, although we are reduced to hypotheses to explain the mechanism of the coagulation.[2] You know, also, that the plasma has an alkaline reaction, which it owes to salts of soda; which, moreover, is constant and is found throughout the whole animal kingdom.[3] This is a matter of prime importance, from a therapeutic point

[1] Davy, in 1799, extracted oxygen and carbonic acid from blood. Since the application of the vacuum, and the gas-pump of Ludwig, to this study, the analysis has been completed. According to all analyses, 100 volumes of arterial blood (of the dog) contain 22.2 volumes of oxygen at about the freezing point. This oxygen is intimately combined with hæmoglobin, and the richer the blood in hæmoglobin, the more oxygen it contains.

One hundred volumes of arterial blood (in a dog) contain 33.3 vols CO_2; this gas comes from the serum. Schoeffer and Dreyer have shown that the blood globules have an action in the disengagement of CO_2 from the serum.

The blood also contains a quantity of nitrogen.

[2] Several theories have been given to explain the coagulation of the blood. No one of them is without objection; so much so, that it may truly be said that we do not yet know the exact cause of this coagulation.

Denis conjectured that the plasma contains a special substance, *plasmine* formed by the union of *concrete* fibrine and *soluble* fibrine. When the blood leaves the vessels its plasmine is decomposed and concrete fibrine is deposited.

The plasmine, however, has never been isolated.

In opposition to Denis, Schmidt has maintained that the fibrine which is deposited from the blood is constituted by two elements, *fibrinogenous* substance, and *fibro-plastic* matter, which are contained in the blood in the living state and which, combining outside of the vessels, lead to the formation and deposition of fibrine. A ferment produced by the alteration of the globules is the efficient cause of this combination. This opinion has been vehemently combated by Hammarsten and others.

Mathieu and Urbain consider the coagulation as produced by the fixation of CO_2 by tne fibrine.

Gautier has shown that this theory is not exact since all it is necessary to do in order to retard the coagulation of blood is to add common salt to it, and yet the blood is not by this means deprived of its CO_2. In fine Glenard in exposing blood plasma to CO_2 did not thereby produce coagulation. Mantegazza has maintained the opinion that the coagulation depends on the white globules. These globules in certain conditions set at liberty a substance which is the efficient cause of coagulation, if not coagulated fibrine itself.

Albertoni has produced arguments in favor of this view.

According to Hayem it is not the white globules but really the hematoblasts which play the active rôle in coagulation, and the phenomenon has for origin the physico-chemical actions which accompany the decomposition of the hematoblasts. (*a*)

[3] The serum of blood comes from the plasma after the coagulation of the fibrine. In man this serum is of a light greenish yellow color. The reaction is alkaline; this alkalinity

(*a*) Denis, *Recherches expérimentales sur le sang humain considéré à l'etat sain*, Paris, 1830. *Mémoire sur le sang*, Paris, 1869, p. 32.—Schmidt, *Chemis. central*, 1861, p. 403 (*Arch. für Anat. u. phys.* 1851, 545 et 675; 1862, p. 428, 583; *Arch. für pathol. anat.*, t. XXIX, p. 1).—Hammarsten, *Arch. für physiol.*, t. XVIII, p. 33, 1878.—Fredericq., *Bull. de l'Acad. roy. de Belgique*, 2e série, t. LXIV, n° 7.—Mathieu et Urbain, *Acad. des sc.*, comptes rendus, t. LXXXIX, p. 665 et 698.—Gautier, *Acad. des sc.*, comptes rendus, t. LXX, p. 1360.—Glenard, *Bull. de la Soc. chim.*, t. XXIX, p. 511.

of view, for all medicaments which do not possess this alkaline reaction, or which are unable to undergo, in the economy and before entering the blood, certain modifications converting them into an alkaline compound, cannot become an integral part of the circulating fluid, and can have but a local action.

This predominance of the salts of sodium in the blood plasma explains why the sodium salts are better tolerated in the organism than the salts of potassium. This is a fact on which I insisted when speaking of the elimination of medicines by the kidneys, and I need only refer you to what I then said.[4]

The blood corpuscles play a preponderating rôle in the blood. Veritable travelling merchants of hæmatosis,[5] as Kuss felicitously calls them, they speed their way, carrying life to the most remote points of the economy. These globules present themselves, as you are aware, under three aspects—the red corpuscles, the white corpuscles, and the hæmatoblasts.[6]

is, however, less than that of the plasma and this results from the formation of a certain quantity of acid after the coagulation of the blood. The serum contains albuminoid substances, fatty matters, extractive matters, salts and gases.

a. Albuminoid Matters.—In the largest quantity and of the most importance, is the albumen of the serum, described under the name of *serine*. This *serine* when it is perfectly pure and deprived of salts, becomes cloudy at 60° C., but its coagulation becomes complete between 73° and 75°. Besides this *serine* three other albuminoid substances are found in the serum: *paro-globuline*, described by Schmidt; *serum caseine*, which is only a combination of serine with soda (albuminate of soda); *serum globuline*, a protine body discovered by Denis.

b. Fatty Matters.—Certain fatty matters have been found in the serum; their proportion may be as high as 20 per cent. This quantity of fatty matters augments notably under the influence of a rich diet. *Cholesterine* is another constituent. Goblet and Hoppe Seyler have also found *lecithine*, and Boudet has extracted from serine a crystallizable substance which he has designated under the name of *seroline*. This seroline is only a mixture of cholesterine and lecithine.

c. A saccharine matter is also found in normal serum. Claude Bernard has shown that it is a normal element of the blood even in carnivorous animals. This sugar is probably glucose or maltose and may be a mixture of both.

d. Extractive Matters.—The presence of urea in the blood has been indicated by Picard. The proportion of urea rises during fever and falls during inanition; uric acid and creatine have also been found in the serum.

e. The most abundant of the salts of the serum is chloride of sodium; it exists in the proportion of five or six grammes to every thousand, that is to say, about ½ per cent; then, next come the phosphates and in particular the alkaline phosphates.

f. Gases.—The serum contains certain gases, and in particular CO_2, N. and O. CO_2 presents itself in the serum in three different states: in solution, in feeble chemical combination, and in combination with soda.

[4] Chap. I, Vol. II, The Kidneys from a Therapeutic Standpoint.

[5] Commis voyageurs de l'hématose.

[6] The white corpuscles or leucocytes are spherical and more voluminous than the red corpuscles. Their diameter is from 4 to 14 thousandths of a millimetre. But little is known of the condition of these globules, which are with difficulty separated from the red corpuscles. There is about 1 white to 350—500 red corpuscles: one cubic millimetre of blood contains 8,000. The hæmatoblasts are very small bodies, about 3–1000 millimetre in diameter. They are colorless, and are discoid, biconcave like the red globules. They are in a marked degree susceptible of change, and after issuing from the blood-vessels they take on widely varying forms. These hæmatoblasts exist in the blood of all vertebrates. They give origin

It was Hayem who first called attention to these last-named corpuscles, and pointed out their importance. These little bodies, very refractive and very alterable, are, in fact, red corpuscles in the process of formation; therefore, whenever it is necessary for us to study the renewal and regeneration of the blood, we ought to take great account of their number and their form. As for the red corpuscles, I can teach you nothing new as to their constitution. You are not ignorant of their form, their structure, or the important physiological rôle which they play. The hæmoglobin which they contain gives to the blood its color, and as this hæmoglobin has iron as one of its constituents, you understand the importance of chalybeates in impoverishments of the blood. This is, however, a more complex question than at first sight it seems to be, and will be more fully discussed hereafter, when we come to treat of anæmia and chlorosis.

Do these blood globules undergo modifications in the presence of medicinal substances? This very important point is, unfortunately, not yet decided. Binz, Kerner, Blake, and, more recently, Mayet, of Lyons,[7] have made numerous researches to elucidate this problem; but they have given us no positive information, for their experiments were made with blood drawn from the vessels, and there is nothing to prove that the modifications in the form of the corpuscles, which these writers have described as being produced under the local action of medicaments, ever take place in the living subject. For my part, I am inclined to believe that, if we except the blood poisons, the

to the red corpuscles. Their own origin is involved in obscurity. Hayem supposes them to originate in the lymphatic network. (Hayem—Researches on the Normal Anatomy of the Blood, p. 99.)

[7] Binz and Kerner have studied the action of the toxic and medicinal substances on the globules, and in particular on the white globules. Kerner mixed one part of a one-tenth solution of sulphate of quinine with four thousand parts of blood, and found that the globules changed their form and lost their movements. Blake injected into the blood sulphate of lithia, sulphate of thallium, chloride of rubidium, nitrate and acetate of silver. The substances alter the blood globules, rendering them adhesive and thus causing fatal congestions of the lungs.

Mayet, of Lyons, has studied the action of certain toxic and medicinal substances on the red globules. He takes one quarter of a milligramme of the substance with which he wishes to experiment, which he reduces to a fine powder and places on a glass slide; then he pricks the index finger of the left hand, obtaining a drop of blood with which he impregnates the medicinal substance; then he expels the air and lutes it with paraffine.

It is thus that he has observed the action of chlor-hydrate of morphia, chlorhydrate of apomorphia, of narceine, of codeia, of basic sulphate of quinine, of basic brom-hydrate of quinine, of chlorhydrate of pilocarpine, of sulphate of atropia, and of the French and German digitalines.

All of these substances have a double action, the one of solution of the globules, the other of deformation of the globules. With regard to the substances which produce solution of the globules, those most active are, first, the German digitaline, then sulphate of atropia, chlorhydrate of pilocarpine, brom-hydrate and sulphate of quinine. In a second category are placed bodies having a feeble and slow solvent action. In the order of their activity, these are, codeia, the French digitalines, chlor-hydrate of apomorphia and narceine.

As for the alteration of the globules, this was the result of his observations: the French

principal medicaments have little or no action on the red corpuscles or leucocytes. Take any animal, inject under its skin morphia, atropia, and most of the alkaloids, examine the blood, before, during and after the experiment, and it will be impossible for you to recognize with the microscope the least alteration in the globules of the blood.

Fonssagrives believes that the globules charge themselves like sponges with medicinal substances, and that on arriving at the extremity of the capillary network they express into the serum the medicinal principle, in such a manner as to cause it to penetrate to the inmost recesses of the tissues. This is an hypothesis which has no inductive evidence in its favor, and it is more probable that the blood plasma alone serves as vehicle to medicines.(*a*)

Be it understood that in this discussion I exclude those medicaments which, in depriving the red corpuscles of their respiratory power, despoil them also of their physiological function. You are all familiar with the interesting researches of Claude Bernard on the oxide of carbon.[8] We have here some interesting facts from a toxicological point of view, but which have no direct bearing on the therapeutic action of medicinal substances generally. I except, however, alcohol. I believe, and I insist upon it, that it is in depriving the globules of their oxygen that alcohol possesses antithermic properties.

There are other medicaments which act on the blood corpuscles, either in destroying them or augmenting their number. I will revert to them when I come to speak of the action of mercury and of iron in syphilis and anæmia. The problem of their action is a difficult one to solve, for we are still ignorant, as physiologists, of the real origin of the red corpuscles. The labors of Hayem have shown that these corpuscles result from the evolution of the hæmatoblasts, but we do not know from whence the hæmatoblasts come. Is their source the marrow of bones, as the Italian and German schools teach? Do they come from the lymphatics, as Hayem supposes? We have only hypotheses to enlighten us, and this is why we cannot tell how the aglobular and hyperglobu-

digitalines caused a granular transformation of the globules. Codeia, narceine, chlor-hydrate of morphia, and apomorphia occasioned a spheroidal deformation of the globules, with a period in which the borders of the corpuscles are prodigiously swollen.

Sulphate of quinine transforms the globules into spheroidal elements but without previous swelling of their borders.

According to Meyet it results from these experiments that from the point of view of physiological action, these toxic and medicinal substances influence the chemical molecular constitution of the organized albuminates of the economy.(*b*)

[8] The hæmoglobin of the corpuscles has such an affinity for the carbon monoxide that the latter drives out all the oxygen and takes its place, forming a stable compound to the detriment of the organic combustions on which the vital processes depend. The globules no longer having the power of absorbing oxygen the animal on which the experiment is made of breathing the vapor of oxide of carbon, speedily dies asphyxiated.

(*a*) Fonssagrives, Thérapeutique générale, Paris. 1875, p. 170.

(*b*) Kerner, the Lancet, 30 janvier, 1872. Blake, on the action of inorganic substances when introduced directly into the blood. (Journal of Anat. and Physiol, No. 12., et Jour. Anat. and Phys., xiv.) Mayet, etud, sur l' action de quelques substances toxiques medicamentenses sur les globules rouges du sang. (Arch de Phys. 1883, t, 1er, p. 374.)

lar medicaments act (those that diminish and those that increase the blood globules), and whether they produce their destructive or reconstituent effect in the blood itself, or in the hæmatopoietic organs.

But in order to understand this special action on the blood corpuscles, therapeutics is to-day in possession of very exact and very ingenious processes, which enable us to estimate with a considerable degree of accuracy, the number of globules in men and in animals, and, as these processes are very easy of execution, everybody ought to be able to put them in practice. The most simple apparatus and the one the most in use is that of Hayem, which has replaced that of Malassez.

This hæmatimeter is composed of a microscope to which is adapted an eye-piece micrometer destined to project on the glass side where the examination of the blood is to be made, the image of a square measuring one-fifth of a millimetre on each side, and divided into sixteen parts. The glass side has a ring one-fifth millimeter in depth cemented to its upper surface; it is, of course, necessary that under the covering glass there shall be a stratum of the blood to be examined of equal depth everywhere. (Fig. 8.)

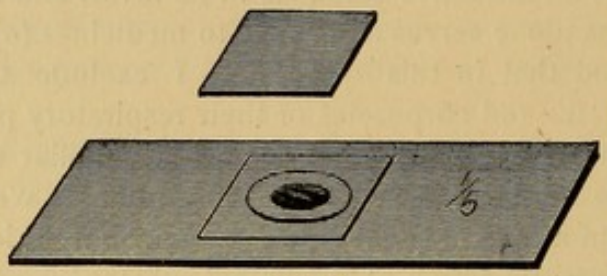


FIG. 8

Then you have two graduated pipettes. One is furnished with a capillary gutta percha tube (fig. 9, A). You prick with a pin the end of the finger, and immediately aspirate with this pipette two cubic millimeters of blood. With the other pipette (fig. 9, B), you take up half a cubic centimeter of artificial serum.[1] This serum you place in the little test tube C, and in this serum you deposit the drop of blood which you have just taken. By repeated aspirations in this mixture of artificial serum and blood you clean your pipette; then, after a homogeneous mixture has been effected by means of your glass spatula, you take up one drop on the end of your pipette and put it in the cell on the glass slide.

When you apply your eye to the eye-piece and survey the microscopic field you will have an appearance before you like that of the following figure (fig. 10) and you will understand how easy it is to count the number of globules. As will be seen, each of the squares is divided in the middle by a bar, which is alternately horizontal and vertical. The globules which are astride the lines which bound the great square, are to be counted apart, and the whole number divided by two before adding to the sum total.

A very simple calculation, or what is more handy still, the examination

[1] This serum is made according to Hayem's formula as follows:

℞	Chloridi sodii	1.00 gr.
	Sodii sulphatis	5.00 gr.
	Bichlorid. hydrarg	0.50 gr.
	Aquæ dist	200.00 gr.

M. This liquid serves for the enumeration of the globules in man.

of a table constructed for this purpose, will enable you, when once you have determined the number of globules in the square, to know the whole number of globules in a cubic millimeter.[1]

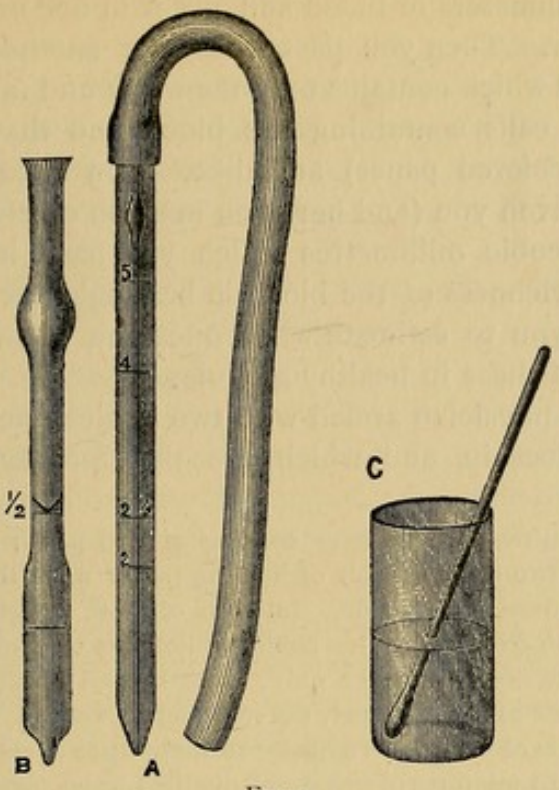


FIG. 9.

If from a medicinal point of view (as having a bearing on the action of medicaments) it is often important to know the number of the globules, it is more necessary to be able to ascertain the quality of the hæmoglobin, the active principle of the corpuscles. In the treatment of anæmia such quantitative analysis is especially necessary. I shall leave to one side the chemical method of dosage of hæmoglobin, which is tedious and laborious, and briefly describe the clinical method, which is comparatively simple.

The clinical methods are quite numerous and are almost all based on the chromometric examination of the hæmoglobin. I shall only refer to Hayem's method. In the employment of this test you have a glass slide, prepared for the purpose, with two cells, separated from each other by a partition. These cells contain just two cubic centimeters of water. Then you require a little cardboard with a series of colored papers of various tints, each one corresponding to a given number of red globules.[2] You place an equal quantity of water in both cells, and then with your pipette you take up

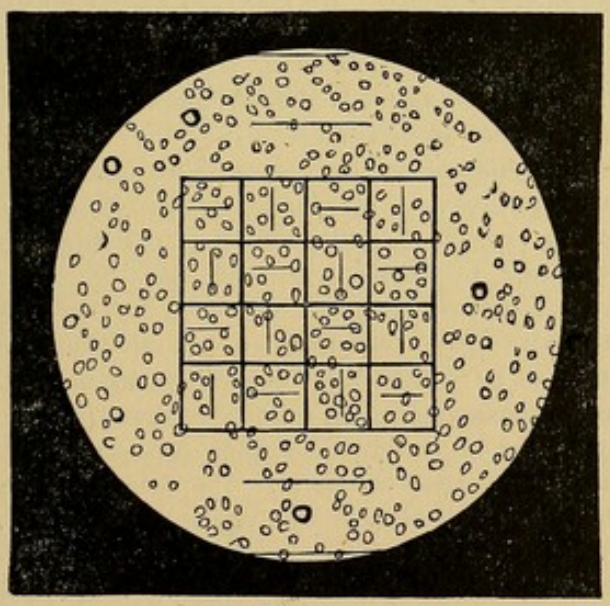


FIG. 10.

[1] The proportion of blood to artificial serum in the mixture is ascertained to be as 1 to 248. A cube with sides 1 millimetre will contain 125 cubes of one-fifth millimetre. To find out the number of globules in one cubic millimetre of blood, multiply the whole number counted in the square of one-fifth millimetre depth, by 125x248, that is, by 31,000.

[2] This is Hayem's scale with the value in healthy blood globules of the different chromometric tints:

Tint No.	1	8,649,000 globules.	Tint No.	6	14,054,625 globules.
" "	2	9,720,125 "	" "	7	15,135,750 "
" "	3	10,811,260 "	" "	8	10,216,875 "
" "	4	11,892,375 "	" "	9	17,298,000 "
" "	5	12,973,500 "	" "	10	18,379,125 "

two to four cubic millimeters of blood and put it in one of the cells, the other containing only water. Then you pass, one after another, a series of colored papers under the cell which contains only the water and take note when the two tints (that from the cells containing the blood, and that from the cell under which you have the colored paper) are alike. You have then, thanks to the table which I have given you (and here you must be careful to divide the whole by the number of cubic millimetres which you have introduced), you have then before you the richness of the blood in hæmoglobine. A very simple calculation will enable you to estimate when once you know the number of the globules, the value of these in healthy globules.[1]

Behold then the physician armed with two clinical methods which demand little or no apprenticeship, and which are therefore available by all; rapid

[1] It will be seen that the chromometer consists of two parts; the first a glass slide in the middle of which are two cells, capable of holding rather more than 500 cubic millimetres of liquid; these cells are fixed side by side. Into one of these troughs a mixture of 500 cubic millimeters of water, with from two to ten cubic millimetres of blood is introduced, into its fellow an equal volume of distilled water only. The second portion of the apparatus is a series of small round discs of tinted paper, ten in number, each of which is attached to the centre of a slip of white card board. The color of these discs is made exactly to match with that of a series of standard mixtures of blood and distilled water, every one of which contains a known number of normal red globules. We place our glass slide over one of these discs in such a way as to bring the latter exactly under the trough filled with pure water; we then seem to have two solutions of hæmoglobin side by side. When the tints are accurately matched, the optical illusion is well nigh perfect, and it is almost impossible to tell which trough contains the blood mixture, and which the water alone.

At this stage of the process we have ascertained that the mixture of 500 cubic millimetres of distilled water with a measured volume of blood containing a known number of red corpuscles per cubic millimeter (for chromometry is always preceded by numeration) corresponds in depth with the tint of the mixture of the same quantity of water with a known number of discs. The latter figure is obtained from a table supplied with the chromometer. Supposing the corpuscles of the blood under examination to be functionally equivalent to normal corpuscles, *i. e.*, contain an equal proportion of hæmoglobin, the number of those in the mixture will be equal to the number represented by the colored disc, and their ratio will equal 1. This figure represents the functional value of a normal corpuscle. Supposing the corpuscles under examination to be impoverished, they will yield a tint equivalent to that furnished by a smaller number of normal corpuscles; the ratio between the figures will be fractional. An example will make the mode of calculation plain: Let us take a specimen of blood containing 3,400,000 red corpuscles per cubic millimeter (the normal average is usually put at 5,000,000). We introduce 6 cubic millimeters of this blood, mixed with 500 cubic millimeters of water, into one trough, and find that the tint exactly matches that of the disc marked 2. On reference to the table, we find that the disc represents the coloring power of 9,730,125 normal corpuscles. Accordingly we conclude that 3,400,000 x 6, or 20,400,000 of our corpuscles only contain as much hæmoglobin as 9,730,125 normal globules. The functional value of each of our corpuscles, referred to unity as a standard, will therefore be represented by the fraction :

$$\frac{9.730.125}{20,400,000} = 0.148$$

The normal average of corpuscles per cubic millimeter is usually put at 5,000,000, in conformity with Welcker's estimate. (Contribution to Clinical Hæmometry, by Baxter & Willcocks. London Lancet, June, 1880. Am. Reprint.)

methods, and which require for their execution only a drop of blood. Remember always that these two procedures should go hand in hand, and that a therapeutic result based simply on the enumeration of the globules is of very little value, for the reason that in order to appreciate the globular richness of the blood it is necessary not merely to know the number of the globules, but also their character, as determined by comparisons with blood that is perfectly healthy.

Let us return to the subject with which we were occupied before this digression. I have told you that the blood serves as a vehicle for medicinal substances. Whether they undergo absorption by the pulmonary mucous membrane, by the stomach or by the skin, they reach in a short time the left ventricle of the heart, from whence they are sent forth to different points of the economy. In my lecture on the lungs from a therapeutic point or view,[1] I stated the circumstances which explain the greater or less rapidity of action of the medicament, showing you that this results from the time it takes the medicinal principle to reach the left ventricle.

In order to render this action more speedy, it has been proposed to make the medicament enter the circulation directly, and intra-venous injections have been recommended. This is a deplorable procedure which should only be mentioned to be condemned, even from the standpoint of experimental therapeutics; in fact, any results obtained in animals from such experiments are altogether untrustworthy.

In fact, we have here superadded to the natural effect of the medicine a direct action on the blood which considerably modifies the symptoms which we observe. When we introduce a medicament by the digestive passages, by the skin or by the lungs, this medicament undergoes in some part of its transit between the point of absorption and the venous network, intimate modifications which for the most part escape us, and which enable it to traverse without danger the blood current. Is it the same when we mingle directly the medicinal solution with the blood in the veins? Assuredly not; and this is so true that when, in administering hypodermic injections, you carelessly make the injection in a vein, you see supervene very grave accidents, however small the dose may have been.

I am well aware that attempts have been made to bring certain of these intravenous injections into general practice, and we have seen Oré, of Bordeaux, propose to substitute for chloroform anæsthesia intravenous injections of chloral. The accidents which followed these injections caused them to be promptly abandoned, and even in cases of hydrophobia where they have been employed by Bucquoi, nobody now-a-days thinks of using them.

It is of course understood that this absolute condemnation of intravenous injections extends only to medicinal substances. It is not so with the question of supplying to the blood or to the economy nutritive elements which are wanting, and transfusion within certain limits is a justifiable and thoroughly rational therapeutic means.

[1] Vol. II. Lecture—The Lungs from a Therapeutic Standpoint.

Transfusion originated in experimental therapeutics. This is a fact worthy of note, especially if you take into account the epoch in which it was first practiced. Indeed, before Denis, of Montpellier, the 15th of June, 1667, caused this operation to be performed by Emmerez, transfusing the blood of a lamb into a male patient, Lower, then King, had the year preceding shown that it was possible to transfuse the blood of one animal into another animal of the same or of a different species without any injurious results; from this date till the commencement of the present century transfusion like every other new therapeutic measure, was much abused, and it was imagined that all diseases including insanity could be cured by it, and it became even necessary to pass an act of parliament to oppose the misuse of the operation.[1]

From 1815 to 1830 transfusion issued from the oblivion into which it had

[1] Transfusion is of very ancient date, having been practiced centuries before the Christian era. It was not, however, till about the middle of the 17th century (1666) that the first scientific treatise on the subject appeared. It was the work of Lower, who put the artery of one dog in communication with the vein of another dog. King modified the operative procedure of Lower, and using animals as the subjects of his experiments, made the transfusion from vein to vein, and practiced transfusion between animals of different species, as the calf and the sheep. In the same epoch Denis, of Montpellier, taking the previous experiments for his guide, caused transfusion to be performed on a man by Emmerez, June 15th, 1667, making use for this purpose of the blood of a lamb. History has preserved the report of this case. The patient was a young man of sixteen attacked by a fever with stupor, and which was believed to be typhoid fever; he had been bled twenty times. Finally 90 grammes were taken from him, and a transfusion was made of 270 grammes (9 fluid ounces) of arterial blood from a lamb; the patient got well.

Lower and King shortly after reproduced in human subjects the therapeutic experiment of Denis and the operation from henceforth became very famous. In Italy, about the same date (1668), transfusion was practiced from man to man by Fracassati, Riva and Manfridi.

It was proposed by these transfusions to modify the character of the blood, which was thought to be altered, and this method was applied to a great number of affections, and particularly to madness. The operation speedily became abused and leagues were formed against it, and the intervention of legislation was sought; by an act of parliament the practice was forbidden. Thus transfusion fell into disrepute and almost complete oblivion till the year 1825. Nevertheless, in 1788 there appeared the work of a physician of Modène, Michel Rosa, who had made numerous experiments on animals, transfusing the blood of one animal into an animal of another species.

In 1815 this question was agitated again, and James Blundell counselled to employ a syringe to take up the blood and inject in the veins. Dieffenbach, in 1828, treats of two kinds of transfusions; immediate transfusion, when the artery of one animal communicates with the vein of another animal, and mediate transfusion, when a syringe is used. He was the first to recommend the use of defibrinated blood. In fine, coming down to our own times, since 1860 this question of transfusion has been taken up anew, and not only has the manual procedure been perfected, but the numerous physiological problems presented by the operation have been studied, experimentally and physiologically. (*a*)

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a Blundell, *Researches physiological and pathological on transfusion of blood*, London, 1824.—*Transfusion* (*in the principles and practice of Obstetric medicine*, p. 209).—Dieffenbach, *Die transfusion des blutes*, Berlin, 1828, et trad. in *Journ. complétent. du Dict. des sc. méd.*, t. XXXV, 1829.—Awater, *Zur Transfusion* (*Beitræge zur jeburtshülfe, and gynækologie*, t. II, gasc. 3, Berlin, 1875.—Gesellius, *Die transfusion des blutes; eine historische, kritische, und physiologische studie*, Saint-Pétersbourgh et Leipzig, 1873.—Jennings, *Transfusion. Its history, indications and modes of application*, London, 1883.

fallen; works appeared by Hufeland, De Graefe, De Boer, by Blundell and Bischoff especially, and the action of defibrinated blood was studied. Then transfusion fell again into neglect, to be taken up a few years ago at the point where it started, and while Oré, Gessellius, Hasse and Albins advise the direct introduction of lamb's blood into human veins, Landois, Panum, Ponfick, Albertoni, Beel and Kuster have pointed out the dangers of this practice.[1]

To-day, notwithstanding the efforts made by Roussel to perfect the instrumental apparatus (which he certainly has modified in a happy manner) transfusion is an operation exceptionally performed, and there certainly are among you few that have ever been present at the operation.

Nevertheless, this question of transfusion is one of the most important, and the recent researches of Hayem have enabled us to elucidate many obscure points. I shall then rapidly review this interesting topic, and I shall especially dwell on the three following points: the kind of blood which we ought to employ, the operative procedure which we should make use of, and the indications and contra-indications of transfusion. Struck by the inconveniences and difficulties which often arise in the transfusion of human blood, the proper person from whom to obtain the blood not being always at hand; guided, moreover, by theoretical considerations which require that absolutely healthy blood should be used in the operation, certain physicians, in the early history of transfusion, made use of the blood of the lamb. You have seen that this

[1] Gessellius, in 1873, reverted to the procedure of Denis, of Montpellier, counselling to employ the blood of a lamb, not defibrinated. Hasse proposed and practiced the direct inoculation of lamb's blood, connecting the artery of the lamb with the vein of the man. He describes minutely the operative procedure. Oré is one of the partisans of the transfusion of lamb's blood. He pretends that such accidents as have been reported from the transfusion into the human subject of the blood of different animals are due to the too great quantity of blood introduced, or to the too great rapidity of the operation. He claims that the blood of animals is preferable to human blood for transfusion, and counsels transfusion in all desperate cases. At the same time, in the case of transfusion performed by Oré the individual succumbed, although only 35 grammes (or about an ounce) of blood had been injected; the death was by asphyxia.

Hasse of Nordhausen, has practiced the transfusion of the blood of a sheep into the human subject 52 times, and has had but one unsuccessful case.

Among these observations we shall cite the one which had for subject Dr. Redtel, of Cohen, a phthisical patient affected with dysphagia. The patient was slightly if at all benefited by the operation.

Kuster, of Berlin, has taken a stand against transfusion, and in particular against transfusion of the defibrinated blood of the sheep. He has observed grave accidents after these transfusions.

Brugelmann, of Cologne, on the contrary, affirms that arterial transfusions of lamb's blood, after Hasse's method, give excellent results in phthisis.

Albertoni maintains that the transfused blood of an animal of the same species serves to form new blood, and constitutes a sort of sanguineous grafting. According to this authority the transfused blood of an animal of a different species is injurious, and such blood has toxic effects. (*a*)

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a Albertoni, *Que deviente le sang transfusé* (*Rendiconto delle recerche sperimentali esegulte nel gabinetto di fisiologia delle R. Universita di Siena*; Milan, 1876).

practice was revived in France latterly by Oré, and in Germany by Gessellius and Hasse, in Italy by Albini, and in America by Carl Proegler, but these transfusions were not always followed by happy results. There have been observed to follow them, fever, hæmaturia, albuminuria and even death. The cause of these accidents has been indicated to us by the curious experiments of Landois and Ponfick, which have shown us the solvent action of the blood of animals of different species, the one on the other; and while Albertoni and Landois described the embolic infarctions noted at the autopsy, infarctions produced by the agglomeration of heterogenous corpuscles, Biel gave us a chemical explanation of the toxic action of the blood of animals of different species, so that to-day this question seems to be definitely settled, and the transfusion of blood from animals to the human subject ought to be completely abandoned. Human blood, then, is the only proper material for transfusion.[1]

Here a discussion quite as important has arisen between the partisans of whole blood and those of defibrinated blood, and this question has been especially the subject of labors by Professor Hayem. Some, as Claude Bernard, Magendie, Jullien, in France, Mittler, Demme and Madier, in Germany, have maintained that by defibrination you destroy the vital properties of the blood.[2]

[1] Ponfick has made numerous experiments on transfusions. He has arrived at this conclusion that the foreign blood can be of no utility; it is even dangerous, he says, for it is immediately destroyed and the products of its destruction may have a toxic action.

Landois has studied the action of the blood of different animals when transfusion is made from one species to another. He has injected the blood of mammals into the veins of frogs, the blood of hares into dogs, of dogs into cats, etc. He has shown that according to the animal experimented on, the globules injected are more or less rapidly dissolved. Dog's serum has the greatest solvent power; hare's is the least active. The globules injected present a variable resistance according to the species; those of the dog and cat are very refractory, those of the hare dissolve rapidly, and when injected in a dog they disappear in a few minutes, and hæmoglobinuria, lasting several minutes, ensues. The globules of the animal under experimentation also undergo a certain solution. Thus the blood of a dog injected in a hare causes dissolution of the globules of the latter.

Landois in a later work takes a positive stand against the transfusion into the veins of a human subject of animal blood, and explains the accidents which follow as resulting from embolic obstructions from the agglomeration of heterogeneous globules.

According to Biel, sheep's blood is rich in alkaline, earthy carbonates and carbonate of soda, and when introduced into the blood of a man, it precipitates the earthy phosphates, causing embolisms. (*a*)

[2] Magendie, after bleeding animals and injecting their own defibrinated blood, always observed fatal accidents, and hence he opposed the defibrination of blood. Claude Bernard, Behier, and Jullien who considered this operation as unphysiological, have also maintained that defibrinated blood has lost its vital properties. This opinion has been supported by Mittler, Demme, Madier and Roussel. On the other hand Vorm Muller, who has made many experiments with defibrinated blood, counselled this defibrination as rendering the operation easier, the oxygenation of the blood more prompt, and as being opposed to the embolic accidents which supervene in consequence of the presence of clots. Casse maintains

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(*a*) Ponfick, *Experimentelle Beiträge zur Lehre von der transfusion* (*Arch. für Path., Anat. und Phys.*, t. LXII, p. 273).—Landois, *Würdigung der Thieblut-transfusion beim Menschen* (*Centralbl.*, 1875, No. 1).—*Transfusion mit dun Blute verschudener thierarten* (*Centralbl.*, 1874, No. 56, p. 883-885, 897-900.

Others, on the contrary, like Vorm Muller, Landois, de Christoforis, Casse and Hayem, have shown that defibrinated blood is not attended with the risk of embolism and the grave danger therefrom resulting, and that it possesses all the revivifying properties of whole blood, and promotes reconstruction of the blood when used in transfusion. Defibrinated blood may then be employed in transfusion, but in my judgment whole blood is preferable, especially if this transfusion be made without the possibility of admixture with air. If defibrinated blood does not "graft" well, whole blood on the contrary may be utilized in great part, and the experiments made by means of the apparatus of Roussel with whole blood show that the cipher of globules rises immediately after the operation, and that this augmentation is maintained for several days.

It is well understood that when the question of the quality of the blood to be used is once decided, the transfusion is to be made in the veins and not in the arteries, although certain authorities as Hüter, Petrognio and Wing claim good results in transfusing from artery to artery, alleging in favor of transfusing in this way that you thus escape the danger of pulmonary infarctions and especially the entry of air in the veins. By this method, however, you run the risk of obliterating the arteries; a greater pressure is demanded to cause the transfused blood to enter the circulation, and grave local disorders are likely to ensue.

Progress in the manual procedure of transfusion has been especially in the direction of improvements in the instrumental apparatus, and to the pumps of Moncocq and Belina (more or less perfected by Charrière, Collin and Matthieu), which draw up the blood from vessels in which it has been exposed to the air to inject it in the veins of the patient, apparatuses have been substituted which enable us to transfer the blood from one party to the other without any exposure to the air. To the simple gutta-percha tube, which Postempski and Luciani placed between the veins of the donor and the receiver, various agents of propulsion have been appended, and it is thus that are constructed the transfusion instruments of Schliep, Neudorfer and Roussel. The latter is the most complete, and I may safely say it is the one most in use at the present day. I show you here one of Roussel's instruments. It consists of a soft tube of caoutchouc, with an aspirating and force-pump, P, having a capacity of just ten grammes. This tube terminates at one extremity by two bifurcations, A

a similar opinion. On his part Landois has shown that whipping (to remove the fibrine) does not destroy but a small quantity of globules, and Christoforis affirms that the globules all remain intact despite the whipping. Hayem has repeated all these experiments and he has shown that from an experimental point of view it is necessary to make a distinction between defibrinated injections made with an animal's own blood, and those made with the blood of an animal of the same species. The former speedily entail diminution of the globules and hæmatoblasts; injections made with the defibrinated blood of an animal of the same species energize the process of blood renovation, and the hæmatoblasts are observed to multiply prodigiously. (Jullien, Thesè de Paris, 1875; Landois, on Transfusion of Blood, Leipzig, 1875; Behier, Revue Scientifique, 1874; Vorm Muller, Transfusion und Plethora, ect., Christiana, 1875; Casse, on Transfusion of Blood, 1874; De Christoforis, on Transfusion, etc., Ann. Univ. di Medicine Chir., Vol. 233–234, 1875; Roussel, on Transfusion, Arch. Gen. de Med., 1876.)

and A'. An ingenious stop-cock C enables us to send blood or water at pleasure into one or the other of these bifurcations. The most important part, however, is the cupping apparatus I V, which enables us to practice venesection with the lancet I, without the possibility of contact with the external air. This lancet terminates in a cutting-blade, like an inverted V. This cupping machine is placed over the vein of the donor of blood; the ball B is employed to exhaust the air, and the bell M, with the stop-cock C, is plunged into warm water.

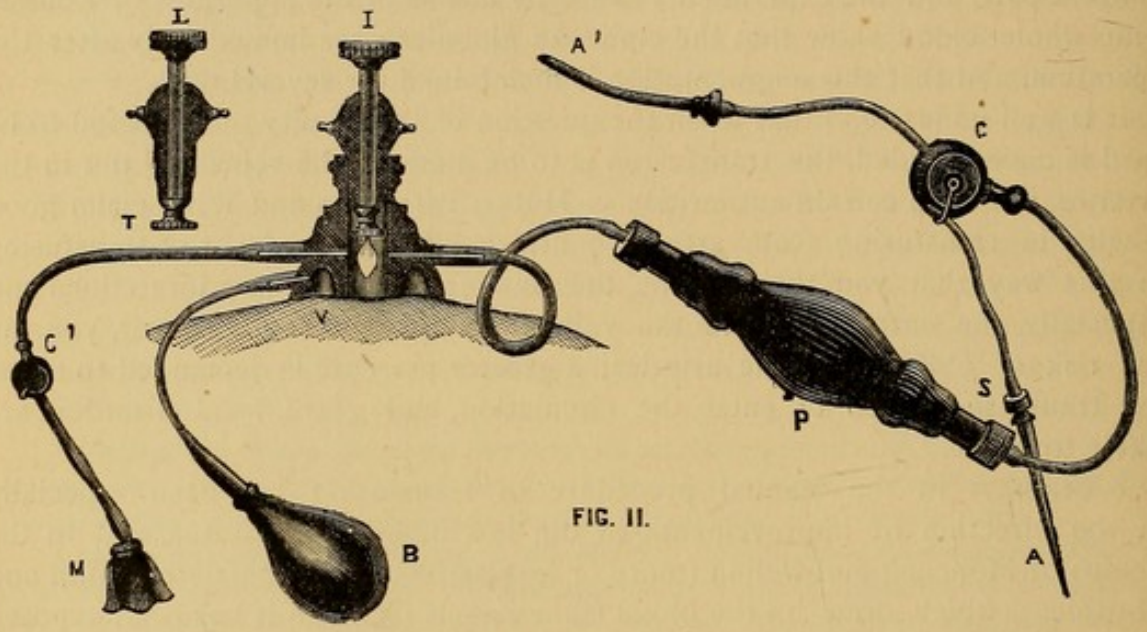


FIG. II.

You will readily understand the way in which this apparatus is managed. The vein of the patient is first dissected out and well exposed. Then the cup is applied to the arm of the person who furnishes the blood, and right on a level with the point where the bleeding is to be practiced a stream of warm water is made to traverse the entire apparatus. A V-shaped incision is made in the exposed vein of the patient, and one of the canulas of the transfuser, full of warm water, is introduced and fastened into the vein; the communication is closed, a smart tap is given to the lancet I, the pump is worked, and presently there is seen to flow by the distal extremity of the apparatus, first blood mingled with water, then pure blood. At this moment you turn the stop-cock C, and the blood passes freely from one arm to the other.[1]

As to the quantity of blood to be transfused, this is very variable; it is impossible to fix in advance the minimum figure. What we know is, that, from an

[1] Roussel makes many stages in the operation :

First Stage—Get ready the vein of the patient.

Second Stage—Fix a firm ligature above the elbow of the donor of blood; place the exhausting cup over the projecting vein, and arrange the porte-lancet, whose cutting blade must be regulated according to the depth you wish to penetrate.

Third Stage—Pump up the water in order to clear the apparatus of air ; introduce the afferent canula, full of water, into the vein of the patient; close the canula; close the water aspirator (stop cock C1).

Fourth Stage—Give a smart tap on the head of the lancet ; the blood drives out the

experimental standpoint (as the curious experiments of Eulenbourg and Landois have shown), one may augment the mass of blood from 80 to 83 per cent. in animals without producing any accident, and that in clinical practice it suffices in cases of extreme anæmia, to transfuse very small quantities to restore the cardiac pulsations and bring the patient back to life.

Transfusion is an operation which may be attended with accidents. Thanks to the very perfect apparatus of Roussel, we may avoid the gravest of these accidents, that is, the introduction of air into the veins and the production of emboli. There are, however, other accidents which are not so easily escaped. I refer particularly to the lesions of the vein in which is placed the transfusion-canula. This is one of the most formidable parts of the operation, and, notwithstanding the improvements in the canula devised by Istomin and Welikig, phlebitis often occurs as a sequel of transfusion. Sometimes, moreover, it happens that the blood, instead of penetrating the vein, escapes into the cellular tissue, and produces thromboses and serious displacements and lesions. These are, however, accidents that belong to every operation on the circulatory system, and they ought not to lead us to abandon transfusion. It is necessary, moreover, to bear in mind that there almost always comes on, after transfusion, a febrile paroxysm, characterized by chills, elevated temperature and profuse perspiration.[2]

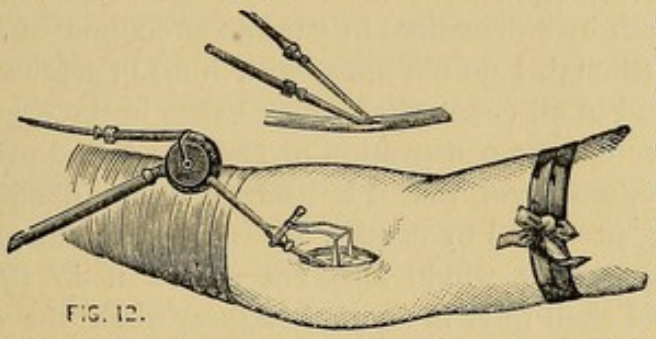


FIG. 12.

water, which presents itself, red, at the exit tube; close the exit tube, and open the afferent canula.

Fifth Stage—Transfuse slowly, ten grammes at a time, five or six times a minute, till a sufficient quantity has passed.

The dressing is simple enough, a figure-of-8 bandage being applied to the two arms.

Roussel always takes pains, before the operation, to iscæhmiate the hand and forearm of the patient by a Martin bandage, and he afterwards puts a tight band around the middle of the forearm. (The bands above and below the elbow render the vein turgid, and prevent escape of much blood during adaptation of the canula.) He hooks up and opens the vein with scissors, making a flap like the letter V, then introduces and fastens the canula. This is kept in position by a *serre fine*. The two bands are removed the moment the transfusion commences.

From a table published by Roussel, brought down to May, 1883, we find that he has performed transfusion 62 times; 33 of these were in surgical cases (traumatic, puerperal, chronic hœmorrhages, suppurations, pyæmia). Of these 33 cases, 24 are reported as successes, 7 as unsuccessful, and 2 as doubtful. Twenty-nine cases out of the 62 were medical (leucocythyæmia, chlorosis, inanition from dementia and other causes, cachexia from grave fevers, and blood-poisoning). Of these 29, 13 are reported as successes, 10 as unsuccessful, and six as doubtful (*a*).

[2] The fever after transfusion is due, according to Liebrecht, to stagnation of the blood in the venous system (Jour. des Sc. Med de Broux aller. 1875).

(*a*) Roussel of Geneva, Direct transfusion of living blood.—(Gaz. des Hôp, Feb. 18th, 1882).

What results may you obtain from transfusion? To-day, thanks to the decisive experiments of Hayem, it may be affirmed, first, that defibrinated blood introduced into the organism, if it does not "graft" with the blood of the individual, nevertheless favors the renewal of the blood; secondly, that whole blood may be utilized in part, if taken from an animal of the same species.

These scientific data enable us to judge the indications and contraindications of transfusion. It is indicated in all cases of extreme anæmia, except where the economy is still capable of aiding in the renovation of the sanguineous fluid. Thus, according to Kuster[1] we should resort to transfusion in anæmia from hæmorrhages, or other wasting discharges, in acute affections which threaten death by exhaustion, in curable affections of the digestive system, and he adds (though I do not agree with him) in septicæmia, and pyæmia. It is contraindicated in all cases where there exists in the organism an incurable lesion, directly affecting the constitution of the blood, and preventing its reproduction. I believe, moreover, that it is useless, if not dangerous, in cases of profound cachexia, produced by cancer, advanced tuberculosis, and disorganizations of the kidneys. I would also not advise it in the anæmias called essential, to which I shall refer in another lecture, when the organism, smitten in the hæmatopoietic centres themselves, finds itself impotent to reconstruct the blood globules. On the other hand, in such cases as those mentioned above, where the patient is almost moribund from traumatic or post partum hæmorrhages, and from fibroid tumors, epistaxis, etc., I would resort to it, all other therapeutic resources having failed.

You understand that I do not favor transfusion in general diseases and in most cases of blood-poisoning, such as pyæmia, septicæmia and all affections where microbes play a preponderant part. I make only one exception among the blood empoisonments; it is that produced by carbonic acid. It is easy to comprehend how, in carbonic-acid poisoning, mortal accidents may be averted by substituting living globules for globules smitten with death, and by favoring the renovation of these sanguineous elements. A great number of facts of this kind have been reported where, indeed, complete restoration has rarely been noted by transfusion, but where temporary amelioration has generally been obtained, as Traube, Wagner, Moller, Kuhn, Belfrage, Maurice Raynaud have shown. In a word, save in this particular case of blood intoxication, one cannot in general hope by transfusion to substitute healthy blood for vitiated blood, and this for the reason, to-day experimentally made certain, that whatever may be the operative procedure employed, only an incomplete grafting of one blood with another blood can be obtained.

Latterly in order to avoid the introduction of air in the veins, it has been proposed to inject the blood in the cellular tissue, or in a serous cavity, as the peritoneal; I avow that such procedures seem to me quite inapplicable to man. While recognizing the fact that subcutaneous injections of blood generally

[1] Kuster, *Ueber die directe arterielle, thierblut-transfusion* (*Arch. f. klin. chir.*, XVII, 3e fasc., p. 384).—Panum, *De l'indication et de la méthode de la transfusion* (*Nordiskt medicinskt Archiv.*, t. VII, no 3, 1875).—Casse, *De la transfusion du sang* (*Mém. de l'Acad. de méd. de Belgique*, 1874).

undergo in the cellular tissue slow and progressive absorption, it seems to me difficult to believe that this absorption can be of any utility in the renovation of the blood, and I am of the opinion of Casse that these injections void of all therapeutic value, determine often grave local accidents.[1]

If we may rely on the experiments of Obolinski, Nikolski, Bizzozero and Golgi, intra-peritoneal injections of blood have in future a store of some promise. These experimenters have, in fact, always remarked in animals a rapid absorption of blood injected into the peritoneal cavity, corresponding to an augmentation in the number of globules and their richness in hæmoglobin; but while admitting these facts as demonstrated, it seems to me difficult and impracticable to apply a procedure of this kind, as a therapeutical resource, to a human patient, especially when you reflect that for venous transfusion you are substituting the dangers of peritonitis, quite as serious as those of phlebitis.[2]

It is often difficult in transfusion to find the requisite blood and in sufficient quantity for the performance of this operation ; therefore of late years it has been proposed to substitute milk for blood. This is a modification of transfusion which Hodder, of Toronto, had already put in practice in 1850 in a case of cholera, and which Howe, of New York, employed in 1877 in cases of phthisis. It is, however, especially Dr. T. Gaillard Thomas who gave popularity to this method, which he considers superior to the tranfusion of blood.[3]

One cannot protest too strongly against such affirmations. Not only are injections of milk useless as far as renovation of the blood is concerned, but they are injurious and dangerous. The experiments of Brown-Sequard, of Laborde and of Culcerq are absolutely demonstrative of this, and the cases of death which have happened during these injections confirm in every respect the

[1] Casse, on the Value of Subcutaneous Injections of Blood, Bull. de l. Acad. Med., Belgique, July, 1879.

[2] Vide Bizozzero and Golgi, Transfusion of the Blood into the Peritoneal Cavtiy (L. Obsérvatore, Nov. 4, 1879, p. 689). Obolinski, Experimental Researches on Peritoneal Transfusion (Centralblatt, f. Chir., No. 19, 1880). Nikolski, Influence exerted by Transfusion of Blood into the Peritoneal cavity, on the number of blood corpuscles and the quantity of hæmoglobin contained in the blood in circulation (Wratsch, 1880, No. 4.)

[3] Hodder, of Toronto, in 1850 performed the intra venous injection of milk in a patient affected with cholera. Howe, of New York, in 1877 practiced these injections in a case of phthisis in the last stage; he injected 200 grammes (over six ounces) of goat's milk into the cephalic vein. Dr. T. Gaillard Thomas has practiced the intra-venous milk injections twelve times, and has had but one case in which any accidents occurred. The milk should be drawn just at the moment of the operation, and not more than eight ounces should be injected at one time. These injections are especially applicable to cases of grave hemorrhage, Asiatic cholera, typhoid fever and pernicious anæmia. Thomas considers these injections infinitely easier of administration than those of blood. Wm. Pepper has also performed these transfusions of milk in two cases ; in one of these the patient died suddenly during the third injection. He concludes, however, that these injections of milk give results as satisfying as those of blood. He does not think that there is any danger of embolism. Brinton is of the same opinion. Brown-Sequard considers these lacteal transfusions as of considerable utility. In his estimation the morphological constitution of the figured elements of the blood plays a secondary rôle in the phenomena of transfusion.

experimental data, showing us that milk corpuscles act in these cases by determining emboli, which are generally fatal.

In fine, it has been proposed in certain cases to inject into the blood principles which are lacking in that fluid. Thus, in cholera, where the symptoms of algidity are produced by the elimination of serum in great quantity in the stools, injections of water and of serum have been made. I myself put in practice this method in the epidemic of cholera which I was enabled to observe in 1872 and 1873 at the Hospital Beaujon, thus renewing a practice which was employed during the first outbreak of cholera in Europe in 1830 by Jachnichen, of Moscow, and in 1832 by Latta, of Scotland, and by Magendie the same year in France.[4]

Less successful than Lorain, who, during the epidemic of 1868, obtained in this very hospital (St. Antoine) a single cure from these intra venous injections of saline solutions, I have been able to realize only a temporary amelioration, and I believe that this results from the difficulty we meet with in the construction of an artificial serum. In fact, in spite of the complex formula of this solution which I used, I could not prevent the dissolution of the blood globules, nevertheless I persist in believing that in the final periods of cholera these in-

Culcerq has experimented on animals with the intra-venous injections of milk. He has shown that these injections may be often dangerous, and that the accidents observed are to be attributed to fatty embolisms (*a*).

[4] Saline solution of Dujardin-Beaumetz for intravenous injections in cholera, founded on the analysis of blood serum by Dumas:

Distilled water	1000.00 gr.
Chloride of sodium	3.10 gr.
Phosphate of sodium	0.50 gr.
Carbonate of sodium	
Sulphate of potassium	
Lactate of sodium	ää 1.00 gr.

In making these injections all that is necessary is a syphon, terminated by a fine metallic tube which is introduced into the vein.

[The solution for intravenous injection of Hayem is as follows (Gazette Medicalé de Paris, September 13, 1884):

℞	Water	1.000
	Chloride of sodium	5
	Hydrate of sodium	5
	Sulphate of soda	25

M. It is, according to Prof. Hayem, advisable to inject a quart of this solution. It is especially recommended in the algid stage of cholera.]

(Dujardin-Beaumetz: "Intravenous Injections of Water and Saline Solutions in the Treatment of the Period of Algidity of Cholera." Union Medicalé., 1873)

(*a*) T. Gaillard Thomas: "Intra venous Injections of Milk as a Substitute for the Transfusion of Blood," N. Y. Med. Jour., May, 1878. Bullard: "A Successful Case of Intra venous Injection of Milk," N. Y. Med. Jour., April, 1878. Pepper: "On the Intra venous Injection of Milk in Functional and Organic Anæmias," Med. Record (New York), Nov. 16, 1878. Brinton in N. Y. Med. Record, Nov. 2, 1878. Howe in the Medical Record, Dec. 7, 1878. Brown-Sequard: "On Transfusion of Milk in the Human Subject," Gazette Med. de Paris, No. 43, 1878. Culcerq: "Experiments on the Intra venous Injections of Milk," These de Paris, 1879.

jections may render service, and even result in recovery. Quite recently Jennings has taken up these intra-venous injections of saline solutions and has endeavored to bring them into general use.[1]

Such are the considerations which I desire to present *à propos* of the blood from a therapeutic standpoint, but I have only unfolded a part of my subject in this lecture. It remains to examine what happens when blood is removed from the economy, that is, to study the rôle of blood-letting in therapeutics, which will be the subject of my next iecture.

[1] O. Jennings, On Transfusion, London, 1883.

[Recently the subject of intravenous saline injections has been brought prominently to notice by Szuman, in Berliner Klin. Woch., and Bischoff (Bull.Gen.de Ther. t cv, p. 190 q.v.) Szuman's case was that of a boy æt. 15, who had sustained a compound fracture of the humerus, and fractures of the right femur and tibia. When seen he was in a state of collapse, the face, lips and conjunctiva bloodless, and he was almost pulseless. Resection of the humerus was performed; the collapse became so great that artificial respiration was resorted to; food and stimulants could not be given by the mouth on account of vomiting. As the patient seemed to be dying of cerebral anæmia, intra venous injection of saline fluid was made— ʒ iss common salt, gr. xv of carbonate of soda in ℥ xxxivss of distilled water. The saline solution was injected by means of a simple extemporized apparatus of gutta percha, with a syringe and canula. After ℥ xxiv were injected the pulse fell from 144 to 112 and he began to complain of feeling cold; the injection was discontinued and the ligature removed from the vein. From this time he steadily improved and finally completely recovered.—Med. News, August 18, 1883.

The case of Dr. Bischoff's was one of postpartum hæmorrhage with complete collapse. An injection of 200 grammes of a six-per-cent. solution of common salt was made into the peripheral extremity of the divided radial artery. The solution was rendered alkaline by the addition of two drops liquor potassæ. Amelioration was immediate and recovery complete. It would seem from these experiments that the benefit derived from transfusion is largely, if not chiefly, due to the restoration to the circulation of its *quantitative* equilibrium, and that weak saline solutions are the best for this purpose. Still more recently remarkable instances have been recorded by Mikulicz of Cracow, and Fox of Laibech, in which life was saved after very profuse hæmorrhages by intra venous injections of common salt solution; in one instance twenty ounces, in another eight-and-a-half. Wikulicz's solution consists of: one part carbonate of sodium, six parts of common salt, and 1,000 parts of thoroughly boiled water, injected into the medium basilic vein. He used a funnel with rubber tube attached to the canula.—TRANS.]

ON BLOODLETTING.

SUMMARY—Bloodletting—History—Popularity and Decadence of Bloodletting—Divisions—Local Bleeding—General Bleeding—Arteriotomy—Phlebotomy—Manual Procedure of Bleeding—Experimental Researches—On the Influence of General Bloodletting—Action on the Blood—Modifications of the Globules—Modifications of the Serum—Influence on the Circulation—Modifications of the Pulse—Modifications in the Speed of the Circulation—Modifications of the Mass of Blood—Modifications of the Blood Pressure—Influence on the Respiration—Influence on the Nervous System—Influence on the Nutrition—Conclusions—Therapeutic Applications of Bloodletting—Local Bleeding by Cupping—Leeches—Artificial Leeches—Mode of Application—Physiological Effects—Therapeutical Applications.

GENTLEMEN: From a medical point of view there is no history more interesting alike to philosopher and physician than that of bloodletting. It is a history replete with useful lessons. We see there illustrated the truth that when the spirit of system and of routine takes possession of a philosophical or medical doctrine, the results are distorted and misinterpreted, and the practical outcome is barren of good fruits and baneful. If, moreover, the word of the master is worthy of respect, hot-headed enthusiasts who urge to riot and madness every good measure are always to be distrusted; finally, enlightened observation and the true scientific spirit ought continually to submit to the test of the experimental sciences the data furnished by tradition.

We are ignorant of the origin of bloodletting; we only know that it was in use at the dawn of our historical era. Eleven hundred years before Christ, Podalirius is said to have practiced it at the siege of Troy. It is probable that it was already in vogue among nations where civilization was more advanced, and that in Egypt, India, and China bleeding was a recognized therapeutic measure.

However this may be, Hippocrates, in his writings, speaks of bloodletting and its indications. Afterwards Aretæus and especially Galen insist on the importance of bleeding, and thenceforth down to the seventeenth century venesection was practiced in accordance with the principles which Hippocrates and Galen had laid down. It was as much as ever, if during this long space of time certain opponents, Van Helmont and Porcius in particular, dared lift their voices in protestation against the abuse and the uselessness of bloodletting.[1]

[1] The following passage from one of the writings of Hippocrates makes particular mention of bloodletting: "A patient had borboygmi and pain; had taken emetics without relief; was bled by turns from each arm to syncope, and got well."

From the time of Hippocrates, bloodletting has given rise to very many discussions; nevertheless, owing to the influence of Galen and Celsus, who were for ages the teachers in medicine, bleeding was adopted as a treatment applicable to a great number of complaints. Galen made the following reservation: not to bleed children under four years of age, and rarely to bleed old people.

It was in the seventeenth century that the contest between the adversaries and the par-

They were, however, little heeded, and the majority ranged themselves on the right side of Botalli, who compared diseased blood to stagnant water in a well, which becomes more and more pure the more you take out. It is precisely so, said Botalli, with the blood and with bloodletting.[2]

It was, however, in the seventeenth century that phlebotomy attained its zenith, becoming in France, as in England, the unique system of treatment of all diseases—children and old men alike were bled; the newborn babe even was not spared, and blood was taken by *quarts*. Guy Patin bled his *confrère* and friend Mentel thirty-six times in succession, and caused himself to be bled seven times for a simple cold. Pitcairn drew more than five kilogrammes from a rheumatic patient, and Gregory, for a pleurisy gave issue to more than six kilogrammes. Medicine at this epoch was reduced to these three great elements: purgings, bleedings, and clysters; and the response of the bachelor in

tisans of venesection took on the most vehemence, and a perfect furor for letting of blood seized certain physicians. Guy Paton was the most ardent of these enthusiasts. He bled his *confrere* Mental thirty-two times consecutively, and bled himself seven times for a cold. He would bleed infants at the breast, and even aged people.

Chirac went further, if possible, than Guy Paton, and to him is ascribed that celebrated utterance, "Small-pox, I will make you used to the lancet."

Pitcairn boasted of having drawn twenty English pounds of blood from a patient affected with acute articular rheumatism.

Tweedie, in a case of pericarditis, took first 421 grammes, then 720 grammes, then 960, then 1200, and finally 1440, before the patient was relieved.

Gregory caused a pleuritic patient to lose 5520 grammes in the course of several days.

There was a revival of excessive bleeding under the influence of Broussais at the beginning of this century, and Bouillaud, with his bleedings, "blow after blow" (*coup sur coup*), was the last representative of this period, which Schneider has characterized as the period of *hæmatomania*.

The ancients practiced phlebotomy with various instruments; generally a spear-pointed fleam, called *fossorium*, was thrust into the vein. This instrument is still used by veterinary surgeons when they bleed horses. One of these *fossoria* was found in the ruins of Pompeii.

They also used an instrument called *scalpellus*, with which they opened the vein. Galen employed a cutting implement which he described under the name of *phlebotomon*. Albucasis made use of all three kinds, the *scalpellus*, the *fleam*, and the *phlebotomon*.

The words *lance* and *lancet* were not introduced into surgery till about the year 1200. (*a*)

[2]Botalli was a physician of the University of Paris; afterwards (from 1571), Physician to Charles IX. His controversy with the faculty, and in particular with Donatus, has become famous. The latter reproached him with the hardihood of his bloodlettings. He was one of the greatest partisans of phlebotomy. He bled all his patients to excess, basing himself on the principle which he enunciated to his friend Etiénne Pasquier: "The more you withdraw of stagnant water from a well, the more of pure water flows in to take its place. The more the wet-nurse is sucked by the infant, the more milk she has; the like holds good with bloodletting." (*b*)

(*a*) Journal, Considerations Relative to General Bloodletting, 1867. Brichetau, Bloodletting, Its Physiological Effects and Therapeutic Indications, Bull. de Thér., lxxv. p. 261, 1868. Article Saignèe, in Dict. Encyclop. des Sciences Méd. Saucerotte, Bull. de Thér., li., p. 145.

(*b*) Etiénne Pasquier, Lettres liv. xiv., lettre 19; Botalli, "On the Cure of Disease by Bloodletting, including the Opening of Veins, Scarifications of the Skin, and the Application of Leeches." Antwerp, 1583.

the immortal comedy of the *Malade Imaginaire* is in exact conformity to the prevalent practice of the epoch, when he replies to all the questions propounded to him by these three lines :

Clysterium donare,
Postea seignare,
Ensuita purgare.

When one thinks of the prodigious number of purges ordered, the enormous quantity of lavements administered, and the sanguinary floods which phlebotomy produced in this and the succeeding epoch, one can but exclaim with Bouley, physician to the hôpital Necker, in view of such heroic medication: "A sick person has more vital resistance than one would think !"

This mania for bloodletting, after having abated for a number of years, burst forth with new ardor at the commencement of the nineteenth century, and Bosquillon with his humoral ideas, Broussais with his physiological doctrine, Bouillaud with his system of bleedings, *blow upon blow* (coup sur coup), gave a new *eclat* to the practice of phlebotomy. Then the zeal by degrees died away again, and it may be truly said that to-day the prescription of a phlebotomy is an exceptional thing in the practice of our hospitals, and it is as much as ever if I order one or two bleedings a year. Peter has indeed made some attempts the last few years to show the evil consequences of so complete an abandonment of this therapeutic measure. We will now see by the most recent data of experimentation, if the favor which bloodletting once found and its present abandonment, are susceptible of justification.

We purpose here to divide our subject into two parts, and study in particular the action of general bloodletting, and that of local bloodletting. We purpose also under each of these heads to examine successively the operative procedure, the physiological effects, and lastly the indications and contra-indications of general and local bloodletting.

General bloodletting (called also venesection, phlebotomy) is practised, as you know, at the bend of the elbow; and although in my audience there are doubtless many who have never bled a person, or seen one bled, I need not now take up your time in describing the operation, which you will find in full detail in any text-book on minor surgery.[1] This ignorance of the manual pro-

[1] Bloodletting has been practised from quite a number of vessels. Galen Hippocrates and Celsus bled from the veins of the nose; Rhazes and Avicenna selected the veins of the tongue, a kind of phlebotomy still practised in veterinary surgery; in fact, blood has been taken from almost all of the superficial veins of the body. To-day bleeding is practised exclusively at the bend of the elbow. Various instruments have been devised for bloodletting; the Germans still use mechanical *phlebotomes* which consist of a metallic box, a graduated lance, and a spring.

The vein at the bend of the elbow which is generally selected for venesection is the median cephalic, and this is generally preferred because the median basilic passes over the brachial artery. This is a very important relation and explains those unfortunate cases where bloodletting has resulted in aneurismal varix.

To cause swelling of the veins, a ligature or tight bandage is made to encircle

cedure is quite pardonable in anybody, considering how very seldom bleeding is practiced in even our large hospitals.[2]

What are the physiological effects of bloodletting? Here we have to study the effects of bleeding on the circulation of the blood, and on the blood itself, and the modifications which supervene in the functions of the different organs of the economy.

The blood is profoundly altered by bloodletting, and we must examine successively the modifications of the globules, and of the serum. In treating the globules, we are to consider the changes in the red corpuscles, the leucocytes, and the hæmatoblasts.

Hayem has shown us in his admirable work on the modifications of the blood, from which I derive the principal data of this lecture, that every loss of blood, however trifling, and though not exceeding 1.75 per cent. of the weight of the body, produces a diminution in the number and quality of the globules which persists from ten to twenty days.[3] When the hemorrhage is large, or when the bleeding is often repeated (*coup sur coup*), the diminution of the globules continues and even augments during the eight days which follow the operation. But that which it is important to note, is that in proportion as

the arm above the elbow, the forearm is rubbed vigorously upward, the patient being instructed to shut the fist firmly; then, when the veins are sufficiently distended, the operation is performed.

The operator takes the forearm in his hand, places his finger on the vein a little below the place of the intended puncture, and then (using the right hand for the left arm and vice versa) pushes the lance obliquely into the vein and makes it cut its way directly outward. When enough blood has been taken, the surgeon should untie the ligature above the elbow and place his thumb over the bleeding aperture. He should then put a small piece of lint on the wound and secure it with a strip of plaster; over this he should put a square compress of linen and over the whole a figure of eight bandage.

Bloodletting is generally a very simple operation, nevertheless it sometimes presents great difficulties, resulting from the corpulence of the patient and the depth to which it is necessary to make the incision. These difficulties are enhanced if the patient proves refractory during the operation.

The accidents which may accompany venesection are numerous; the most grave of all is puncture of the brachial artery; sometimes there follows abcess in the areolar tissue, or even phlebitis; the latter resulting from the carelessness of the operator in using a foul instrument or from the fact of the operation itself, however carefully it may have been performed. (*a*)

[2] Phillipart, of Tournay, has protested against the abandonment of bloodletting. He insists that the profession, in forsaking venesection, has gone too far, and that it is needful to return to this ancient mode of treatment in acute diseases. *Apropos* of the neglect of bloodletting, he cites some curious facts—namely, that the physicians of hospitals attached to the Central Bureau in the year 1867 prescribed bleeding but twice out of 8000 consultations, while in 1852 it was prescribed 1259 times. (*b*)

[3] According to Hayem, a single emission of blood not exceeding 1.75 of the weight of the body, produces a slight degree of anæmia and a reduction in the number of globules

(*a*) Vide Chelius Surgery (South's ed.) vol. iii, p. 609.

(*b*) Phillipart, On Bloodletting in the Treatment of Acute Diseases, Bull. de l'Acad. de Med. de Belgique, 1883; t. xvii, p. 128.

the globules are destroyed, others are produced with extreme rapidity. The number of the hæmatoblasts also augments after each bleeding, and in a marked manner; this it is which has led Hayem to say that every hemorrhage inevitably causes a *hæmatoblastic crisis*. This reproduction is even so rapid in certain animals, as the dog, that it is difficult to produce in them a persistent anæmic state by bleedings of moderate intensity, even if frequently repeated.

As for the leucocytes, Weber and Bauer maintain that they augment with losses of blood; Hayem affirms, on the other hand, that it is not so, and that their number remains the same after as before the emission of blood.

The modifications effected in the blood-plasma are less known than those of the globules. Thus, while Prévost, Dumas, and Jürgensen allege that there is augmentation of albumen, Becquerel and Rodier maintain that there is diminution. There is the same dispute with regard to the fibrin; White, Andral, Gavarret, Schutzenberger, Nasse, Sigmund, Mayer, Jürgensen, assert that fibrin is increased; Magendie, Coze, Hirtz, Brücke, affirm a decrease; Hayem is of the opinion of the first-mentioned experimenters, and according to his numerous researches there is a positive increase of fibrin after each blood letting.

As for the plasma, note that Arsonval has always found peptones in the serum after copious bleedings; this is a fact of great importance, and shows the modifications affected in nutrition by phlebotomy, the peptones being the result of a veritable *autodigestion* provoked by each bleeding.[4]

which persists from ten to twenty hours. When the hemorrhage is large a much more marked diminution in the red globules follows, and continues for several days.

In the dog it is difficult to cause any great degree of anæmia by bloodletting, and you cannot reduce the number of globules below 200,000 without producing death.

In the dog, moreover, reproduction of the red globules is effected with great rapidity.

Bloodletting, according to Hayem, is always attended with augmentation in the number of hæmatoblasts, what he calls a "hæmatoblastic crisis" resulting.

[4] Bleeding modifies the blood-plasma. We have few precise data respecting the modifications effected in the proportion of albumen.

According to figures given by Prévost and Dumas, there is augmentation in the quantity of water and albumen.

Jürgensen also found increase of albumen while Becquerel and Rodier report diminution.

As for fibrine, there are two contradictory opinions, Andal, Gavarret and Schutzenberger, have maintained that bleeding augments the proportion of fibrine and that the blood becomes more coagulable. Brichetau affirms that it is after the second bleeding that this augmentation in the proportion of fibrine is produced.

Other authorities, as Nasse and Jürgensen, have also noted increase of fibrine, and with their observations agree those of Hayem. Brucke and Magendie, Coze, Hirtz, singularly enough, have arrived at precisely opposite conclusions.

Darsonval has found constantly in the dog after bleeding, notable proportions of peptones in the blood. These peptones come from the auto-digestion which ensues after each bleeding. (*a*)

(*a*) Prévost et Dumas, *Examen du sang et de son action dans les différents phénomènes de la vie* (*Ann. de chimie et de phys.*, t. XXIII, p. 51, 1825).—Jürgensen, *Blutentziehungen* (*Hand. der. Allgem. therapie*, Bd I, p. 163, 1880).—Andral, Gavarret, Delafond, *Recherches sur la composition du sang de quelques animaux domestiques dans l'état de santé et de maladie* (*Ann. de chim. et de phys.*, t. V. p. 304, 1842.

This same modification in the nutrition is still further indicated by the diminution in the quantity of gases dissolved in the blood.[1] Lothar Meyer Mathieu, Urbain, Vinay, and Noil, have in fact observed a decrease in the quantity of carbonic acid, and especially in that of oxygen.

Bleeding has also an influence on the circulation. It at once modifies the pulse, and here, too, Hayem has shown us these modifications in the frequency, force, and form of the pulse. We must here distinguish the effect of one bleeding from that of several, and this distinction should always be made when the physiological effects of blood emissions are to be studied. When there has been but one bleeding, the pulse, half an hour afterward, becomes slowed; when on the contrary there have been repeated bleedings, the pulse augments in frequency in a sensible manner; in augmenting in frequency it diminishes in force, and its form takes on that which is observed in cases of anæmia or aortic insufficiency. The ancients attached great importance to this action of bloodletting on the pulse; they maintained that bleeding *raised the pulse.* One can readily understand, to-day, that this increased amplitude of the pulse results not from the greater energy of the circulation, but from the diminution of the vascular tension in consequence of the loss of blood.[2]

[1] Lothar Meyer, Vinay, Mathieu, and Urbain have remarked a diminution in the proportion of CO_2, and especially of O in the blood, after bloodletting.

Hayem, after an exhaustive study to determine the respiratory capacity of the blood, with relation to hæmoglobin, concludes that this respiratory capacity remains appreciably proportional to the contained hæmoglobin. (*a*)

[2] Hayem has remarked, after one bleeding, increase of pulsations during the operation, but this increase ceases half an hour afterward. When the hemorrhage is mortal, the pulsations increase at first, then diminish, and become irregular at the moment of death.

In the case of repeated venesections, the augmentation of pulsations becoms more and more marked with each bleeding, as is seen by the following table:

Before first bleeding	122	pulsations per minute.
During " "	164	" "
One-half hour after first bleeding	149	" "
Immediately " " "	180	" "
Before second bleeding, 24 hours later	148	" "
During " " " "	204	" "
Immediately after second bleeding, 24 hours later	189	" "
One-half hour " " " " "	209	" "
Before third bleeding, three hours later	188	" "
During " " " " "	240	" "
Immediately after third bleeding, three hours later	220	" "
One-half hour " " " " " "	220	" "

As for the force, Vinay from his experiments concludes that the force diminishes with acceleration of the pulse, and this is the rule in bleedings of moderate intensity. In fine, as to the form, after abundant hemorrhages the character of the pulse is like that observed in aortic constriction and insufficiency. (*b*)

(*a*) L. Meyer, Die gase des blutes (Zeitscher. f. rat. Med., Bd., 8, s. 256, 1857). Mathieu and Urbain, Des Gas du sang, experiences physiologiques, etc. (Arch. de Phys., 1872). Vinay, Thése agrég., 1880. Hayem, Leçons sur les modifications du sang, 1882, p. 227.

(*b*) Hayem, Modifications du Sang., p. 177. Vinay, Des Emissions Sanguinés dans les Maladies Aignës, Thèse de Concours, 1880, p. 25.

These modifications of the pulse are subordinate to the disturbance occasioned in the blood-pressure. For it is now admitted by all experimenters—Volkmann, Navrotky, Gatzirck, Vorm-Muller, Vinay, Hayem—that hemorrhages diminish the blood-pressure;[1] but in order that this diminution may be effected and maintained, considerable losses of blood are required, for, as Vinay and Arloing have shown, these circulatory depressions disappear with great rapidity. This diminution in pressure is accompanied with a swifter blood-current, but on condition always that the hemorrhage has not been too considerable.

These circulatory modifications give rise to troubles more or less profound in the functionating of the different organs. The respiratory movements, at first slowed, become more frequent, and more tumultuous in proportion as the hemorrhage becomes more considerable. Nevertheless, when the blood loss is moderate in amount, the dyspnœa is diminished; and this it is that explains the relief experienced by most patients affected by pulmonary diseases after bleeding. These respiratory troubles are connected with the perturbations caused in the functions of the nervous system by bloodletting.[2]

This *rôle* of the nervous system renders more complex than one would suppose the question of the physiological effects of blood-letting. Since we have learned the existence of the vaso-motors we are obliged to assign to the nervous influence, modified by the hemorrhage, a part quite as important as we ascribe to the direct effect of the loss of blood on the mechanical and physical conditions of the circulation.

[1] According to Volkmann's table, the normal vascular pressure being 155, a bleeding of 2 per cent. of the weight of the body reduces the blood-pressure to 56, and one of 3 per cent. to 30. Vinay and Arloing have established the following laws:

1. That venesection produces immediately a considerable lowering of blood-pressure in the arteries.
2. That equilibrium is reëstablished with great rapidity.
3. That copious bleedings effect great oscillations of pressure.

According to Hayem, the lowering of pressure is not progressive. Scarcely appreciable in the first fifth of a mortal hemorrhage, it is between the first and second fifth that the diminution takes place the most rapidly. It is inappreciable in the last stages of the hemorrhage.

According to Vinay, small or medium-sized hemorrhages are accompanied with a more marked irrigation of the tissues, but when the loss becomes more considerable the course of the blood changes, and is slowed. (*a*)

[2] Lichtenstein has remarked a diminution in the number and profundity of the respirations following medium hemorrhages. Bauer has arrived at the same results, but when the hemorrhage is more considerable, this diminution gives place to augmentation. In the experiments of Hayem, the respiratory movements augment and become more and more irregular in proportion as the hemorrhage continues.

These modifications result from the anæmia of the spinal cord produced by the loss of blood. (*b*)

(*a*) Volkmann, Hemodynamik, 1850. Vinay, op. cit., p. 21. Hayem, op. cit., p. 162. Gatzirck, Centralbl. f. d. Med. Wissensch, No. 53, p. 883, 1871.

(*b*) Lichtenstein, Zeitschrift f. Biologie, Bd. vii, 2 Hft. Bauer, Geschicht des Aderlasses, München, 1870. Hayem, op. cit.

We ought also to attribute to this double influence the action of bleeding on the temperature.[1]

Bleeding lowers the animal heat, and this in the normal as well as in the pathological state. It even seems to me that we have not of late years insisted enough on the therapeutic value of this powerful anti-thermic means. I know of none more active or more efficacious, and in contemplating what sometimes takes place in certain pyrexias, as typhoid fever, one is tempted to ask if it would not be well to return to the practice of bloodletting, after the manner of our fathers. This is what happens with our typhoid patients: when in the course of this disease a moderate hemorrhage appears, you see immediately the thermometric curve fall, and this lowering of temperature long persists. I know that this benefit is obtained at the expense of a convalescence often long and painful, but the fact none the less remains that, placing ourselves exclusively on the stand-point of hyperpyrexia, bleeding is a powerful depressant of this high temperature, and I am astonished to see an attentive observer like Lorain consider this fever-fall as transient and illusory.

Bleeding acts not only on the circulation, on the respiration, on the nervous system, on the temperature; it modifies the organism in its entirety, and the conditions of nutrition even.

Every abstraction of blood, as Lepine, Bauer, Claude Bernard, and especially Hayem, have shown, energizes the nutritive movement; but this activity produces, if the bleedings are prolonged, a fatty transformation of the different organs, and particularly the heart, and this is a point which must not be lost sight of.[2]

If, then, I were to sum up the physiological effects of bloodletting, and with special reference to its pathological applications, I would say: sanguineous losses of medium intensity diminish the number of globules and raise the pulse, while they enfeeble the blood-tension; they also lower the temperature; their

[1] In animals a lowering of temperature is observed after hemorrhage. The experiments of Marshall Hall, of Bœrensprung, of Gatzirck, and of Hayem, were absolutely demonstrative of this; in man the pathological temperature falls also. At the same time Thomas and Lorain have considered this fall as transient and illusory. (*a*)

[2] Experimentally, under the influence of bloodlettings, instead of obtaining a slowing of the nutritive exchanges, there is an acceleration; the experimental researches of Lepine prove this. According to Claude Bernard, bleeding has a constant effect to accelerate and provoke the organic exchanges. Bauer has studied experimentally on animals the action of bloodletting on nutrition, and he proves by the examination of the urine, as well as by that of the gases of respiration, that there is an exaggeration of the phenomena of denutrition and accumulation of fatty matters. He insists especially on the augmentation of urea, which is produced immediately after the bleeding, and which persists for several days. According to him, bleeding causes not simply a loss of fluid pabulum, but a real alteration of the organs and tissues. There is also a perturbation of nutrition under the influence of repeated bleedings, characterized especially by fatty transformation of the organs, and in particular of the heart, as Perl has shown. (*b*)

(*a*) Gatzirck, Centralb., 1871, p. 53. Bœrensprung, Müller's Archiv, 1851, p. 126. Hayem, op. cit.

(*b*) Lepine, Soc. de Biologie, 1880. Perl, Virchow's Archiv, 1873, pp. 39–51. Bauer, Zeitschrift f. Biologie, viii. Bd., 4 Heft., Munich, 1872.

effects, however, are generally temporary, for the reason that they provoke a hæmatoblastic crisis,which tends to bring back the blood to the state in which it was before the hemorrhage, and if the latter be often repeated, the hæmatopoietic formations exhaust the organism, and speedily produce grave disorganizations in the different viscera.

Local bloodletting has general effects analogous to general bloodletting, but it has local effects quite different. The mode of performance of these local abstractions of blood is very variable; sometimes we open the vein directly, sometimes we have recourse to mechanical means, as wet cups, or we employ leeches. Local bleeding, properly so called, that is, the opening of certain veins by the lance, has fallen into greater desuetude than venesection at the bend of the elbow. Nevertheless, latterly, Arango, Chaparr, Mestivier, and especially Aran, have endeavored to revive the old practice, vaunted by Hippocrates, Galen, and Alexander, of Tralles, of bleeding from the ranine veins of the tongue, while Seutin, Cruveilhier, and Denucé have proposed to take blood from the nasal mucous membrane, thus going back to another ancient practice. At the present day, despite these tentatives, local venesections are abandoned, and we have recourse only to leeches and wet cups.[1]

Cupping is to-day very much in use, in spite of our repugnance to let blood, and you see it employed in a considerable number of affections, and in particular in ocular therapeutics.

Here, as in the case of venesection, I refer you to your manuals of minor surgery for the details of the operation, reminding you only that under the name of *pneumodern*, Montain, of Lyons, and under the name of *terabdele*, Damoiseau, have devised cupping apparatus similar to those which Heurteloup and, more recently, de Wecker devised and used in inflammatory affections of the eye, and which are veritable artificial leeches.

As for leeches, they render us daily great service, although we have much restricted their usage.[2] The application of these leeches, the hemorrhages which result, the means of augmenting the flow of blood, or of arresting it—these are points with which you are all familiar, and which you learned at the commencement of your medical studies.

[1] Cupping apparatuses are too well known to require description in this place. The instrument by which the air is exhausted by means of a pump is much the more advantageous. The apparatus with rubber ball, operated on the principle of the modern breast-pump, is much employed; at the same time only a partial vacuum is produced by it, and its action is less energetic than that of the pump apparatus.

An interesting modern invention is the little scarifier, furnished with an air exhauster and described under the name of artificial leech. That of Heurtloup is the most used. These artificial blood-suckers are to-day reserved entirely for ocular affections. (*a*)

[2] The leech belongs to the class Annelidæ and to the order and family Hirudo. The species employed in medicine are especially the gray leech (Hirudo medicinalis), the green

(*a*) Mestivier, on Bleeding from the Ranine Veins in Diseases of the Pharynx (Bull. de Thérap., t. 52, p. 12, 1857); Arango, Treatment of Quinsy by Bleeding from the Ranines (La Union, January, 1883); Chaparr (Gaz. hebd. de Méd., April, 1855); Aran, Bleeding from the Ranine Veins in Diseases of the Larynx and Pharynx (Bull. de Thér., t. 52, p. 105); Denucé, Bleeding Practiced from the Nasal Mucous Membrane (Journ. de Médicine de Bordeaux, August, 1856).

I will now show you what are the physiological and therapeutical effects of local bloodletting—effects which, in some respects, surpass those of general bleeding.

Local bloodletting, whether by scarifications, by cupping, or by leeches, has a double action—a general effect and a local effect. When it results in an abundant loss of blood, it produces the same modifications as general bloodletting; the pulse rises, the blood-pressure falls, and the temperature is lowered. the most marked effect, however, and the one most often sought, is the local action, and this is determined in part by the hemorrhage, and in part by a revulsive influence provoked by the local pain.

As for the hemorrhage, the anæmiating action takes place not solely at the point where you apply the leeches or the cup, but it extends more or less far. Despite the affirmations to the contrary of Binz and Struthers, I persist in thinking with Johnson that a considerable area may be exsanguinated by the local bleeding, and this owing to the vascular communications which unite certain organs to certain points of the skin; owing also to the intimate connections of the cutaneous nervous filaments, which hold under their dependence the vaso-motor innervation of organs situated more deeply.

The *rôle* of the local pain determined by the punctures is as important as that of the hemorrhage. We have here, first of all, a substitutive effect, then a vaso-motor action. We know, in fact, and on this point I insisted when considering the revulsive method in its application to the treatment of diseases of the spinal cord, that revulsion produced in any point of the skin causes anæmia of organs more or less deeply situated. Hence it is that local bloodletting has remained one of our most powerful therapeutic agents to combat the element congestion and the element pain, and especially the association of these two elements.

I come now to the most delicate and difficult part of my subject—namely, the indications for bloodletting, general and local. We will begin with the first.

leech (H. officinalis); this kind is greener than the preceding, and the belly is not spotted; the dragon leech (H. trochina), which has on its back six rows of reddish or black points.

Moquin Tandon estimates that one officinal leech of small size will draw twice its weight of blood. This estimate is less that the reality, for an average leech will take almost an ounce.

To encourage the leeches to take hold it has been advised to wipe them with a linen cloth before applying them, or to dip them in wine.

Various processes have been recommended to stanch the bleeding produced by leeches. One of the best consists in closing the puncture with a *serre-fine*.

Statistics (which it is not necessary to produce here) show that there has been a steadily decreasing employ of leeches in the hospitals of Paris from 1820 to 1875, inc.

Thus, from an annual expenditure in 1820, of ten thousand francs a year, for the single item of leeches in the hospitals; in 1875 the amount expended was only eighteen hundred francs; a remarkable diminution. It is also worthy of the remark *à propos* of these figures, that the number of patients attended in the hospitals is to-day double, if not almost triple what it was in 1820. (*a*)

(*a*) Lasègue et Regnault, La Thérapeutique jugée par les chiffres (Arch. gén. de méd., 6th Série, t. 29, p. 21)

If you reconsider the physiological effects of bloodletting, you observe that these effects are very transient, and cannot be persistent, except on condition either that your bleeding be exceedingly abundant, or frequently repeated, *coup sur coup*, after Bouillaud's fashion and that of the ancient phlebotomists. While, therefore, these repeated venesections undoubtedly do produce durable results, it is necessary to keep in mind that, despite the hæmatoblastic crises which they determine, they are followed by a persistent anæmia, and, what is especially worthy of being remembered, by a tendency to fatty degeneration of different viscera; and one may well ask if the inconveniences and the dangers which result from this double pathological state do not far more than counterbalance the feeble benefits which are obtained from these abstractions of blood, so that to-day, all these facts being well weighed, everybody is agreed to solicit from phlebotomy only the transient effects which it can produce, and to resort to it only for relief of active and passive congestions of different organs.

There is especially one pathological condition where this depletion—temporary as it may be—of the circulatory system, by bleeding, may render us some service. It is when we have to do with those pulmonary congestions which are accompanied with asystolia, and especially those which are not linked to fatty degeneration of the heart. You understand how, in these asphyxiating periods of cardiac affections, a temporary depletion is sufficient to enable the heart to recover its habitual rhythm.

In the phlegmasiæ, properly so called, after the congestive period has gone by, and the exudation has formed, bloodletting can have little or no influence, as I explained to you when on the treatment of inflammation of the lungs.

Impotent to arrest the march of an inflammation, bleeding may nevertheless act the part of a prophylactic in these phlegmasiæ; and if experimentation in animals does not sufficiently explain these facts, clinical experience, and especially clinical surgery, shows us again and again the happy influence of general bloodletting in averting the inflammatory accidents which traumatisms determine. Hence it is that bloodletting, seldom employed in clinical medicine, is still utilized in clinical surgery.

In the treatment of the essential fevers, bleeding can have only an antipyretic effect, and I shall have more to say of this when I come to fevers. This antithermic action is purchased at the cost of a profound trouble inflicted on the economy; nor, for all that, is the course of the febrile phenomena affected thereby. The doctrine of microbes which, in our day, plays so important a part in the pathogeny of the infectious diseases, explains for us sufficiently the impotence of bloodletting in these pyrexiæ, since the removal of blood can in no way prevent the development of these micro-organisms in the mass of the circulating fluid.

Bleeding is indicated much more in the inflammatory fevers, or, at least, in those which accompany local inflammation—fevers which present often a great elevation of temperature, as pneumonia. When we refer to the physiological effects of bloodletting, it is easy to understand the ancient popularity and universality of this therapeutic measure, since, directed to an affection which, by its normal evolution, tends toward recovery, it relieves the oppression of the

patient, lowers the temperature, and gives a marked elevation to the pulse. But our predecessors were ignorant of the price which they paid for this passing amelioration.

Nevertheless, in certain cases of blood-poisoning, obscure in their nature, bleeding has a happy influence. Thus in the eclampsia of puerperal women general bloodletting, practiced heroically, has arrested the convulsions, and all authorities seem unanimous in recommending venesection in these cases, although we are unable to explain the curative action of this spoliative treatment.[1] You see then, gentlemen, that general bloodletting is indicated only in eclampsia and in certain congestive states, especially such as arise from temporary perturbations of the cardio-pulmonary circulation, and that even here the relief obtained from the depletion is only momentary.

Local bloodletting, by its double action in producing revulsion and opposing congestion, has applications to therapeutics which are much more numerous, and it is a very common practice to resort to this method in painful congestive affections. Thus in the pain which accompanies pneumonia and pleurisy, cups and leeches may give relief; in congestions of the spinal cord, of the kidneys, of the liver, and of the uterus local depletions often prove useful. As in bloodletting the revulsive effects are more powerfully remedial than those resulting from the loss of blood, you understand the superiority of wet cups over leeches, and they are therefore more in use.

Such are the considerations which I wished to present relative to bloodletting, and which show the mediocre but useful *rôle* which this therapeutic means is destined in the future to fulfill. They will, moreover, help to convince

[1] Baudelocque affirms that nothing can take the place of bloodletting in puerperal convulsions. Mme. Lachapelle is of the same opinion.

Depaul has carried out the practice of blood-letting to great lengths in puerperal cases. He is in the habit of letting blood to the amount even of 2,000 grammes. The results of his practice are seen in the following table by Charpentier:

AT THE MATERNITY.

Single bleeding, 36 per cent. deaths.
Repeated " 33 " "

OTHER OBSERVATIONS.

Single bleeding, 30.6 per cent. deaths.
Repeated " 21.6 " "

We may conclude from these figures that repeated bleedings have given better results than single bleedings.

Peter has resumed this investigation and concludes in favor of bloodletting, not only as a curative, but also as a preventive measure. It has even been recommended to employ bloodletting in all cases of uræmic convulsions, and Fonnsagrives and Peter have cited cases of speedy recovery under the use of these bleedings. (*a*)

(*a*) Lachapelle (Mme.), Pratique des accouchements, t. III, p. 29 et 30.—Depaul, Bull. de e'Acad. de Médic., 1854.—Charpentier, De l'influence des divers traitements sur les accès éclamptiques, thèse d'agrégation, 1872.—Peter, Leçons de Clin. Méd., t. II.—Fonnsagrives, Considérations pratiques sur l'action déplétive des émissions sanguines générales (Bull. de thér., t. II, p. 5, 1859).

you that, notwithstanding the opposition which we have been called to witness against bleeding in all its forms, and the decadence into which it has fallen, it ought not to be completely abandoned.

In the next lecture I shall treat of one of the consequences of bloodletting; I refer to anæmia and its treatment.

ON THE TREATMENT OF ANÆMIA.

SUMMARY:—History—Anæmia and Chlorosis—Different Kinds of Anæmia—Alteration of the Blood in Anæmia—Red Blood-Corpuscles, Their Composition—Oxy-Hæmoglobin—Evolution of the Globules—Essential and Symptomatic Anæmia—Chlorosis—The Importance of Enumeration of the Globules, and Dosage of the Hæmoglobin—Treatment of the Anæmias—Pharmaceutical Treatment—Iron—History—The Action of Iron—Absorption of Iron—Elimination of Iron—Mode of Introduction of Iron—Ferruginous Preparations—Reduced Iron—Oxides of Iron—Dialyzed Iron—Ferrous and Ferric Salts—Ferruginous Preparations in General—Ferruginous Waters—Artificial Ferruginous Waters—Choice of Ferruginous Preparations—Inconveniences of Iron Medication—Constipation—Blackening of the Teeth—Gastric Pains—Quantities of Iron Absorbed per Day—The Specific Action of Iron—Adjuvant Medications—Manganese—Arsenic—Hydrotherapy—Ærotherapy—Hygienic Treatment—Alimentation—Must We Treat All Cases of Chlorosis?—Pernicious Anæmia, Its Treatment.

GENTLEMEN: There are no diseases more common than the various forms of anæmia, and this age of ours is especially the age of anæmic patients. The treatment of anæmia is, therefore, worthy of your serious, earnest study.

Ever since Varandal, professor of the faculty of Montpellier, in 1620, introduced the term chlorosis into pathology, and Daumius, a century later, wrote the word anæmia, these two affections have been the subject of long discussions, some authorities making them two distinct diseases, others including them in the same description, and successive attempts have been made to found these opposing views on arguments drawn from clinical medicine and on arguments drawn from the chemical examination of the blood.[1]

[1] If the ancients understood anæmia, they have said little about it in their writings. In Hippocrates indeed the word *anaima* is found, and is applied to persons in a miserable exsanguinated condition. Galen makes no mention of anæmia.

In 1620 Varandal in his treatise on Diseases of Women, made mention of the pale color of certain patients, and proposed for this condition the word chlorosis. In 1706 Euth proposed the name oligæmia to characterize the lack of blood. In 1732 for the first time we find the word *anæmia* in the inaugural thesis of Daumius, Mich. Alberti being dean of the faculty. Then a few years later appeared the theses of Kutter and Behr on anæmia. Notwithstanding these works, anæmia was exceptionally admitted in France. Bouillaud in 1833 pointed out the anæmic souffles of the heart and blood vessels. Piorry called attention to local and general anæmias; finally the labors of modern hæmatology enabled us better to understand anæmia.

Then came the numerous divisions corresponding to the varieties of anæmia which were being studied, and an attempt was made to establish between anæmia and chlorosis distinctions more or less precise, and based more particularly on the alterations of the serum and the alterations of the globules. Thus Germain Sée admits four types of chronic anæmia: oligæmia corresponding to a diminution in the whole mass of the blood; globular anæmia; hydræmia, characterized by augmentation of the watery principles of the serum: disalbuminæmia in which there is diminution in the proportion of albumen. Moreover he establishes a distinction between chlorosis and anæmia. He regards chlorosis as a globular anæmia, resulting from nutritive impoverishment entailed by the demands of the reproductive functions and of growth. Jaccoud thus distinguishes anæmia from chlorosis: In

The incessant progress which the physical sciences and chemistry have made in the study of the blood, enables us at the present day to know the veritable nature of the anæmias. At first characterized and described as a diminution in the whole mass of the blood, the anæmias were subsequently considered as resulting from modifications in the divers constituent elements of that fluid. Hence in correspondence with the ingredient lacking, or in excess, different varieties of anæmia were established; essential globular anæmia, hydræmic anæmia, polyæmic anæmia (poly-anæmia) according as the globules alone were diminished in number or as there was predominance of the serous elements or even diminution in the proportion of albumen, such deficiency being indicated by the word disalbuminæmia, coined by Germain Sée.

To-day these distinctions ought to be abandoned, not because, irrespective of globular deficiency, these alterations in the constituent elements of the blood do not exist, but because they are variable and are not based on any very positive mathematical data. On the other hand, by reason of the discovery of processes which enable us not only to number the globules,[2] but to judge of

chlorosis the blood alteration is purely globular; it is an essential globular anæmia. In anæmia proper there is modification of the other constituent elements of the blood.

Under the head of anæmia we distinguish:

1. True or post hæmorrhagic anæmia.
2. Serous or polyæmic anæmia.
3. Albuminous or hydræmic anæmia.
4. Globular anæmia, or chlorosis.

Hayem has shown that in chlorosis the trouble is with the evolution and complete development of the red globules. (*a*)

[2] The discovery of the blood globules was one of the first triumphs of the microscope. It was in 1661 that Malphigi perceived in the blood of a hedge-hog certain red and spherical corpuscles which he considered to be globules of fat. Swamnerdam had, however, several years before, namely in 1658, made the discovery of these globules in the blood of a frog, but these investigations had not been published. In 1673, Leuwenhoek showed that the blood globules exist in the blood of all animals and that it is to them that the red color is due. Finally in 1770 Hewson completed this discovery and studied the structure of these bodies, their form, their dimensions, and published a very important work on the solid particles of the blood.

To-day we know the precise constitution of these corpuscles. In man the globules have the form of circular discs flattened in the centre. They are oval and elliptic in birds, fishes and reptiles.

Their dimensions vary according to the species and conform to the two great laws laid down by Milne Edwards: 1. Throughout the entire animal scale, in proportion as the organism progresses towards perfection of type, the globules decrease in size. 2. In animals belonging to the same zoological group, the more active the respiration the smaller the globules.

In man these dimensions according to Hayem vary from 5 m 5 to 8 m 6 (m = 1-1000 millimetre).

(*a*) Varandœus. De Morbis Mulierum, 1620, Lib. 1, ch. 1. Daumius, Diss. Inaug. Med. de Anæmia, 1732. Kutter and Behr, Opera, 1766. Bouillaud, Jour. hebd., 1833, t. ix., p. 578. Piorry, Traités des Alterations du Sang., Paris, 1836, p. 21. G. Sée, Leçons de Path. Experiment, Paris, 1867, pp. 38 and 244. Jaccoud, Path. Int., 1871, t. ii., p. 819. Hayem, On the Anatomical Characteristics of the Blood in the Anæmias, Compt. Rend. de l'Acad. des Sc., July, 1876. Moriez, De la Chlorose (th. d. agrégation, 1880).

their quality, we can by this very examination of the globules find a basis for the entire study of the anæmias. Here, moreover, it is to Professor Hayem that we are under obligations for the most important and decisive investigations on the characters of the blood in anæmic persons.[1]

Constituted by a solid organic frame-work provided even, if we may accept the latest researches of Ranvier, with a spherical membrane, the red corpuscles circulate in large numbers in the blood current. Deprived of nuclei, at least, as a rule, except in the fœtus, having a distinct form with which you are all familiar, these red corpuscles have a chemical composition to-day well known. They are constituted by an albuminoid matter, globuline, and contain also lecithine, cholesterine and animal matters, but that which especially characterizes them is the presence of a complex azotized matter colored red, crystallizable, containing a notable proportion of iron, the oxyhæmoglobin.

This oxyhæmoglobin is the veritable factor of the respiratory power of the blood; it presents to spectral examination certain characteristic rays which I here show you in this drawing, and when it is deprived of its oxygen, it constitutes what is called hæmoglobin reduced, which offers (and this is an important point) a spectral appearance quite different, as you can judge on comparing the two figures which I place before you. Apart from this reduced hæmoglobin, oxyhæmoglobin gives rise to other products of decomposition, such as hæmatin, hæmochromogen, hæmin, and hæmatodin.

You know from what I told you in a previous lecture, the methods in vogue for ascertaining approximately the amount of hæmoglobin in a given quantity of blood.

Anæmia of every kind, resulting as it must from an affection localized in the red globules, it is absolutely necessary that you chould have precise knowledge of the constitution of these globules and their evolution. Having finished the first part of my task, I come to the second, which concerns the evolution of the blood-corpuscles.

Here, unfortunately, our data are less conclusive, and we are obliged to resort to conjectures.[2] At the same time we know, according to Professor

[1] The number of these globules in the blood is estimated by Hayem as 5,000,000 per cubic millimetre. Their structure has been the subject of numerous researches, the most important of which are those of Rollet and Ranvier. Rollet maintains that the corpuscles are deprived of envelop, and are constructed of a solid organic frame-work, soft and uncolored, which he calls stroma, and which imbibes hæmoglobin like a sponge. Ranvier insists that there is a membrane around them. Sappey affirms the existence of a nucleus in the human blood globule. Hayem has found this to exist exceptionally, and in particular in cases of leucocythæmia. To detect these nuclei you must have a special staining fluid, either iodo-ioduretted water or hæmatoxylin. (*a*)

[2] It has till quite lately been supposed that the red globules come from the lymph and chyle, and that it is in the blood itself that the transformation from lymph globules into blood globules is effected. Within a few years, the tendency has been to assign to certain organs the function of transformation of the leucocytes into red globules. The red corpus-

(*a*) Rollet, Sitzunsbér der Wiener, Akad. der Wissensch., t. xlvi, May, 1862. Ranvier, Researches on the Elements of the Blood, Arch. de Physiol., 1874, p. 790. Hayem, Nucleated Red Globules in the Blood of the Adult, Arch. de Phys., t. i., March 1st, 1883.

Hayem, that the red corpuscles come from those little brilliant bodies which you see in microscopical preparations of blood, and to which the name of hæmatoblasts has been given. But what is the source of these hæmatoblasts? Do they come, as Hayem thinks, from the lymphatic net-work? Or from the marrow of bones, as the German and Italian schools maintain? Or are they engendered in the interior of certain glands, as the liver and the spleen? We are quite ignorant, and while recognizing the fact that there must be hæmatopoietic centres, we cannot at present definitely localize them. It is probable that the entire economy participates in the formation of hæmatoblasts.

The want of precise data concerning the origin of the blood globules, is a misfortune as far as therapeutics is concerned. In fact, the production of these hæmatoblasts is at the core of this whole question of the etiological treatment of anæmias, and if we could know the exact point where the hæmatoblasts originate, it is to this point that all our therapeutic endeavors should be directed.

What we do know is that under the influence of bad conditions of alimentation, or by reason of deprivation of a plentiful supply of oxygen in the air of respiration, or even as a result of the absence of sunlight, the production of

cles issue fully formed from these organs, and among these hæmato-poietic organs appear in the first rank, the liver and the spleen. The labors of Neumann, Bizzozero, and Rindfleisch, have added the marrow of bones. Bizzozero's conclusions are as follows:

1. The marrow of bones serves for the formation of white globules and lymphatic elements.

2. It is an organ of destruction of the red globules.

3. It is an organ productive of the red globules in the ratio of the transformations which the white globules undergo in its interior.

These views are based on patho-anatomical data and on experimental facts. After abundant hemorrhages in animals the medulla of bones contains a large number of nucleated red globules. Litten and Orth even found in the blood of anæmiated dogs nucleated globules.

In pernicious anæmia the marrow of the bones has been found red and altered.

The spleen has long been regarded as a hematopoietic organ. Bizzozero, Salvioli, and Foa affirm that in animals, during the first period of their life it is the spleen and the liver which form the globules.

According to Neumann and Bizzozero, the successive stages in the evolution of the red globules are as follows: The first stage is represented by the white globules and the uncolored cells of the marrow. In the second stage appear the nucleated hæmotoblasts. In the third the nucleus disappears, and the red globule is fully formed. Rindfleisch adds that it is the expulsion of the nucleus that gives to the red corpuscle its bi-concavity.

Hayem, who has reproduced the greater part of these experiments, does not share these views of the German and Italian authorities, and while admitting that in the fœtus the nucleated corpuscles may have multiple origins, he believes that the red globules always come from the hæmatoblasts. (*a*)

(*a*) Neumann, *Ueber die beudeutung des knochenmarkes fur die blutbildung* (*Arch. d. heilk.*, Bd X, s. 68–102, 1869).—*Neue beiträge zur kenntniss der blutbildung* (*Arch. d. heilk.*, 1874, s. 441).—*Knochenmark und blutkörperchen* (*Arch. f. mikr. anat.*, Bd XII, s. 793).—Litten et Orth, *Ueber veränderungen des markes in röhrenknochen unter verschiedenen patholog schen vehralenissen* (*Berl. kl n. Woch.*, s. 743, 1877).—Bizzozero, *Sulla funzione amatopoetica del midollo della ossa* (*Gaz. hebd. Lombard a*, n° 46, 1868).—*Centralbl. f. med. Wiss.*, s. 885, 1868, n. s. 149, 1869).—*Sul. midollo della ossa*, Napoli; 1869.—Rindfleisch, *Ueber knochenmark und blutbildung* (*Arch. f. mikr. anat.*, Bd XVII, s. 1, n. s. *f.* 21).—Bizzozero et Salvioli, *Blukorperthen in der milz* (*Centralbl. die med. Wissens.*, s. 273, 1879).—Foa et Salvioli, *Sull' origine dei globulirossi detisangus* (*Arch. per le sc. mediche*, vol. IV, n° 1.

blood corpuscles diminishes, and the corpuscles, touched in their vitality, do not attain their complete development.[1] In other circumstances the original cause escapes us, and we see develop at certain periods of life those essential anæmias described under the name of chlorosis, and in which the hæmatopoietic centres seem primitively to have undergone some lesion. Oftener these troubles in the evolution of globules are temporary, but there are others which are permanent; we give the name malignant or pernicious to these anæmias, and all our therapeutic efforts are impotent in these cases to communicate a new activity to the production of hæmatoblasts.

Whether we are concerned with symptomatic anæmia, with essential anæmia, or pernicious anæmia, it is always in the evolution of the corpuscles that we must place the first cause of the trouble, and to serve as a basis for our diagnosis of anæmia, and to measure the intensity of the evil, we ought always to refer ourselves to the three following particulars, as Hayem has shown:—What alterations have the globules undergone? What is their real number? what is their individual value?[2]

[1] Hayem affirms that in all kinds of anæmia you will find abnormal forms of globules, and in particular, giant corpuscles with a diameter of 12′ m. There are other globules which are very minute. With these alterations in size there are alterations in shape, due to the abnormal softness of the globules in chlorotic patients; it is, however, worthy of note that the corpuscles never lose their disk shape.

Moriez considers the theories which have been advanced respecting chlorosis under five heads:

1. Chlorosis due to disturbances of menstruation.
2. Chlorosis due to dyscrasia.
3. Chlorosis due to disease of the nervous system.
4. Chlorosis due to inflammatory or organic disease.
5. Chlorosis due to faulty evolution.

1. *Chlorosis is due to menstrual disorders.*—This is the view sustained by the ancient fathers of medicine, and multitudes of modern authorities, who have attributed to uterine troubles the first cause of chlorosis.

2. *Chlorosis is a cachexia, a dyscrasia.*—This is the opinion the most generally adopted, and a great number of hypotheses have been advanced with regard to it. Some see in chlorosis nothing but alterations in the red globules, others alterations in the plasma as well.

3. *Chlorosis is a disease of the nervous system.*—Sydenham compared chlorosis to hysteria, regarding them as akin. Trousseau placed the disorders of the nervous system in the first rank, and before the anæmic troubles. Copland attributes chlorosis to asthenia of the great sympathetic. Hoefer, Cocchi and Braxton Hicks attribute it to neurosis of the ganglionic nervous system; Putegnat to a neurosis of the trisplanchnic nerve.

4. *Chlorosis is an inflammatory or organic disease.*—Broussais considered chlorosis as a visceral irritation. Rasori, Giacomini, and Tommasini invoke a slow arteritis, while Hoffmann, Beau, and Suton place in alteration or functional troubles of the digestive tube, the point of origin of chlorosis.

5. *Chlorosis is a disease of evolution.*—This is the opinion sustained by Germain Sée. According to him, whenever there is disproportion between the developmental forces and the reparatory forces, chlorosis may arise.

[2] Hayem has studied the anæmias from the standpoint of numeration of the globules, and of colorimetry. According to him, the elements of appreciation of the degrees of anæmia are in order of importance:

This examination will be very easy for you if you follow the rules which I gave you in a previous lecture, and all that you have need of in order to carry them out, is a drop of your patient's blood. You will see then by the microscopic examination of the preparation, the form of the corpuscles, their number, and that of the hæmatoblasts; you will appreciate by this examination, which should be a very thorough one, how important it is to combine the numerical examination of the globules with the qualitative estimation of the hæmoglobin, and always to compare the corpuscles under inspection with healthy corpuscles, that you may know their real value.

There exist, in fact, anæmias in which the number of globules is not diminished, and this shows that the word globular anæmia, taken in its most rigorous acceptation, is not always an appropriate word to designate impoverishment of the blood. But if by means of the hæmacytometer you are able to compare these globules with healthy globules, you will find a marked difference in their number.[3] We have now in our hospital wards anæmic individuals (advanced cases), who, by the simple enumeration of the globules, have from four to five millions, a figure almost normal, but which amounts to only two or three millions when the comparison is made with well-developed healthy globules. So that it is not enough to have a normal quantity, they must be healthy as well.

1. The richness of the blood in hemo-globin, expressed in the number of healthy globules.

2. The alteration of the globules.

3. The real number of the globules.

4. The individual value of the globules.

Basing himself on these characters, he establishes four degrees of anæmia:

1. The mild degree of globular deficiency, characterized by alterations nil or feeble, by a globular richness expressed in healthy globules varying between three and four millions. Corpuscular value varying from 1 to 0.70.

2. Globular deficiency of medium intensity, characterized by pronounced globular alterations with diminutions in the dimension of the globules; a richness varying from two to three millions. Individual corpuscular value varying between 0.30 and 0.80.

3. Intense globular deficiency; having also for characteristics altered globules, but of very unequal dimensions, of which the medium approaches the normal by reason of the great proportion of giant globules; a globular richness varying from two million to eight hundred thousand. Individual corpuscular value oscillating between 0.40 and 1.

4. Extreme globular deficiency, characterized by altered globules of very unequal dimensions, but whose medium approaches the normal, and may even exceed it; a richness varying from 800,000 to 450,000. An individual corpuscular value approaching the normal.

[3] According to the researches of Quinquaud, researches based on the dosage of hæmoglobin by the process of Schutzenburger, in the blood of chlorotics there is a double alteration: diminution in the figure of hæmoglobin, and lowering of the maximum of saturation of the blood by oxygen. The hæmoglobin is diminished ½ in chloroses of medium intensity. In the normal state in 1000 grammes of blood the hæmoglobin is 125 grammes; it falls to 70 and even 30 grammes in chlorotics. As for the absorbent power of the blood for oxygen, it is normally in the ratio of 240 cu. centimetres to every 1000 grammes of blood; it falls to 80 cu. centimeters in chlorotics. Quinquaud has also found a diminution in the salts of potash and chlorides which enter into the composition of the blood. (*a*)

(*a*) Quinquaud—Researches on Clinical Hæmotology, Paris. 1880.

This microscopical examination will give you a good basis for prognosis. Whenever you see the hæmatoblasts in sufficient abundance, be persuaded that by reason of the conservation of the hæmatopoietic functions, you will be enabled easily to cure your patient. If there be paucity of hæmatoblasts, you will have difficulty in bringing about restoration, and the difficulty will be insuperable if the hæmatoblasts be very few.

You will pardon these somewhat lengthy details on account of the importance of such investigations as these, investigations which, though as yet little known and employed, have completely modified the study of anæmia. I come now to the practical question before us, the treatment of the various forms of anæmia. The treatment of anæmia is, first, pharmaceutical; second, hygienic.

1. In the first rank of therapeutic agents we place iron, and this question of ferruginous preparations in the treatment of anæmia is one of the most interesting in therapeutics, and one which has awakened the most ardent discussions.

The first physicians who employed iron in anæmia were probably guided by the therapeutic rule called the law of similitudes, and selecting iron as the representative of force—placed, as it had been, under the patronage of Mars—they judged this metal to be indicated in diseases characterized by great depression of the vital forces.

In the middle of the seventeenth century Ferrein thus characterized the therapeutic properties of the ferruginous preparations: 1. Sunt temperantes; 2, Diluentes; 3, Solvunt et aperiunt; 4, Vi stomatica donantur; 5, Vi cathartica; 6, Vi astringente; 7, Diureticæ sunt.

These multiple properties were based only on observation, but an important discovery which had just been made at Bologna and at Venice by Galatti, by Menghini and by Badia, gave a much more powerful support to this ferruginous medication, since these physicians had just recognized the existence of iron in the blood;[1] then more precise investigations proved the presence of iron in the red corpuscles, and in the oxy-hæmoglobin, which constitutes the

[1] The following, according to Pelouze, are the quantities of iron contained in 100 parts of blood of different kinds:

	MAXIMUM.	MINIMUM.
Man	0g.0537,	0g.0506.
Ox	0 .0540.	0 .0480.
Hog	0 .0595.	0 .0506.
Goose	0 .0358.	0 .0347.
Chicken	0 .0357.	"
Frog	0 .0425.	"

Boussingault has given the following figures:

100 grammes of human blood contain of iron	0gr.051.
100 grammes of beef's blood contain	0gr.048.

most important part of these globules.[1] As a result of this discovery iron came into such general use in anæmia that not a mother of family but of her own accord gave ferruginous preparations to her daughters when the appearance of pallor in the countenance indicated this medication—a custom which has prevailed to the present time.

At the same time, despite the popularity of the ferruginous medication, despite the constant multiplication of new preparations of iron, this question of efficacy, and especially of the action of chalybeates, is far from being solved, and there are two ways of regarding the subject. Certain physiologists, emphasizing the fact of the presence of iron in the hæmoglobin, and deriving support from the labors of Prof. Hayem, insist that a course of iron preparations is essential to the cure of globular anæmia. Clinicians, on the other hand, reply that while fully recognizing the utility in certain cases of martial remedies, the latter, nevertheless, have no direct local action on the globules, and what action they have results from stimulation of the entire organism; that all hygienic and other means which improve nutrition and arouse the hæmatopoietic forces, arrive at the same result. In support of this view clinicians appeal to the numerous facts of chlorotic patients where martial preparations, continued for several years, have produced no effect, and where cure has at last been brought about by hydrotherapy, gymnastics, and especially by country air.

Till recently I have ranged myself on the side of the clinicians, but I acknowledge that since I have employed in the study of therapeutic results obtained, the scientific method of the enumeration of the globules, my opinion has been shaken, and within certain limits, which I shall fix presently, I am ready to endorse the claims of the partisans of the ferruginous medication.

What renders obscure this mode of operation of chalybeates is that we are still ignorant of the pharmaco-dynamic action of this remedy daily employed,

[1] Hæmoglobin is the most important part of the chemical composition of blood globules. According to Wurtz, it ought not to be reckoned among the albuminoid matters. It is constituted essentially by a crystallizable matter to which has been given the name of oxy-hæmoglobin. The form of these crystals varies according to the blood from which they are derived, whether venous or arterial and according to the animal species from which it is obtained. Submitted to spectrum analysis, it presents two absorption bands situated between the rays D and E of the solar spectrum and separated by a luminous ray colored greenish-yellow.

When you put oxy-hæmoglobin in contact with a body that has a great affinity for oxygen, you obtain hæmoglobin reduced, which is distinguished from the former in that it is no longer crystallizable and that instead of presenting two absorption bands it has but one, and this in the place of the greenish-yellow band which separates the two absorption bands of the spectrum of oxy-hæmoglobin.

In the presence of acids and of alkalies, hæmoglobin breaks up into albuminoid coagulable substance, and an iron pigment, hematosin (which Lacanut described under that name); this hematosin is capable of combining with sulphuric acid and giving rise to a new body to which has been given the name of hematoporphyrine. It combines also with hydrochloric acid and forms chlorhydrate of hematine, (Wurtz, Treatise on Biological Chemistry, p. 297).

and that on many points relative to the absorption and elimination of this medicament, we are reduced to hypotheses.

As for absorption, the hypothesis of Scherpf is the most probable, who affirms that ferruginous preparations enter the blood under the form of a double salt.[1] First they may be taken up by the stomach as a chloride, which on entering the serum is changed to an insoluble albuminate, which is then rendered soluble by an excess of soda, constituting a double albuminate of iron and of soda. Or on the other hand this transformation into a soluble albuminate or peptonate may be effected in the intestine under the influence of the digestive fluids, and in this state it may be absorbed. But what has given place to the most controversy is the question relative to the elimination of iron.[2]

In fact the whole of the iron ingested seems to appear in the fæcal matters, and this has led the opponents of the ferruginous medication to affirm that iron does not undergo any change in the economy.[3]

At the same time, when we examine the question a little more carefully, we perceive that the iron which is found in the dejections comes not only from the iron introduced directly by the stomach, but also from the different intestinal secretions, the gastric juice, and especially from the bile, which con-

[1] To explain the absorption of iron, three hypotheses have been admitted: 1. Direct penetration of the iron into the blood under the form of an inorganic salt and combination of this salt with the albuminoids of the blood.

2. Combination of the iron and the albuminoids directly in the stomach and intestine.

3. Absorption by these two processes at once.

It is this last theory which has received the support of Scherpf, of Mitscherlich, of Buchkeim and Ditts. The theory more explicitly stated is as follows: The assimilation of iron is brought about in two ways—in the blood and in the intestine. In the blood, the iron penetrates in the state of an inorganic salt and combines with the inorganic substances of the serum; in the intestine there is also, before absorption, a combination of iron with the albuminoid matters, forming veritable ferruginous peptonates. It is probably in the the state of chloride that iron enters the blood. This chloride of iron, introduced into the blood, is transformed into albuminate of iron, at first insoluble and afterwards changed by the alkali of the blood into a double albuminate of iron and soda. These double albuminates of iron and soda and the peptonates of iron are absolutely innoxious to the blood. (*a*)

[2] Scherpf, On the Absorption and Elimination of Iron, Wurtzburg, 1878.

[3] Tiedmann and Gmelin found, so to speak, the whole of the iron administered to subjects under experimentation, in the stools. Most of the secretions contain iron; the tears, saliva, the milk, the digestive and intestinal secretion, the bile, etc. The gastric juice of a man, according to Schmidt, excretes three centigrams a day of iron, the bile four centigrams. Paganuzzi maintained that iron absorbed in the intestines penetrated to the cells of the liver, there stimulated the hæmatopoietic functions of this gland, and was eliminated by the bile to be again taken up by the intestine. Hayem affirms on the contrary that the iron which is found in the excretions does not find its way there till it has been made a part of the blood globules, and that it undergoes an incessant renewal in the economy. In dogs, nourished on aliments deprived of iron, this metal was found in notable quantity in the fæcal matters (*b*)

(*a*) Scherpf, On the Resorption and Assimilation of Iron. Wurtzburg, 1878. Hayem, loc. cit.

(*b*) Hayem, Leçons sur les Modifications du Sang., p. 507.

tains iron in notable proportions. *A propos* of the presence of iron in the bile, I showed you, when addressing you on the functions of the liver, that Paganuzzi and Lussana had based on this fact a particular theory of the action of iron on the hæmatopoietic functions of that organ.

It is, then, probable that the iron which is found in such abundance in the stools and in the intestinal secretions, comes not only from that which has been taken as medicine, and from the food, but also from the incessant modifications which the blood corpuscles undergo in the organism. But what is quite inexplicable, and altogether different from what we observe in the case of other medicaments, the quantity of iron found in the urine is little if at all increased, in whatever form the chalybeate may be administered, that is if we may rely on the experiments of Hamburger.[1]

The method of administration of ferruginous medicines is almost exclusively by the alimentary canal. Nevertheless the past few years attempts have been made to introduce soluble iron preparations hypodermically, and even by the rectum. Neuss has recently experimented with subcutaneous injections of the pyrophosphate in solution of citrate of soda. Luton and J. M. Da Costa have administered the dialyzed iron in the same way, the quantity for hypodermic injection being fifteen to twenty drops. This preparation is said to cause no local irritation whatever. Chiamarelli has employed to advantage the ammonio-citrate, one grain to about fifteen drops of water, and claims that this is a good and safe preparation for hypodermic use.

Jaillet has recommended lavements of peptonate of iron, and I have myself practiced subcutaneous injections of the peptonates. These tentatives ought to be encouraged, for there are persons whose stomachs cannot support the martial preparations, and in these cases there will be an advantage in using the hypodermic or rectal method. At the same time it must be borne in mind that subcutaneous injections of the peptonate of iron are painful, without however being attended with the risk of grave local lesions.[2]

As for the preparations of iron which are administered by mouth, they are innumerable, and their number increases every day. They may be divided into the martial preparations properly so called, and the ferruginous waters.

[1] Hamburger has studied the elimination of iron and affirms that one will always find iron in the normal state in the urine, and when iron is administered to animals, for instance in the dose of five grammes of the sulphate per diem, this dose does not augment more than from one to two milligrammes the quantity of iron contained in the urine. (*a*)

[2] Jaillet's solution of the peptonate is as follows: Take of sublimated perchloride of iron, 1 gramme. Distilled water, 60 grammes. Dried peptone, 2 grammes. Pure glycerine, 40 grammes. Dissolve the peptone in a little water and add the glycerine; dissolve the ferrum perchloride in the rest of the water, and mix the two solutions, add finely pulverized carbonate of soda to saturation, and filter the solution; (see that the solution measures 100 cubic centimeters before filtration). (*b*)

(*a*) Hamburger, Ueber die aufnah me ausscheidung deseiseus. (Zeitschrift f. physiologische chemie, Bd. 11, p. 119, 1878.)

(*b*) Jaillet, Physiological and Chemical Studies on the Chloropeptonate of Iron.

The martial preparations are both soluble and insoluble, simple or compound. I cannot enumerate all. I will only mention the principal. Iron in substance has been used, the oxides and the sesqui-oxides, the ferrous as well as the ferric salts.

Iron in fine powder, iron filings, porphyrized or not, and the *ferrum redactum* (or iron reduced by hydrogen or by electricity), represent the type of the insoluble preparations. Introduced into therapeutics by Quevenne, who recognized its ready solution in the gastric juice, this reduced iron has had and still has a great repute. [It was a favorite preparation with the late Dr. C. D. Meigs, of Philadelphia.—TRANS.] Iron filings are also given in the form of powder, pills, dragees, or as iron chocolate.

Under the name of ethiops martial, and under that of aperient saffron of Mars, therapeutics utilizes the dark ferric oxide, and the hydrated sesqui-oxide, which serves as the basis of numerous complex preparations. Of these oxides there is one which enjoys great repute, at least on the advertising pages of medical journals; I allude to the dialyzed iron, which is a very unreliable preparation, if we may trust the conclusive experience of Bouchardt.[1]

Then comes the long series of ferrous and ferric salts. At their head we have the ferrous carbonate (the old proto-carbonate), two preparations of which, quite complex, are well known—Vallet's and Blaud's pills. Quite recently, too, under the name of the sucro-carbonate of iron, Tanret has put in the market a preparation very agreeable to the taste, which is a combination of ferrous carbonate with sugar.[2]

Next in order is the iodide of iron, which serves as basis of the pills of

[1] The following useful formulas are worthy of mention in this connection:

Iron Chocolate.—Take of chocolate 50 parts, porphyrized iron filings 1 part. Mix. 25 grammes represents 25 centigrammes of iron.

Chalybeate Pill—(Each pill contains 1 grain porphyrized iron filings, with about ⅙ grain socotrine aloes and pulv. canella, made into a pill with a little powdered licorice root and honey.)

Compound Iron Pills.—℞

		GRAMMES.
For one pill.	Quevenne's iron.....0	16
	Sulph. quinine.....0	01
	Pulv. zingib.....0	01
Dose, from one to six.	Ext. cinchon. flav.....0	03
	Ext. rhei co.....0	03
	Aloes soc.....0	005

Mist. Fer. Aromatic.—(Dublin Ph.)

℞ Iron filings, 15 grammes (gr. ccxxv).
Yellow calisaya bark, 30 grammes (℥ i).
Columbo root, 12 grammes (℥ iij).
Cloves, 8 grammes (℥ ij).
Peppermint water, 200 grammes (℥ vi and ℥ v).

M. Macerate three days, shake and filter, then add enough tincture orange peel to flavor. Dose, two to three teaspoonfuls a day.

[2] The formula of Vallet's pills is as follows:

Blancard, the syrup of which is so much used in the treatment of scrofula; the potassio-tartrate, of which the celebrated balls of Nancy are composed, and which are called the balls of Mars;[3] then the ammonio-citrate, and the simple citrate; the lactate which Gelis and Conti have introduced; the pyrophosphate (a very elegant preparation), the chloride and the oxychloride; and, in fine, the recent combinations of iron and albumen, known as the albuminate and the peptonate of iron. One of my pupils, Dr. Chalhoub, has recorded in his graduating thesis the principal trials which I have made with this peptonate of iron.[4]

But you are not to believe that all the preparations into which iron enters as a component can be utilized in therapeutics, for there are some that are not

℞ Crystallized sulphate of iron, pure, 20 grammes (ʒ v).
Crystallized carbonate of soda, pure, 24 grammes (ʒ vi).
Simple syrup, 9 grammes (gr. cxxxv).
Treacle, 3 grammes (gr. xlv).
Water (boiled and deprived of air, and sweetened), q. s.

M. Ft. massa; divide in pil. No. 150.

Blaud's pills are as follows:

℞ Dried sulphate of iron,
Pure carbonate of potassa, ää 30 grammes (ℨ i).
Pulv. acaciæ, 5 grammes (gr. lxxv).
Water, 20 grammes (ʒ v).
Syrup simplicis, 15 grammes (ʒ iij and gr. xlv).

M. Divide into 120 pills.

The formula of the Belgian Ph. is very simple. Each pill consists of the following ingredients:

℞ Crystallized carbonate of soda,
Crystallized sulphate of iron,
Treacle,
Myrhh, ää 5 centigrammes (or about 1 grain).

[The sucro-carbonate of iron of Tanret, resembles the saccharated carbonate of iron of the British Ph.]

[3] The ferri et pot. tart. is made by the contact of pulverized cream of tartar with hydrated sesquioxide of iron; it is the basis of several popular combinations. The tartarized tincture of Mars (French Codex) is made as follows: Take of iron filings, 10 grammes; pulverized cream of tartar, 25 grammes; distilled water, 300 grammes; alcohol, 5 grammes. Macerate a suitable time and filter. The balls of Mars are composed of iron filings, cream of tartar, and certain vulnerary herbs. They are made into balls weighing an ounce, very hard and very soluble. When used, a little is scraped off, dissolved in water, and drunk; it is then called *eau de boule*, and is a popular chalybeate.

[4] Chalhoub, Study on the Chloro-Peptonate of Iron (Thése de Paris, July, 1883). [The tincture of chloride of iron is probably the most used of all the preparations of steel in this country. It is, however, likely to affect the teeth, from the free HCl which it contains. This may in a measure be obviated by mixing it with syrup, and then with milk; the styptic taste is then no longer apparent (*Vide Druggists' Circular*, June, 1881). It is worthy of note that Squibb regards the tinct. fer. chlorid. of the U. S. P. as a mistake. It is not fit for use till six months old. An important part of its therapeutic value depends on the ethers which are slowly generated from the HCl. and the alcohol. TRANS.]

susceptible of absorption when ingested. I cite especially the ferro-cyanide of potassium, and Regnault and Hayem have shown us by precise experiments that this salt traverses the organism without undergoing any change, and without producing any modification of the state of the blood-corpuscles.

When one takes a general view of all these preparations, it is easy to see that their authors have yielded to two tendencies. In the one case they have taken for basis insoluble preparations, on the supposition that the acids of the stomach would transform them into soluble salts of easy absorption. In the other case, in order not to depend on this solvent action of the gastric juice, the secretion of which is deficient in chlorosis, they have resorted to the soluble combinations, and they have aimed to come as near as possible to those ferruginous compounds which are supposed to be the form in which iron circulates in the blood, and have given the chloride, the lactate, the albuminate and the peptonate.[1] It has even been attempted to utilize the iron of the blood globules, and hæmatin and hæmatoidin have been administered in a state more or less pure, in the form of solution or of pills. The same ideas have led certain experimenters to prescribe in chlorosis preparations of dried and pulverized blood.[2]

If ferruginous preparations are numerous, chalybeate waters are no less so, and there is scarcely a town or hamlet in this country which is not credited with a mineral spring containing iron among its important ingredients. Paris boasts of two such springs, one at Auteuil, the other at Passy.

[Here follow the details of the principal ferruginous springs of the continent, which are omitted in the translation, owing to their being of little practical interest to American practitioners. It cannot yet be said that the chalybeate spas of this country in variety and in quality, equal those of the continent of Europe. We have, however one species of natural ferruginous waters, which is

[1] These are the conclusions of Jaillet's work:

1. The chloro-peptonate of iron, which is to be considered as the product of the digestion of ferruginous salts in the stomach and intestine, is a medicament inoffensive to the red globules, the stomach, and the digestive tube, whatever the dose employed or the method of absorption.

2. The chloro-peptonate of iron is absorbed and assimilated in the state in which it is ingested, undergoing no decomposition either by the gastric juice or by the alkalies of the blood.

3. When once assimilated the chloro-peptonate energizes the phenomena of combustion and augments the functions of nutrition, all of which finds expression in elevation of the temperature, diuresis, augmentation of the products of excretion, and of disassimilation, such as urea, phosphoric acid, and the chlorides of the urine.

4. In fine, by this increase of the combustions of the economy and the heightening of the activity of the functions of assimilation and disassimilation, the chloro-peptonate of iron, improves the appetite, and during the duration of the ferruginous treatment, if the alimentation is not sufficiently restorative there is produced emaciation. On the other hand, this loss of weight is largely compensated for by the physiological qualities which the blood regains, and which continue after the cessation of the treatment. (*a*)

[2] See, for example, Guerder's valuable article on "Desiccated Defibrinated Blood," in the Therapeutic Gazette for Feb. 15th, 1884.

(*a*) Jailet, Etude Physiologique, et Clinique sur la chloro-peptonate de fer.

unique; there is nothing in Europe like our aluminous waters. These springs are sometimes called acid springs, by reason of the free sulphuric acid which they contain. They contain also sulphate of alumina and iron. These ferruginous alum springs are found principally in New York and Virginia. In New York we have the Byron Acid Springs and the Oak Orchard Acid Springs. The water of these springs is too sour to be drunk without dilution. The Bath, Rockbridge, Bedford and Church Hill Alum Springs of Virginia, belong to this category. These waters are powerfully astringent and tonic.

Of sulphuretted mineral waters we have several springs that are regarded as ferruginous, notably the Buffalo Springs of Mecklenburg County, Virginia, the Minnequa Springs in Pennsylvania.

Among the saline spas are many which contain iron. The Columbian Spring, Saratoga, is a very fine chalybeate water, and is much resorted to by anæmic invalids.

Other chalybeate springs worthy of mention are the Bailey Springs of Alabama, which are alkaline chalybeate; the Schooley's Mountain Springs, New Jersey; Cooper's Well in Mississippi, a purgative ferruginous water, containing iron with much sulphate of soda and magnesia; Montvale Springs in Tennessee; Beersheba Springs in Tennessee, and Rawley Springs in Virginia. The latter is one of our best chalybeate springs, and is a favorite place of resort for anæmic persons.

The quantity of iron in these chalybeate waters is always small; half a grain of carbonate of iron to the pint would constitute a very strong ferruginous water.

The chalybeate waters which prove most valuable are those which contain a large amount of free carbonic acid gas. Most of these waters hardly bear transportation; unless great care be taken they lose their carbonic acid and deposit their iron.—TRANS.]

By the side of these ferruginous waters are placed the artificial chalybeate potions which may render you some service. You can easily make a very agreeable effervescent chalybeate water by dissolving potasso-tartrate of iron in water artificially charged with carbonic acid gas. The quantity of the ferruginous salt should not exceed one gramme per quart, and fifteen to twenty centigrammes is ordinarily enough for a bottleful of the carbonic acid water.[1]

As for the choice of a ferruginous preparation, everything depends on the tolerance of the stomach, and as a general rule it may be said that what form of iron suits the best is the best. At the same time, when dyspeptic troubles exist, I believe that the soluble preparations are preferable, though no fixed rule is possible. All your art will consist in varying the different iron preparations, soluble and insoluble, according to the case, and in prescribing that form

[1] A good formula is the following, where you cannot have ready access to a soda fountain: Take of spring water a wine-bottleful; bicarbonate of soda, one English drachm and fifteen grains; potassio-tartrate of iron, fifteen grains; citric acid, one drachm. Dissolve the bicarbonate of soda and the tartrate of iron in the water, and add the acid in coarse powder; instantly cork and seal the bottle firmly. An agreeable and sparkling chalybeate drink. (Mialhe.)

which will most promptly give augmentation of the globular richness, with the least trouble to the digestive functions.

One cannot then say beforehand what preparation of iron is the most likely to suit all cases of chlorosis, and almost any chalybeate may be attended with inconveniences. Orfila has indeed shown that certain salts of iron are toxic, and the experiments of Hans Meyer and Williams have confirmed this. Moreover iron almost always causes constipation, more or less obstinate; this constipation is explained by the presence of iron in the stools, and in abundance proportioned to the quantity medicinally taken; it blackens the stools, as you are aware, a phenomenon whose explanation is not easy. Baruel attributes it to the combination of the iron with tannin in the fæces, but Meyer has shown that iron blackens the stools in persons submitted to a milk diet, and Buchheim explains the blackening by the formation in the intestines of a sulphuret of iron.

If the dark discoloration of the fæces is no evil, the injury to the teeth occasioned by the martial preparations is often a serious matter. This is an argument in favor of the pill form of iron in preference to the soluble forms, for by giving the iron in pills you avoid contact with the teeth.

But the greatest inconvenience of the ferruginous medication, besides the constipation, arises from the gastric disturbance which it occasions, and especially the pain, and there are stomachs which will not bear iron in any form. This intolerance, however, is often the result of the choice of an unsuitable preparation, or of excess in the dose. I believe, in fact, that physicians generally prescribe too large doses. You can, moreover, use as a convenient guide the table of Jeannel given below, which shows you the quantity of metallic iron contained in each of the martial preparations.[1]

Moreover, in a critical study which I have made of the employment of iron

[1] Jeannel's table to show the quantities of iron contained in 100 parts of the various ferruginous preparations:

	PART OF IRON.
Iron by hydrogen (fer. redact. Quevenne's iron)	100
Ethiop's martial (black oxide of iron)	72
Ferric oxide	70
Hydrated sesquioxide	59
Aperient saffron of Mars	51
Crystallized sulphate of iron	21
Ferrous lactate (lactate of protoxide)	19
Dried carbonate of iron (proto-carbonate)	47
Iodide of iron	18
Citrate of iron (ferrous citrate)	30
Ferroso, ferric phosphate	30
Chloride of iron	34
Sulphate of peroxide (sesquisulphate)	28
Potassio-tartrate	21
Ferric citrate (citrate of peroxide)	22
Pyrophosphate (citro-ammon. ferric pyrophos.)	18
Pyrophosphate of iron and soda	20

(Jeannel, Formulaire Officinal. 2d Ed.; Paris, 1876.)

in therapeutics, I have proved how insignificant the quantity of iron which the blood loses in even the most advanced stages of chlorosis; I have, in fact, shown that in the case of a woman weighing 60 kilogrammes, the quantity of iron contained in the blood does not exceed 2 grammes, and that the most extreme anæmia does not lower this figure more than 50 centigrammes. It is well to have these facts before you when you give iron preparations, and keep well in mind that the renovation of the globules is not proportioned to the dose administered.

Is not this renovation of globules possible without the administration of iron? Hayem affirms the negative, basing his belief on experiments. For him iron is indispensable in the treatment of chlorosis; other medicaments may lend their help, but iron alone is capable of augmenting the number of globules and their richness in hæmoglobin. I do not altogether share this view. I recognize, with Hayem, that, from a scientific standpoint, iron is the most active of medicaments as far as blood renovation is concerned; but I recognize also, and this time from a clinical standpoint, that there are a certain number of chlorotic patients in whose case every form of iron fails, and will fail to effect a cure, while complete restoration may be brought about by means rather hygienic than medicinal.

Moreover, iron does not seem to have any other action than that of restoring the globules, and this renovation does not take place except where there is anæmia. Although Hayem pretends that in the normal state iron may determine a veritable "martial plethora," Cutler and Bradford maintain that this plethora cannot exist. It has also been affirmed, since the labors of Pokrowsky, that iron augments heat production and the excretion of urea, but these are rather the indirect effects of the administration of this medication when attended with restoration, and consequently with increased appetite and nutrition.

The adjuvant remedies of chlorosis are numerous. In the first rank is placed manganese, which has enjoyed a great reputation. It was in 1847 that Hannon, struck with the little result which attended the ferruginous medication with certain chlorotics, conceived the idea of using manganese instead of iron. Petrèquin, of Lyons, associated iron with manganese in chlorosis, and Trousseau and Pidoux advocated the same treatment. According to the researches of Hayem, manganese is not only useless, but even injurious in retarding the action of the ferruginous preparations, and it is better to discard it altogether.

If manganese be, as I am inclined to think, inefficacious, it is not so with arsenic, which is a valuable medicament in chlorosis. Arsenic is, in fact, one of the most powerful stimulants of nutrition; it increases the appetite and induces embonpoint, and I maintain, despite the negative results attained by Hayem and Delpeuche in the enumeration of the globules during the administration of arsenic in chlorosis, that in certain cases where iron is not well borne, arsenic may be of real service. But I have no faith in the arseniate of iron so much in vogue[1]—in giving the preparation you can appreciate neither the effects of the

[1] A preparation much in repute in Germany, and which is given in the dose of from 2 milligrams to 1 centigram. The following is an old formula, in which the tartarized tincture of iron is associated with Fowler's solution :

iron nor of the arsenic—and if it were necessary to give both remedies at the same time, I should give them separately.

I pass rapidly by nux vomica, proposed by De Ricci, phosphide of zinc, and phosphorus, recommended by Ashburton Thompson, cod liver oil, whose action on the globules has been studied especially by Cutler and Bradford,[2] and I come to two therapeutic agents which have a real action in the treatment of anæmia. I refer to hydrotherapy and ærotherapy.

Hydrotherapy, in stimulating the functions of nutrition, and rendering more active the peripheral and central circulation, is a powerful curative agent in the treatment of anæmia. In the comparative trials which in my hospital service I have made with douches and chalybeates, I ascertained always, as Hayem had done before me, that as far as increase of globules is concerned, iron is much superior to cold water douches; but I also ascertained that in associating hydrotherapy with the ferruginous medication, the globular renovation is notably quickened. Hydrotherapy is then a powerful auxiliary, and I advise you to make use of it in the treatment of anæmia, following the precepts which I gave you in a previous chapter.[3]

Ærotherapy, like hydrotherapy, plays an important part in the treatment

℞ Tincturæ martis tart.,
Fowler's sol., ää 10 gram.

Dose, 20 drops every day in divided doses.

[2] De Ricci, considering chlorosis as a primitive malady of the nervous system, the globular alteration being secondary, has recommended strychnia as the preferable tonic, giving it with sulphate of iron. Thompson has vaunted zinc phosphide, maintaining that it improves nutrition, and relieves the neuralgia which so often accompanies chlorosis. Cutler and Bradford have studied by means of the apparatus of Malassez the influence of iron on the richness and number of the globules. Iron does not increase the globules in a healthy person, but it does so in a marked manner in anæmic persons. Cod liver oil in healthy, as in anæmic individuals, produces augmentation of the red corpuscles, and a slight increase of the leucocytes. Fowler's solution causes increase of the red globules in a healthy person, but has no action in the anæmic. (*a*)

[3] Fleury considers hydrotherapy as one of the most active agents in the treatment of anæmia and recommends general douches, in the form of the shower bath or the jet douche.

The douches ought to be very short at the commencement, not more than five or six seconds.

Becquerel has seen sixteen cases, rebellious to iron, get well in less than forty-five days, by a well-directed hydropathic treatment.

Beni Barde says that it is necessary to administer the water in a different manner according as you have to do with chlorosis from menorrhagia, or from amenorrhœa.

In chlorotic girls whose menses are too abundant he counsels cold foot baths of running water. The duration of these cold baths ought to be very short, and should not exceed several seconds. The water ought to be very cold. When the menses are insufficient, you should employ a warm foot-bath with running water, or a very brief cold sitz bath, and when you employ the shower bath, the douche must strike the lower part of the body. (*b*)

(*a*) Ashburton Thompson on The Treatment of Chlorosis and Anæmia with Phosphide of Zinc.—Obstetric Journal, No. 24. Cutler and Bradford on The Action of Iron, Cod Liver Oil and Arsenic in Increasing the Globular Richness of the Blood.—Am. Jour. Med. Sci., Jan., 1878.

(*b*) Fleury, Treatise on Hydrotherapy. Paris, 1875. Becquerel, Clinical Lectures on Hydrotherapy. Beni Barde, Treatise on Hydrotherapy, p. 408.

of chlorosis, a part which is easily explained when we think of the intimate action of oxygen on the hæmoglobin. Hence it is that inhalations of oxygen have long been recommended in anæmia. While conceding that these inhalations energize the digestive functions, and that they augment the quantity of urine, Prof. Hayem, as a result of his comparative trials, denies that they have any direct action on globular formation.

At the same time these inhalations of oxygen will render you great service when you have to deal with chlorosis complicated with digestive troubles. Such cases are, unhappily, too frequent, where, too, you meet with obstinate anorexia and repeated vomitings. These inhalations remedy the gastric troubles, and enable iron tonics to be borne.

Baths of compressed air act in the same way in the treatment of chlorosis, and it is easy to understand the success obtained with these baths by Genté, Tabarié, Moutard Martin, Pravaz and Fontaine. You can make use of inhalations of compressed air (as is done in my hospital service), and exhalations in rarefied air, by means of the ingenious apparatus of my pupil, Dr. Maurice Dupont. Without having an action as energetic as the inhalations of oxygen, or the baths of compressed air, these inhalations of compressed air energize the respiratory functions, and have an adjuvant and favorable action in the treatment of anæmia. For the employ of these different ærotherapic means, I refer you to what I have said in the previous chapters.[1]

By the side of ærotherapy we must place out-door air and sunlight; and this brings us to the last part of our subject, the hygienic treatment of chlorosis.

While recognizing that iron plays a special part in globular renovation, and constitutes the specific treatment of this affection, we must nevertheless admit that there are cases where the digestive functions are so disturbed, and where the secretion of intestinal juices is so enfeebled that neither preparations of iron nor good food can cure them, however judiciously the treatment may be carried out. What we are obliged to do is to place the patient in an invigorating atmosphere with abundance of pure oxygen, which shall stimulate all the functions of the organism. This is especially necessary in the case of the chlorotics of our large cities, where the determining cause of the chlorosis resides, in great part, in the impure air which they breathe.

Therefore, in all cases of rebellious chlorosis do not hesitate to send your patients to the country or to the sea-side, or even to the mountains, (as Lombard recommends). Make them live out-doors, and in the sunshine, and you will attain results which neither ferruginous medicines nor a well-selected dietary regimen had enabled you to obtain previously.

Alimentation, nevertheless, has an important rôle; not only because healthful nutrition is dependent upon it, but because it is a means of introduction of iron into the economy; not to mention those artificial ferruginous foods, as bread, or chocolate containing iron; animal food contains this metal in its

[1] Vol. II. On the Therapeutics of Diseases of the Lungs.

most assimilable form, and there is no chalybeate equal to beefsteak. But by the side of meat is ranged a great number of alimentary substances, and nothing is more curious in this respect than the figures furnished by Boussingault.

Boussingault, in fact, not only has given us a list of the principal foods with the proportion of iron which they contain, but in studying the daily rations of the soldier and day laborer, he has shown us that they include from six to ten centigrammes of iron and we are enabled to affirm that in the dietary of the wealthier classes the quantity of iron is considerably greater.[1]

Unfortunately it is not enough to know that the food contains of itself sufficiency of iron to cure chlorosis, it is necessary that these aliments shall be digested and absorbed. In the greater number of our chlorotic patients the digestive functions are so enfeebled that neither this digestion nor this absorption can take place, and hence it becomes necessary to invoke the auxiliary influence of pure bracing out-door air, hydrotherapy, and even gymnastics, which regulate and arouse the forces of the economy.

But before terminating this too long lecture, it remains for me to consider

[1] According to Boussingault the daily rations of the sailor and the soldier in France, contain 0.0660 to 0.0780 of iron. In the case of the English workingman the quantity is greater, attaining the enormous figure of 0.8912 in England, and 0.1090 in Ireland.

Below is Boussingault's table, showing the proportion of iron in different alimentary substances; the proportion being given in decimals of a gramme:

	1000 PARTS.
Beef's blood	0.03750
Swine's blood	0.06340
Beef's flesh	0.00480
Veal	0.00270
Fish (whiting)	0.00150
Fresh cod fish	0.00420
Eggs (of fowls)	0.00570
Shell fish	0.00360
Fresh beef bones	0.01200
Sheep's feet (bones)	0.02090
Wheat bread	0.00480
White beans	0.00740
Oats	0.01310
Lentils	0.00830
Potatoes	0.00160
Milk (of cows)	0.00180
Carrots	0.00090
Indian corn	0.00360
Rice	0.00150
Apples	0.00200
Spinach	0.00450
Cabbages (green leaves)	0.00390
Red wine of Beaujolais (per quart)	0.01990
Beer	0.00400
River water (Seine)	0.00104

(Boussingault, Comptes Rendus de l. Acad. des Sciences, t. 74, p. 22.)

two important points in the subject which is before us. Ought we to try to cure all cases of chlorosis? Are all cases and kinds of chlorosis curable? Trousseau maintained that there were forms of chlorosis which we ought to let alone, and in speaking thus, he meant those symptomatic anæmias in the commencement of phthisis; he affirmed that in these cases when you administer iron tonics you may cure the chlorosis, but you will fatally enkindle the symptoms of pulmonary tuberculosis.

I believe that this affirmation of Trosseau is an exaggeration. I admit with him that ferruginous medication may have its inconveniences, and in particular that of predisposing to hæmoptysis, but to say that in these cases we ought not to treat the anæmia, is to go to the other extreme. We ought on the contrary to raise the rate of nutrition as high as possible in persons predisposed to tuberculosis, for the more the functions of the economy are feeble and languishing, the more the soil becomes favorable for the development and multiplication of the *bacillus tuberculosis*. We ought then to treat these false chloroses, but especially to employ hygienic means in these cases.

Are all forms of chlorosis curable? Assuredly not. There are anæmias called pernicious, essential anæmias which resist all treatment. You will see these pernicious anæmias, which Immermann and Biernier have well studied, supervene as a sequel of prolonged lactation, and I have seen them so arise in my infant hospital. That which most markedly attracts your attention in these cases, apart from the enormous decrease of blood corpuscles, and the disappearance of hæmatoblasts, is the anorexia which nothing can overcome, a subject concerning which I have already spoken under the head of diseases of the stomach.[1] [See Vol. I. Part 2.]

At the necropsy nothing is noted but fatty degeneration of the different organs. Is this fatty disease primary, or is it secondary? This is a question which we cannot answer. What has struck me particularly in these cases is the fatty transformation of the pancreas, a morbid condition which must play an important part in the digestive troubles. Whatever may be the pathogenesis, everything has been tried, ferruginous preparations, inhalations of oxygen, country air and exercise, the most carefully directed dietary regime, and everything has failed. I have even attempted, not merely the alimentary regimen of

[1] Immermann, of Bale, and Bierner have studied a disease which they have described as progressive pernicious anæmia, and which is characterized especially, by a hæmorrhagic diathesis, and by febrile attacks. In this anæmia all the elements of the blood diminish in quantity; at the autopsy is observed fatty degeneration of the heart, of the muscles and of the different viscera.

Quincke has found in a case of pernicious anæmia, a considerable quantity of iron in the liver, in the kidneys and in the pancreas. In the liver the quantity of iron is as great as 7 grammes, or a quantity larger than the sum total of iron in the economy in a normal state. He maintains that this iron is a result not of ferruginous treatment, but of the destruction of corpuscles. (*a*)

(*a*) Immermann, Ueber Progressive Perniciose Anemie. Quincke, Zeitschrift den Andenken an Alb. Vhaller. Dargebracht, Bern, 1877. Destrée, On Progressive Pernicious Anæmia, Jour. de Med. de Bruxelles, August, 1882. Jacquemart, On Progressive Pernicious Anæmia, Jour. de Med. de Bruxelles, July, 1882. Lepine, Union Med., Nos. 114 and 115, 1876.

Brown-Sequard, but forced feeding with the œsophageal sound, with, however, indifferent results. It may be truly said that the alimentary canal, profoundly affected in all its glandular elements, is incapable of fulfilling its functions of digestion and assimilation.[1]

Transfusion has been recommended in these inveterate cases, and I have even seen it practiced by my master Beheir for anæmia, and with good results.[2] I believe, in fact, that in true pernicious anæmia transfusion, although not conferring any very lasting benefit, may nevertheless lengthen out the life of the patient. I think, however, that the benefits of the operation are hardly commensurate with the risks.

There are then, gentlemen, chloroses which we cannot cure; happily these are exceptional, and by following out the precepts which I have given, you will meet with success in the greater part of your cases.

It remains for me to indicate how you should modify your treatment according to the forms of anæmia which you have to treat. I will be brief, as this lecture has already been too long. It is especially in essential anæmia that the therapeutic rules which I have traced are applicable. This chlorosis presents itself, as far as menstrual troubles are concerned, under two states; sometimes there is amenorrhœa, sometimes menorrhagia. When the menses are very profuse it is necessary to be chary in the administration of ferruginous medicines which increase the hæmorrhage, and it is well to employ concurrently ergot or ergotine.

When you have to treat symptomatic anæmia, and in particular anæmia from loss of blood, good food and out-door air may be sufficient to bring about a cure. As for the anæmias which accompany cachectic states, they are not amenable to ferruginous treatment, and our efforts should aim to combat the first cause of these cachectic states.

Such, gentlemen, are the therapeutic rules which I desired to give you as

[1] Brown-Sequard has proposed to treat functional dyspepsia, anæmia, chlorosis by a sort of forced or frequent feeding, which consists in making the patient eat a great many times a day, even as many as sixty times. (*a*)

[2] Not only has transfusion been proposed in cases of pernicious anæmia, but it has been applied to the treatment of grave chloroses.

Neusbaum, from 1861 to 1864, cured three patients by the injection of large doses of defibrinated blood, 360, 450, and 550 grammes.

Hasse, in 1872, obtained two successful results by injecting thirty and ninety grammes of defibrinated blood.

Casse, in 1873, practiced injections of defibrinated blood in three cases of chlorosis, using 80, 75, and 25 grammes.

Roussel has injected in one or two instances, 250 grammes, and Christoforis, 600 grammes.

In fine, Heyfelder has injected arterial blood in the veins of a chlorotic woman.

To sum up, out of twelve cases of grave chlorosis, treated by transfusion, the result was successful in ten.

(*a*) Brown-Sequard, On a New Treatment of Functional Dyspepsia, Anæmia and Chlorosis in Archives of Scientific and Practical Medicine, No. 1, 1873.

touching anæmia. In the next lecture I shall continue the study of the treatment of general diseases, and shall make my subject the treatment of acute rheumatism.

ON THE TREATMENT OF ACUTE RHEUMATISM.

SUMMARY—Acute Articular Rheumatism—Natural Evolution of Rheumatism—Expectancy in Rheumatism—Divers Treatments of Rheumatism—Antiphlogistic Treatment—Blood-letting—Antimony—Anti-febrile Medication—Quinine—Local Treatment—Revulsive Method—Vesicatories—Anti-rheumatic Balms and Liniments—Hypodermic Injections—The Specific Medication—Alkalies—Salts of Sodium—Salts of Potassium—Acid Medication—Ammoniacal Salts—Propylamine and Trimethylamine—Cyanides—Salicylic Acid—History—Administration of Salicylate of Soda—Advantages and Disadvantages of Salicylate of Soda—Indications and Contra-indications of the Salicylate Medication—Treatment of Local Rheumatism—Balneo-therapy in the Treatment of Rheumatism—Sudorifics—Vapor Baths—Medicated Vapor Baths—Sulphur Baths—Resumé of Treatment—Treatment of the Complications of Rheumatism—Treatment of Cerebral Rheumatism.

GENTLEMEN: The plan which I have marked out for these lectures in practical medicine does not allow me to discuss the numerous theories which have been prevalent respecting the nature of rheumatism. I shall, therefore, enter at once upon the subject, which is the treatment of this disease in its acute articular and peri-articular forms.[1] I shall then examine the various modifications to which therapeutic rules must conform when rheumatism affects tissues and organs other than the joints.

Manifesting itself by severe pains in the joints, and intense febrile symptoms, acute rheumatism has been the subject of a variety of treatments. I shall trace for you, as rapidly as possible, the history of kinds of medication formerly in vogue, and then set forth at some length those which are to-day generally employed.

Clinical medicine has, in fact, made great progress in the treatment of

[1] The theories on the nature of rheumatism may be referred to four heads: The embolic doctrine; the parasite doctrine; the neuro-trophic doctrine; the humeral doctrine.

According to the first hypothesis, endocarditis is always primitive, and the inflammations of the joints depend on emboli which lodge in the vessels of the articular synovial membranes; these emboli are constituted of solid particles, taking their origin in the diseased valves.

2. The doctrine of infection is very much like the other; it has been maintained by Klebs. According to this view, the embolus is not formed in the heart, but results from the penetration into the blood of figured ferments (living microphytes), which are supposed to enter the system through the orifices of the skin dilated by the perspiration.

3. The neurotrophic doctrine has been defended by Heymann; it is based on the production of the arthrites under the influence of lesions of the nervous system. According to this theory, cold acts on the nervous centres and determines modifications in the trophic centres which preside over the joints.

4. There are two hypotheses concerned in the humeral theory. According to the one, it is uric acid which predominates, and rheumatism is assimilated to gout; according to the other, the peccant humor is lactic acid; this theory has been maintained by Richardson and Rauch (*a*).

(*a*) Bouchard, Maladies par ralentissement de la nutrition, p. 333. Paris, 1883.

rheumatic fever, and we are in position to-day to affirm that we possess a heroic curative agent for this affection, and which answers to the desiderata formulated with so much sagacity by Chomel, and reiterated in the remarkable article which my colleague, Ernest Besnier, has devoted to rheumatism in the *Dictionnaire Encyclopédique.*[1] We can then say that we have a medication for rheumatism, applicable to all acute febrile cases, which merits the appellation of specific. I refer to the salicylic treatment of rheumatism.

But before attaining this goal, therapeutics has had a route to traverse in which it has been guided by considerations based on the ideas which were entertained of the precise nature of rheumatism. Various methods of treatment the more readily found favor since by the natural march of the disease acute articular rheumatism spontaneously undergoes evolution toward recovery. I have in this particular shown in a communication made to the Medical Society of the Hospitals, that acute rheumatism presents itself under three forms—benign, moderate and grave. In the first form the disease naturally finishes its course in eight or ten days ; in the second, oftenest observed, the duration is at least three weeks ; in the grave forms the entire period of the disease is reckoned by months rather than by weeks.[2]

You understand then that physicians who have proposed certain treatments for rheumatism, have invoked in favor of the medication employed, what was in reality but the natural evolution of the malady, and it has been the easier for them to do this, that it is impossible for us at the onset of an attack to say what shall be the normal duration of the case which we have before our eyes. There has even resulted from this fact an application of the expectant method to the treatment of rheumatism, and Honoré has made himself defender of this method, which to-day has but few partisans.

Formerly, in the multiple manifestations of the disease, reasons were sought for the different kinds of treatment counselled in such cases. So, according as one considered rheumatism as an inflammation or was desirous of combating the febrile symptoms which accompanied it, or the articular pains which characterized it, or the rheumatismal virus itself, different remedial agents have been put in usage, which may be arranged in four groups—antiphlogistic medication, antifebrile medication, local medication, and specific medication.

(1) The antiphlogistic medication applied to rheumatism, comprises especially the treatment by bloodletting and tartar emetic. Vaunted of old by

[1] "We are to look for a medicine which, out of a total of 30 or 40 patients affected with rheumatic fever, will bring about a cure in a mean of 14 days. Then there would be no doubt as to tne efficacy of the remedy. Such a remedy has long been sought for in vain."—*Chomel.*

"In the present state of science there is no anti-rheumatic medication, in the true sense of the term. There are only therapeutic agents applicable to rheumatic patients, according to the general and common rules of therapeutics."—*Ernest Besnier in Dict. Encyclopedique.*

[2] Dujardin Beaumetz—Critical Reflections on Expectancy as a Method of Treatment of Acute Articular Rheumatism. (*a*)

(*a*) (Bull et Mem. de la Soc. Med. des hôp. de Paris, 2d Serie, t. xii, p. 184, 1875.)

Sydenham, restored to honor by Broussais, and applied with extreme rigor by Bouillaud,[1] bleeding in rheumatism is now completely abandoned, and this for several reasons. First, because contrary to the opinion of Bouillaud, it diminishes neither the intensity nor the duration of the disease, as Cullen long before the time of Bouillaud remarked. Secondly, because as Gubler observes, rheumatism is itself an anæmiating disorder, and determines an alteration of the blood characterized particularly by an *a globular* condition which sometimes persists. By the side of venesection we must place tartar emetic in large doses, once vaunted by Bayle, but now for a long time abandoned, in accordance with the just observations of Dance.[2]

(2) Antifebrile medication. In the first rank of antifebrile medicaments, we must place sulphate of quinine, and especially quinine in large doses, a kind of treatment which has been extolled by Briquèt and Monneret.[3] This medication consists in giving from two to four grammes of sulphate of quinine a day, and under the influence of these doses there is often observed a lull in the pain, and above all, a decline in the fever. Quinine has been accused of being the cause of grave cerebral accidents. This is a mistake, for these accidents which are among the complications of acute rheumatism, may occur apart from all medication. To-day, since the discovery of the salicylic treatment, quinine occupies but a secondary place in the therapeutics of rheumatic fever.

(3) As for local treatments they are very numerous, and consist especially of revulsive applications, soothing embrocations, subcutaneous injections, and the use of topical appliances that are more or less complex.

The revulsive method is very much employed. Little applicable to acute articular rheumatism by reason of the mobility of the symptoms, it gives remarkable results in the local arthrites, and I shall have more to say about it when I come to speak of chronic rheumatism.

At the same time it has been proposed to treat acute articular rheumatism

[1] This is Bouillaud's method of treating acute rheumatism: *First day.* On the arrival of the patient at the hospital at the evening visit, blood is let to the amount of twelve ounces. *Second day. Bloodletting* to the amount of from nine and one-half to twelve ounces, morning and evening, and in the interval, one application of leeches, or better still, wet cups around the joints. The local bleeding ought to be to the extent of nine, twelve, and even fifteen ounces. *Third day.* A fourth bleeding of from nine to twelve ounces, and local bloodletting in about the same quantity. In case the patient is better, stop the bloodletting. *Fourth day.* If the remission is not decided, practice another bleeding of nine ounces. In the fifth, sixth, and seventh days which follow, if the rheumatism is grave, repeat the bloodletting. Bouillaud pretends that by this treatment the mortality of rheumatism is diminished, and the disease is prevented from becoming chronic and that the duration of the disease is shortened from one to two weeks. (*a*)

[2] Bayle, Bibliotheque de Thérap II. Dance on the Employ of Tartrate of Antimony in the Treatment of Acute Articular Rheumatism. (Arch. Gen. de Med., 1849).

[3] Vinay, Treatment of acute articulate rheumatism by sulphate of quinine. (Thése de Paris, 1841.) (Briquèt. Bull. de l'Acad. de méd., Paris, 1842, t. viii, p. 152 et 898.—Monneret, Compendium de méd. prat., art. Rheumatisme, t. vii, p. 390.

(*a*) Bouillaud, Traité clinique du rheumatisme articuláire, Paris, 1840, p. 351.

by blisters around the joints, and Dechilly, Lasègue, Fernet, in France, Herbert Davies, Jeafferson, Greenhow, in England, Frantzel, in Germany, have vaunted the good effects of this method, which has found, it must be owned, few partisans in our own country.[1]

Next in order come the local anodyne preparations. The number of these pomades, liniments and lotions is innumerable, from the opodeldoc of ancient repute and the complex balm of Fiorvanti,[2] to embrocations of steel and other

[1] Dechilly (Bull. et Mem. de l'Acad. de Med., 1870, t. xv, p. 665) proposed in 1850 to treat articular rheumatism by blisters made to surround the affected joints, and Herbert Davies, of London, recommended to apply the blisters not upon the joints, but in the vicinity. This treatment was said to assuage the pain and to abridge the duration of the rheumatism. Jeafferson and Greenhow, in England, have derived benefit from the so-called method of Davies; in France, Lasègue and Fernet have employed it. This is Lasègue's method: from the commencement of the pain and swelling, strips of blistering plaster from an inch and a half to three inches wide and long enough to surround the limb like a bracelet or garter, are applied half an inch or so above and below the painful joint. In Germany Frantzel has also adopted the practice of Davies. (*a*)

[2] Below are several formulæ of anti-rheumatic liniments:

1. Pomade of Gueneau de Mussy:

℞ Extract of hyoscyamus, " " belladonna, ... āā 3 parts.
" " hemlock ..... 4 "
" " Axunge ..... 40 "

M. Ft. pomade.

2. Liniment of turpentine and acetic acid (Pharmacop. Br.):

℞ Spts. tereb. ..... 15 parts.
Acetic acid ..... 15 "
Camphor ..... 3 "
Olive oil ..... 12 "

M. Fiat linimentum.

3. Rheumatic liniment:

℞ Oil of Cedar, Fluid Ext. Hyoscyamus, Opodeldoc, ... āā 1 part.

M. Fiat linimentum.

4. Calmative liniment:

℞ Tinct. opii, Chloroform, Tinct. aconite, Sweet oil, ... āā 1 part.

M. Fiat linimentum.

The formula for opodeldoc (tinct. saponis co) is too generally known to require reproduction here.

The balm of Fiorvanti is a very complex terebenthinate preparation. It consists of seventeen different ingredients: among them turpentine, elecampane, amber, storax, galbanum, myrrh, aloes, ginger, cloves, cinnamon, nutmeg, alcohol.

The balm of steel consists of steel needles dissolved in nitric acid, to which is added olive oil and alcohol.

(*a*) Davies, On the Treatment of Rheumatic Fever, in its Acute State, Exclusively by free Blistering, London, 1864.—Frantzel, Charite-Annalen, Berlin, 1874.—Fernet, Du rheumatism articulaire aigu et de son traitement par les vésicatoires (Arch. gén. de méd., t. vi, p. 531).

absurd formulas which are patented and advertised as infallible for aching joints. These preparations have really a very limited action, and if they do good it is due more to the rubbing by which they are applied than to the absorption of any of the analgesic principles of which they are composed.

By the side of these revulsives and these soothing preparations we should place subcutaneous injections. Dieulafoi has proposed to calm the pains in the joints by hypodermic injections of water, for which, however, of late, phenic acid injections have been substituted, as employed by Kunz[1] especially, and Senator, Mader and others, in Germany. Badia and Heyfelder have used colchicine subcutaneously. This practice has not had many partisans, and I am not aware of anyone in France advocating these subcutaneous injections. When I come to speak of chronic rheumatism I shall have more to say about this kind of local treatment, and I hasten now to:

(4) The specific treatment of the disease under consideration.

Thinking that there existed an alteration of the blood in rheumatism, and that this alteration consisted, as in gout, in the predominance of certain acids, and of uric acid in particular, or even supposing that it was possible to modify the fibrine of the plasma, clinicians have employed in this affection the alkaline treatment, at the head of which stand the salts of soda, and especially the bicarbonate of soda, which English practitioners have administered in large doses, till as much as an ounce daily was taken. A remedy very popular in gout, the benzoate of soda, has also been used in acute and sub-acute rheumatism, and Senator is the leading advocate of this medication.[2]

Some authorities have preferred the salts of potash to the salts of soda. Thus, in England, Garrod, Dickinson and Chambers give from an ounce to an ounce and a half of bicarbonate of potash daily to their rheumatic patients.[3]

[1] Kunz practices around the joints from two to six injections, with a Pravaz syringe, of a one-per-cent. solution of carbolic acid. This treatment, he alleges, calms the pains. Senator has also witnessed local alleviation from these injections. Mader makes use of a two-per-cent. solution, injecting one cubic centimetre. Badia administers colchicine in the same way, injecting in the neighborhood of the joints two milligrammes in one gramme of water. Heyfelder, of St. Petersburg, also favors the same treatment. These injections produce quite severe local irritation, but they hasten a cure, even in the case of chronic rheumatism, according to these authorities.

[2] Senator employs benzoic acid and benzoate of soda in acute rheumatism. He gives the latter in doses amounting to ten or twelve grammes a day. He considers benzoate of soda an auxiliary of salicylic acid. (*a*)

[3] Garrod gives two scruples (℈ij) of the bicarbonate of potassa every two hours, day and night, till the fever is gone. Chambers' practice is to give one scruple of bicarbonate of potassa, every hour, in camphor-water. In England it is also a common custom to prescribe the citrates, tartrates, and acetates of potassium and sodium in the medium dose of fifteen grains every two hours, so that three or four drachms shall be taken during the twenty-four hours. Dickinson affirms that any quantity less than two drachms a day, is of no effect whatever, and he recommends to give from one ounce to an ounce and a half of potash

(*a*) Senator, Uber die wirkung der benzoesäure bei der rheumatischen polyarthrites. Zeitschrift für Kl. Med., 1879, t. 1, p. 243.

Some prefer the citrates, tartrates, or acetates of the fixed alkalies, in quantities of from half an ounce to an ounce in the twenty-four hours. Nitrate of potash has been administered in similar doses, and Gendrin, Martin Solon and Seux, in France, and Brocklesby, Macbride and William Whytt, in England, stand as the representatives of this treatment.[4]

In opposition to this alkaline medication we must note the acid treatment of rheumatism, and particularly the treatment by lemon juice. Proposed by Owen Rees,[5] adopted by Donald Dalrymple,[5] Hector Pelletier[5] of Montreal, Perkins of Brussels, and by Ciraud,[5] this lemon juice medication is not so widely different from the treatment by alkalies as one would suppose, for, as Golding Bird observes, lemon juice is nothing more nor less than supercitrate of potash.

I myself believed that I had found several years ago an alkaline compound containing ammonia for its base, which has an action truly specific in the treatment of acute articular rheumatism; I refer to those ammoniacal salts, propylamine and trimethylamine.

It was in 1872 that I commenced the trial of these preparations in the Maison Municipale de Santé, and on the 10th of January, 1873, I communicated the results to the Societé des Hôpitaux. From this time, and as a consequence of this report, propylamine and trimethylamine have been the subject of numerous labors in France and elsewhere, and Aissa Hamdy, Peltier and Bourdet, in France, Phillipo Cæsari and Namias in Italy, Spencer in England, Mount in Canada, Loever and Leo in Germany, have published the results of important investigations on these remedies. Despite all these efforts this medication has

salts per day. He gives these alkalies in the following manner: Every four hours the patient is made to take a draught containing one drachm of bicarbonate of potash and one-half drachm of acetate of potash in spirits of mindererus.

According to the statistics published by Basham and by Chambers, this medication protects from cardiac complications. (*a*)

[4] According to Martin Solon, nitrate of potassa, given in large doses in acute articular rheumatism, causes resolution in from four to ten days, and oftener in seven than in ten. It manifests its action in the most severe cases as well as in the mildest. He administers the nitrate in the following way: The patient is made to take, every few hours, from two to four drachms of nitre in a cup of some bitter infusion, the time for each dose being so regulated that from half an ounce to two ounces may be administered per day; ordinarily a quantity of one ounce per diem is not exceeded.

The salt may be given in lemonade, in chamomile tea, or in any other simple herb ptisan. Basham has employed the nitrate of potassa in still larger doses than the foregoing, *i. e.*, exceeding two ounces a day, but he makes especial use of the salt externally in strong solution, saturating with it felt or wadding, with which the inflamed joints are swathed. (*b*)

[5] Owen Rees, Edinb. Med. Jour., Aug., 1845. Donald Dalrymple, Lancet, Sept., 1850. Hector Pelletier, Montreal Medical Journal, April, 1853. Ciraud, Jour. des Conn. Med. Chir., July, 1851.

(*a*) Garrod, Lancet, March 3, 1857. Behier, du Traitment, du Rhumatism, Bull. de Ther. t. lxxxix., p. 529, 1875.

(*b*) Martin Solon on "The Employ of Nitrate of Potassa in Large Doses in the Treatment of Acute Rheumatism," 1843. Basham, Union Med., March, 1850.

been abandoned, and this more on account of the difficulty of obtaining a reliable preparation than for any other reason.[1]

Although I had effected the substitution of chlorhydrate of trimethylamine for the impure propylamine extracted from cod-liver oil and herring brine, and though I showed the chemical differences which separate the two amides, I recognize the fact that we have not a medicament possessing always the same

[1] Wertheim discovered propylamine in 1850 as a product of the reaction of potassa on narcotine; the same year Anderson obtained an identical compound from codeia, having the formula C_6H_9N, to which he gave the name it now bears. In 1851 Anderson's propylamine was found in herring brine, and Desaignes discovered it in *chenopodium vulgaris*. The labors of Hofmann and Wurtz have brought to light the differences which exist between the three amides which have the same atomic constitution—propylamine, ethylo-metylamine and try-methylamine—and which result from the substitution of alcohol radicals for hydrogen, as may be seen in the following table:

Propyl.....	C_6H_7	$N=C_6H_9N$
	H	(prophylamine)
	H	
Ethyl.....	C_4H_6	$N=C_6H_9N$
Methyl.....	C_2H_3	(ethylo-methylamine)
Methyl.....	C_2H_3	$N=C_6H_9N$
Methyl.....	C_2H_3	(tri-methylamine)
Methyl.....	C_2H_3	

Awenarius, of St. Petersburg, in 1856, was the first to employ propylamine, obtained by him from cod-liver oil, in medicine. Other Russian physicians, as Nelinbin and Jean, of Kaleniczenko, subsequently made successful use of it as a medicament.

In 1872, John Gaston, in the United States, reported the results of his experience with propylamine in the treatment of acute rheumatism. Lagrange, in France, about the same time, made trials of tri-methylamine in the same disease, but the subsequent wide-spread usage of these amides in rheumatism is chiefly due to the communication of Dujardin-Beaumetz to the Societé Med. des Hôpitaux in 1873. (*a*)

Dujardin-Beaumetz showed that propylamine from herring brine is nothing but trimethylamine, and he substituted for these commercial propylamines chlor-hydrate of trymethylamine, which he administered in the dose of one gramme daily.

The clinical experience of Dujardin-Beaumetz, Namias and Aissa Hamdy has shown that try-methylamine lowers the pulse and temperature, and diminishes the secretion of urea and the number of pulsations. It is, according to Pelletier, who assigns it a place between digitalis and quinine, a neurocardiac medicament.

Martineau has pretended that the ammoniacal salts have the same action as tri-methylamine. Dujardin-Beaumetz has experimented comparatively in animals with chlor-hydrate of tri-methylamine and chloride of ammonium, and he has shown that if these two medicaments lower the pulse and temperature, chlor-hydrate of try-methylamine never produces, even in large doses, the convulsive accidents which are produced by chloride of ammonium. Laborde has repeated the experiments of Dujardin-Beaumetz; he maintains that chloride of ammonium and chlor-hydrate of tri methylamine ought not to be arranged among antipyretics, and that they have a special action on the spinal cord, and that the salt of ammonium alone produces convulsions.

(*a*) Dujardin-Beaumetz, On the Comparative Therapeutic and Physiological Action of Muriate of Ammonia and Chlor-hydrate of Tri-methylamine, Gaz. Med. de Paris. No. 26, 1873. On Propylamine and Tri-Methylamine in the Treatment of Acute Articula Rheumatism, in Gaz. Med des Hôp., Jan. 16, 1873, and Gaz. Hebd., 1873, Nos. 13, 15 and 16.

composition. But the dominant reason for the abandonment of trimethylamine was the discovery of a substance much more effective in the treatment of rheumatic fever, namely, salicylic acid.

Trimethylamine, in fact, had no curative action except in rheumatism of moderate intensity, and in these cases it procured alleviation of the pain and cessation of the fever, just as does salicylic acid, but it failed in the severe forms. Luton's specific treatment of acute rheumatism by the cyanides, and cyanide of zinc, in particular, has also shared the same abandonment, as well as the *veratrum viride* medication proposed by Heuser; the salicylic acid treatment has deservedly superseded them all.

The application of the salicylic preparations to the treatment of acute articular rheumatism was the result of empiricism, and even to-day, as you will see as I go on, we cannot explain by the physiological properties of these preparations their specific effect in the treatment of rheumatism.

Employed from time immemorial in the treatment of fever and ague, willow bark (salix alba) had also given good results in certain cases of rheumatism, but these were lost sight of, and notwithstanding the discovery of salicin in 1829, this crystalline principle was not used in the treatment of rheumatism.

It was Stricker, who, in 1876, first made therapeutic use of, not salicin, but salicylic acid, which Kolbe and Lauteman had just discovered by way of synthesis by acting on phenol.[1]

What was the idea which directed Stricker in the administration of salicylic acid in rheumatism? Did he believe that the anti-fermentative properties which had just been discovered in it were applicable to this disease? Did he think that it would do good, like quinine, by its anti-pyretic action? We do not know. At any rate, he showed quite conclusively that in administering

[1] In 1827 Leroux, a pharmacist of Vitryle Francois, discovered salicin in willow bark. A few years later appeared Blaincour's treatise on the employment of salicin in intermittent fever.

In 1836 Peria obtained salicylic acid by the action of potassa on spiraea ulmaria (queen of the meadow). Then Kolbe and Lauteman obtained it by way of synthesis, by passing CO_2 into phenol containing a little sodium. Salicylate of soda is thus obtained at the present day.

In 1876 Kolbe and Meyer demonstrated the antiseptic action of salicylic acid, and it came into use for dressing wounds. The same year Stricker employed salicylic acid in acute rheumatism, and called attention to the rapid curative action of the medicament, which was especially noticeable when 50 centigrammes (7½ grains) were given every hour. At the same time that Stricker counselled salicylic acid in rheumatism, Maclagan made trial of salicin, and quite a discussion arose as to which was preferable, Maclagan claiming remarkable results from salicin.

In 1877 G. Sée communicated to the Academy of Medicine his observations on the treatment of rheumatism by salicylate of soda and showed the advantages of the sodium salt over salicylic acid. From this date the salicylate of sodium treatment became generally adopted and medical journalism has swarmed with treatises on this particular part of therapeutics.

(*a*) Stricker, Berlin. Klin. Wochen., Jan., 1876, No. 1. Maclagan, Lancet, 1876-77, etc. Blaincour, Thèse de Paris, 1830, No. 235. G. Sée, On the Treatment of Rheumatism by Salicylate of Soda, Academy de Medicine, 1877, 2d Serie, t vi Nos. 26 and 27.

salicylic acid in the dose of fifty centigrammes every hour, you may throttle rheumatism in its march, and complete its evolution in three or four days.[1]

I did not hesitate, when I learned of Stricker's success, to test the new treatment in the wards of my hospital, and I obtained, like him, remarkable effects. One of my pupils, Dr. Anger, whom I have since then had the misfortune to lose, has recorded in his thesis the principal points in this experimentation.

At the same time Prof. Germain Sée, who was making trial of Stricker's method of treatment substituted for salicylic acid the salicylate of soda, and published the results of his clinical experience in his important communication to the Academy of Medicine, June 26th, 1877, and despite the efforts of Maclagan to bring the profession back to salicin, it is the salicylate of sodium which is to-day universally employed.[2]

How ought you to conduct this salicylic medication? What are its disadvantages? What are its effects? These are points which remain for us to

[1] Salicylate of sodium, administered to the human subject in large doses, determines an irritation of the digestive tube. After a dose of five grammes (75 grains) there supervene buzzings in the ears, or roarings, with sometimes brain troubles and delirium, lowering of the pulse and temperature. Salicylic acid is rapidly eliminated in the urine, in the form of salicyluric acid. According to Lecorché and Talamon, salicylic acid considerably augments the excretion of urea and uric acid, an augmentation which continues for three or four days; then the excretion progressively falls, sometimes quite suddenly. There is also an increase of the excretion of phosphoric acid. Several explanations have been given of the action of salicylate of sodium in rheumatism. Some have attributed it to a special influence on the sensibility, but the experiments of Bochefontaine on animals have shown that salicylate of soda has no action on normal sensibility, and even if it had, it would be difficult to show why it should act in acute articular rheumatism, and not in gonorrhœal rheumatism. It has been claimed that this medicament owes its power to a special influence on the vaso-motor system, exercising a constrictive action on the dilated vessels of the synovial membrane. This is all pure hypothesis. Oltramare thinks on the other hand that it has a vaso-dilator action. The diuretic, also the anti-pyretic effect of this medicament has been invoked to explain its remedial action in rheumatic fever, while Binz has put forth the opinion that it acts directly on the living protoplasm. Vulpian proposes the following explanation: The analgesic, diuretic, vaso-motor and anti-pyretic properties of salicylic acid cannot explain its specific action in rheumatism. It does good by acting directly on the articular elements, bringing them back to their normal state, and if one does not observe the same curative effects in gonorrhœal rheumatism, and in chronic rheumatism it is because the anatomical lesions are different. (*a*)

[2] Maclagan claims that salicin is less disagreeable than the salicylate and is much better tolerated. His method of giving it is as follows: Thirty grains an hour till an ounce is administered, that is, sixteen hours. At the end of this time the pain is generally gone, and the temperature normal or nearly so. Then thirty grains every three hours till the second ounce is taken, and finally the same dose three times a day for eight or ten days. (*b*)

(*a*) Petit, on "The Employment of Salicin, Salicylic Acid, and Salicylate of Soda in Therapeutics." Bull. de Ther., t. xci, p. 454 and 508, 1876. Vulpain, on "The Mode of Action of Salicylate of Soda in Acute Articular Rheumatism," Bull. de Ther., Paris, 1881, t. c. p. 97. Lecorché and Talamon, on "The Action of Salicylate of Soda on the Urea, Uric Acid and Phosphoric Acid of the Urine, in Acute Rheumatism." Revue. Mens. de Med. et Chir., March, 1880. Anger, on "The Treatment of Rheumatism by Salicylic Acid," Thèse de Paris, 1877.

(*b*) Maclagan, on "The Treatment of Rheumatism by Salicin and Salicylic Acid. Lancet, June 21, 1879.

study. You prepare with salicylate of soda solutions more or less dilute which you administer to the patient. These solutions have a rather disagreeable taste, which is remedied to a certain extent by giving the medicine in milk. Here is the formula which I generally use:

℞ Salicylate of soda ..... 15 grms. (℥ ss)
Water ..... 250 grms. (℥ viij and ʒ ijss).

M. Signa. A tablespoonful *pro re nata*. Each dose should contain one gramme of the salicylate.

The question of dose plays an important part in the results attainable by this medication. Stricker was right in asserting that it is necessary to administer the salicylate of soda every hour till complete cessation of the rheumatism. You must give large doses, and proportion them to the gravity of the affection.

I am accustomed, in rheumatisms of moderate intensity, to administer daily from 4 to 6 grammes (1 to 1½ drachms) of salicylate of soda, in fractional doses, two hours apart, and if by the second day I obtain no abatement of the pain and fever, I increase the dose so that the patient shall take 10 grammes (150 grains) during the twenty-four hours; ordinarily 6 grammes a day will suffice.

When once the pain is subdued, I take care not to stop the salicylate medication, which, in smaller doses of two or three grammes a day is prolonged for a fortnight, but the dose is instantly increased if I see any tendency to a return of the rheumatism. For if the salicylic treatment often causes the symptoms of acute inflammatory rheumatism to disappear as if by magic, it does not arrest the disease altogether, and if you leave off abruptly the administration of the medicine, you will see the rheumatism return with a new intensity; the relapses are then more stubborn to treatment than was the incipient attack. Therefore, I cannot too strongly recommend you, after the cessation of pain, and the disappearance of the rheumatism, to keep your patients in bed for two weeks, and to consider them all this time as under the influence of the malady.

Clinicians have much discussed and much exaggerated the dangers of these doses of salicylate of soda. Such disastrous results have been attributed to them, that you will sometimes see families obstinately oppose the employment of this medicament. The salicylate, in fact, does produce buzzing in the head and some vertigo, especially when the dose is large; but these symptoms are transient and not at all alarming. Children, it must be admitted, support admirably the salicylate,[1] while women experience the cerebral effects in a much more marked degree than men, and you should make a note of this fact when you prescribe it to females.

[1] Deseille, by observations made in the service of Bergeron, has shown that salicylate of soda is well borne by children, who can take six grammes a day with safety. Muscular rheumatism yields in forty-eight hours or more, and acute rheumatism of the joints experiences a very marked sedation at the end of two to five days of treatment. (*a*)

(*a*) Deseille on the Salicylic Treatment of Rheumatism in Infants. Thèse de Paris, 1879.

To the salicylic medication have been attributed all the complications which may appear in the course of rheumatism, and in particular, those which manifest themselves on the part of the cerebrum, or the heart. This is a mistake. I believe, on the contrary, that the salicylate, administered at the onset of the rheumatism, opposes the evolution of the malady, and so far, within an actual limit, the cardiac complications which play so considerable a part in the prognosis of rheumatism. Will the salicylic medication prevent every complication? Assuredly not, for in certain cases it is the cardiac rheumatism which appears as the first symptom of the disease.

Therefore, you ought to employ this medication in the greater number of cases, and I know of but one contra-indication to the use of the remedy; namely: its non-elimination by the urine. This is a point to which I alluded when treating of diseases of the kidneys, in a former lecture.

Whenever salicylate of soda is administered to a patient suffering from parenchymatous or interstitial nephritis, the smallest doses may determine cerebral accidents of the greatest gravity, therefore you ought to examine carefully the urine of your patients before advising the salicylic treatment.

Does salicylate of soda thus administered cure all cases of acute rheumatism? One may reply in the affirmative for the great majority of cases. At the same time there are a certain number of rheumatic patients who are not benefited by this treatment. I am convinced, however, that save in exceptional cases, these refractory forms are tendinous rather than synovial, and that, as a general rule, the more frankly acute the rheumatism, the more amenable it is to medication by salicylate of soda.

There is another form of rheumatism which resists the salicylate medication. I refer to gonorrhœal rheumatism. Whether this rheumatic inflammation be diffused, or localized in a joint, it is pretty certain that salicylate of soda has little or no action on these muscular or tendinous rheumatisms, and that you have no other means of subduing these obstinate arthrites but the revulsive method.

Thus far I have been occupied only with acute articular rheumatism, but there are certain other forms of rheumatism of which I must speak. I refer to muscular rheumatism, and those rheumatisms which are not accompanied with fever, and which have been described under the name of rheumatic pains, pains which come on under the influence of atmospheric changes, and which are so frequent and so annoying in old persons of arthritic habit. These manifestations are amenable to external treatment, and you can use revulsion or topical anodynes, or baths.

Revulsion is one of the most powerful means of treatment of local rheumatism, and according to the degree of the arthritis, you can use tincture of iodine,[1] blisters and galvanic cauterizations.

[1] The officinal tincture of iodine (French Codex) is iodine 1 gramme, alcohol 12 grammes. In the United States a decolorized tincture is prepared as follows: ℞ Iodine, 5 grammes; alcohol, 50 grammes; aquæ ammon. fort., 11.60 grammes. M. It takes about five weeks to obtain complete decolorization. For relief of intense pain, the iodine tincture

As for the iodine applications, you can make use of the tincture of iodine of the pharmacopœia, or of the iodized cotton,[2] or if you desire still more revulsive an action, you can add a little more iodine to your tincture.[3]

You can also make use of the means proposed by Bernard,[4] who based quite a therapeutic method on nascent iodine. This method consists in the decomposition, on the place where it is applied, of an alkaline iodate by tartaric acid. It is quite an efficacious way of procuring severe local revulsion.

It is in these cases of rheumatic pains that use is made of the pomades and liniments of which I have before spoken. One point I must urge upon you: In these painful muscular and joint affections it is well to keep the limb at rest. Moreover, this immobilization is instinctively made by the patient, who thus seeks to avoid anything that will produce pain. Œhme has gone so far in this direction as to propose splints in the treatment of acute rheumatism of the joints.[5] I think that this is carrying immobilization to excess; and notwithstanding the importance which ought to be attached to arrest of movements in the treatment of certain mono-articular arthrites, it would be a mistake to apply retentive apparatuses in the case of inflammations so mobile and shifting in their character as are observed in acute rheumatism.

Balneotherapy occupies an important place in the therapeutics of acute rheumatism, whether muscular or articular. This disease being generally pro-

may be advantageously medicated with morphia as follows: ℞ Morphia, 1 gramme; tincture of iodine, 30 grammes. M.

[A favorite anodyne application is the extract of belladonna or stramonium rubbed up into a paste with water, and spread on cloth, with which the affected joint is covered.]

[2] The iodized cotton is made according to Mehu's directions as follows: Take 25 grammes (nearly an ounce) of finely carded stove dried cotton, sprinkle over it 2 grammes (ʒ ss) of iodine reduced to powder, and heat to 100 degrees 212° F.) Eight per cent. of the iodine remains fixed to the cotton. (*a*)

[3] Bouvier gives the following formula for a stronger tincture of iodine than the officinal; ℞ Tinct. iodine, 30 grammes; iodine 2.50 grammes; iodide potas., 1.50 grammes. M. Laborde's tincture is still stronger: ℞ Tinct. iod., 60 grammes; iodine, 10 grammes; iod. pot., 5 grammes. M. This solution has the consistence of paint, and is applied with a camel's hair pencil. (*b*)

[4] Bernard's solutions for nascent iodine are as follows: ℞.—Iodide of sodium, 98.85 grammes; iodate of soda, 26.17 grammes; water, q. s. For a solution which will mark 12.5 on the salinometer. This is No. 1. No. 2 is as follows: Tartaric acid, 125.80 grammes; water, q. s. To make a solution that shall mark 12.15 on the salinometer. Apply with two different brushes the two solutions successively, or surround the joint with cotton soaked in No. 1; the acid sweat will set free iodine by decomposition of the alkaline iodate.

[5] Œhme employs splints in the treatment of acute articular rheumatism, and he has compared the results obtained by this method in 45 cases of rheumatism, with 45 other cases treated by other methods. According to this writer, immobilization lowers the fever, and the total duration of the disease is diminished a week at least (*c*).

(*a*) Delpech on Iodized Cotton. Bull. gen. de Th. t. 87. p. 33, 1874.

(*b*) Laborde on The External Applications of Iodine. Bull. de Th., t. 87, p. 76, 1874

(*c*) Œhme, Die behandlung des Rheumatismus acutus mit festen verbanden (Arch. der Theelkunde, 1875, 5th livr.)

voked by the direct action of cold and dampness on the cutaneous surface, and by arrest of the functions of the skin, it has always been believed that sudorifics have a very energetic and beneficial action in the treatment of rheumatism, and that nature has given an indication for their employment in the abundant sweats that characterize the malady. Therefore it has seemed logical to increase the secretory action of the skin. Sudorifics have then been in fashion, whether administered internally in the form of ptisans or externally in the form of vapor baths; thus infusions of dulcamara (bitter-sweet) have been advised, of borage (borago officinalis), of bryony, and especially of the European ash (fraxinus excelsior) vaunted by Delarue, Marbotin and others.[1] I must not omit to mention the infusion of black cohosh (cimicifuga racemosa) so recently recommended by Bartlett.[2]

In the same group we must place jaborandi and pilocarpine, with which, in the treatment of rheumatic fever, Gubler, at the beginning of his career as a clinician, made several trials; trials which have seldom since been repeated.

If diaphoretic infusions play a doubtful and disputed rôle in the therapeutics of rheumatic fever, it is not so with external sudorific applications, such as vapor baths, the wet pack,[3] and hydrotherapy.

Sudation is obtained by the vapor bath in two ways: either by the hot dry

[1] The leaves of the ash, *fraxinus excelsior*, have been much employed in rheumatism, and recently Delarue, Pouget and others have experimented with this old remedy, and have found the leaves efficacious as a therapeutic agent. The infusion, if we may judge by their trials, provokes abundant sweats and a copious diuresis. The leaves contain the medicinal principles, and the dry leaves are better than the green. With the former a decoction is made by infusing from half an ounce to an ounce in eight ounces of water, a pinch of peppermint leaves being added before steeping. This infusion is taken in teacupfuls every two or three hours; it may also be used in the form of lavements. The dried leaves may also be applied around the painful joints. Pouget has proposed a similar infusion, made by steeping fifteen grains of the dried powder of the leaves in about a gill of hot water; this is infused three hours and strained. (*a*)

[2] The black cohosh (also called macrotys) is much used in this country in acute and chronic rheumatism. It is a great favorite with eclectic practitioners. The decoction of the root (one ounce to the pint) may be used in doses of one or two fluid ounces, or the tincture or fluid extract, in the dose of 15 drops every two hours, till relief is obtained from the pain and active diaphoresis is produced. According to some authorities its physiological action is characterized by slight nausea, vertigo and lowering of the pulse, but not by sweating. Dr. F. N. Johnson, of New York, was one of the first to introduce it in this country in the treatment of acute inflammatory rheumatism. It induced no sensible evacuations but diminished the force and frequency of the pulse, and caused the pain to disappear. Dr. Simpson found it wonderfully efficacious in lumbago. In sciatica and rheumatic dysmenorrhœa it is highly vaunted.—TRANS.

[3] Dowse employs in cases of acute rheumatism wrappings in wet sheets, and claims good results. He envelopes the patient in a sheet wrung out of warm water, which he covers with dry blankets, so as to provoke copious diaphoresis; from time to time the patient is made to drink some hot ptisan. (*b*)

(*a*) Delarue, Jour. de Conn. Med. Chir., August, 1852. Pouget and Peyraud, Union Med., Dec. 9, 1852. Marbotin, Bull. de Ther., 1853.

(*b*) Dowse, Brit. Med. Jour., 1875, pp. 39 and 106.

air, or the hot moist air process, and we can in certain cases apply warm steam douches to the patient in bed, by projecting jets of steam around his body encircled with hoops which are covered by the bed clothes.[1]

During the last few years there have been great improvements in the processes of balneation. Zaba has advised the use of the vapor of water as hot as can be borne. Benoit, Bremond and others have added turpentine to these baths and have thus constituted terebinthinated vapor baths, which play an important part in the treatment of certain forms of rheumatism. By the side of these baths of medicated vapor, we place medicated baths, properly so-called, and among these last the sulphur baths.[2] These give good results in the treat-

[1] Vapor baths are divided into hot air baths (the hot air chamber) and vapor baths properly so-called. These baths are of great antiquity. The Egyptians employed dry air baths, also the ancient Mexicans, according to Von Humboldt. Among the Greeks and Romans these balneal practices were in great repute. After undressing in the *spoliatorium*, the bather entered the *laconicum*, an oven-like chamber filled with hot air, and in which profuse perspiration was excited. Then he passed into the *frigidarium*, where he took a cool plunge bath, and from this he went on to the *tepidarium*, a warmer apartment where massage was practiced, and where he was dried and rubbed and anointed with oil.

Hot air baths are given at the present day in special apartments which the subject enters, or they consist of partial air baths in which the head of the patient is protected from the heat. A simple way of administering this bath is to place the patient on a chair pierced with holes and covered with a cloth, beneath which an alcohol lamp is burning. He is then wrapped with blankets, all but the head. The temperature of the hot air chamber varies from 35° to 65° centigrade. It is not, however, prudent to exceed a temperature of 45° (113° F). After staying a while in these hot air chambers, the subject takes an invigorating plunge in a cold tank, or receives a cold douche (as in the Russian bath). In the Turkish or Oriental bath, after emerging from the hot air room, the bather is shampooed, wrapped in warm towels and wiped dry.

Vapor baths are also whole baths or partial baths. The temperature of these moist air chambers is lower than that of the dry rooms, and varies between 37° and 45° centigrade. At the same time the people of northern countries can support for a short time, without suffering, a temperature of 75° C. (167° F).

[The partial vapor baths are given in a similar way to the partial hot air bath above described, a dish of hot water being placed over the alcohol lamp and made to evaporate; the vapor being confined by the bed clothes which envelope the patient, all but the head. In a very short time profuse perspiration takes place.]

The last few years Fleming has studied the action of the Turkish bath. He has shown that it augments the temperature and pulse. The destiny of the urine is increased; it loses a great part of the chlorides, while the quantity of urea is augmented; arterial tension is raised. Fleming considers the Turkish bath a powerful curative agent in rheumatism, but it is contra-indicated where there is any heart affection. (*a*)

Bremond's apparatus consists of a tight box in which the patient is confined, all but his head. Into this box steam is conveyed by a suitable generator; this steam carries with it minute quantities of the vapor of turpentine which impinges upon every portion of the body of the patient, except what is outside the box. Bremond affirms that by this means there is a considerable absorption of turpentine by the skin and elimination by the different emunctories. (*b*)

[2] There are several formulas for these sulphur baths. We present three :

(*a*) Physiology of the Turkish Bath, Jour. of Anat. and Phys., July 13, 1879.

(*b*) Bremond, Cutaneous Absorption. A New Method of Treatment of Rheumatism, Paris, 1874.

ment of rheumatic pains, but it is necessary to take great care, as Lasègue recommends, always to raise the temperature of the bath so that the bath will be hotter when the patient leaves it than when he enters it.

It would now be in place to speak to you of the thermal treatment of rheumatism, but as this kind of treatment belongs rather to the chronic than to the acute manifestations of this affection, I will defer the exposition of this subject till my next lecture, when I will consider the treatment of chronic rheumatism and of gout.

To sum up, then, what I have said: In simple acute articular rheumatism you need employ only one medication, the salicylate of soda, giving it from the very beginning in the doses of from four to six grammes (3 j to 3 jss) a day, and you must prolong the treatment a long time after the disappearance of the pain and febrile symptoms. In subacute rheumatism, whether articular or muscular, yet accompanied by severe pains and great mobility of symptoms, it is still well to make use of salicylate of soda. When, on the other hand, you have to do with vague rheumatic pains without fever—frictions, vapor baths and sulphur baths will serve you a good turn. In fine, when rheumatism localizes itself, it is the revulsive medication which you should employ, and according to the effects which you would produce, you may use successively tincture of iodine, vesicatories and punctiform cauterizations. It is this revulsive method which, joined to the use of suitable retentive apparatus, is of most efficacy in the treatment of gonorrhœal rheumatism. It remains for me now to say a few words about the treatment of the complications of acute rheumatism.

You all know the predominant tendency of rheumatism to affect serous membranes, and especially those of the heart. These endocardial, pericardial, pleuritic rheumatisms are all amenable to revulsive treatment, but you can prevent in a certain measure their development by the salicylic medication; and notwithstanding the statistics furnished by Fagge and Broadbent, I can assure you, after my own experience, that the salicylate of soda, administered from the very commencement of rheumatism, will oppose cardiac and pulmonary complications.[3] Among these complications is one which is of great gravity, and

1. Take of sulphide of sodium.....two ounces.
   Chloride of sodium.....two ounces.
   Dried carbonate of soda .....one ounce.

Mix. To be added to the water of an ordinary full bath.

2. Take of sulphide of calcium.....two ounces.
   Bicarb. soda.....two ounces.
   Chloride of sodium.....two ounces.

Mix. For a bath.

3. Take of tri-sulphide of potassium.....five ounces.

Add to the water of an ordinary full bath.

No. 3 is the most generally used.

[3] There is not perfect agreement among medical authorities respecting the influence of the salicylic medication as preventive treatment of the cardiac complications in rheumatism. In Germany certain statistics have been published which pertain to eighteen cases of acute rheumatism treated from the first or second day by the salicylate. In only five per cent. of

which, by the treatment which it demands, has a place apart from the other manifestations of rheumatism. I refer to cerebral rheumatism.

The accidents which may occur on the part of the brain in the course of rheumatism have multiple forms.[4] Sometimes intellectual troubles supervene, which my excellent friend Mesnet, my colleague in this hospital, has described under the name *folie rheumatismale* (rheumatic insanity). Sometimes veritable attacks of hemiplegia take place (rheumatic apoplexy); sometimes meningeal symptoms predominate; sometimes there exists hyper-pyrexia with or without delirium. This rheumatic hyper-pyrexia has especially attracted the attention of English physicians, and in his recent work on rheumatism, Maclagan devotes a long chapter to this hyper-pyrexia, which he likens to that produced by sunstroke. He attributes it to irritation of the thermic nerves of the skin by lactic acid, the excess of which in the blood is, he thinks, the first cause of all the rheumatismal complications. It is this hyper-febrile movement which is

these cases were there any cardiac lesions, instead of in eighty per cent., which has been given as the ratio of heart complications where this medicine was not used.

English statistics give results completely opposite. The statistics furnished to the Medical Society of London in December, 1881, pertain to 5,000 cases. According to the statistics of Fagge, in 500 cases of rheumatism not treated with salicylic acid, there were 273 with cardiac lesions, or fifty-four per cent.; in 350 cases where various kinds of treatment were used, there were cardiac lesions in 227, or sixty-five per cent.; in 350 cases treated by salicylate there were cardiac lesions in 241, or sixty-eight per cent. According to the statistics of Broadbent, there were cardiac affections in fifty five per cent. where salicylates were not used; and in 1,748 cases in which this medication was employed, there were cardiac affections in 1,109, or sixty-three per cent. In England, then, instead of the small proportion of five per cent., we find a medium of sixty-four per cent. of cardiac complications during or following the salicylic medication.

[4] Hervez of Chegoin was the first to describe, under the name of cerebral rheumatism, the brain complications which supervene in the course of rheumatism. These complications may be classed under four heads: *Folie rheumatismale*, rheumatic apoplexy, rheumatic meningitis, and simple delirium with hyper-pyrexia.

Hyper-pyrexia is observed especially in connection with simple delirium, and it is this form which is benefited by cold baths. The delirium may even be wanting, and there exist rheumatisms with hyper-pyrexia, without delirious manifestations. Steward Lockie cites curious examples. The temperature rises in these cases to 41° C., and even attains a higher point. What characterizes this form of rheumatism is the disappearance of the articular phenomena, and their reappearance when the delirium is gone. Cerebral rheumatism has been accused of being provoked by the exhibition of certain medicaments, and in particular quinine. Aran has shown that these medicines have nothing to do with the production of cerebral rheumatism. The treatment of cerebral rheumatism by cold baths was first adopted by William Fox in 1871; then, the same year, by Moxon and Clifford Albutt; by Thompson and Russel in 1872; by Weber in 1873; by Raynaud in 1874; Fereol and Blachez in 1875, and Heubner in 1877. (*a*)

(*a*) William Fox, On the Treatment of Hyperpyrexia as Illustrated in Articular Rheumatism, London, 1871. Morton, Med. Timet, 1871, p. 243. Clifford-Albutt, Lancet 26 décembre, 1871. Thompson, Brit. Med. Journ., 3 aug. 1872, et Med. Times, 19 mars 1873. Russel, Brit. Med. Journ., 20 mars 1872. Weber, A Case of Hyperpyrexia, Clin. Soc. Trans., V, 1872. Heubner, Zur Behandlung der Hyperpyrexia in Acuten Gelenkrheumatismus des Sagenaunten cerebralrheumatismus, Arch. der Heilkunde, XVII, p. 134.

of all the cerebral accidents of rheumatism, the only one amenable to treatment by cold baths.[1]

In the discussion which arose in 1875 in the sessions of the Société des-Hôpitaux, with reference to the treatment of cerebral rheumatism by cold baths, I was forced to take the ground that in the event of cerebral complications, the indication for this kind of treatment was derived neither from the disappearance of the joint symptoms, nor from the appearance of delirium, but from the elevation of temperature, and that the only guide in the use of cold baths was the temperature which in these cases may reach, and even exceed 41° C. (nearly 106° F.) (*b*)

This cold bath medication, recommended for the first time by William Fox in 1871, and introduced into France by Maurice Raynard in 1874, has given, in certain cases, marvellous results. It consists in immersing the patient in cold water, according to the method of Brand, and in continuing or repeating the baths till the temperature is brought down, and remains below 40° C. (104° F).[2]

This kind of treatment is heroic, and you ought always to resort to it when you have to do with rheumatism complicated with excessive fever

[1] Maclagan dwells at great length on rheumatic hyperpyrexia. According to him there exists a special heat centre, situated probably in the upper part of the spinal cord, which governs and regulates the heat-production of the entire economy; this centre, which has the double power of producing and arresting heat, is in immediate connection with the thermic nerves which are abundantly distributed in the skin. It is thus that is explained the hyper-pyrexia produced by *coup de soleil*, and the febrile excesses observed in rheumatism.

The skin possesses an extraordinary activity in rheumatic fever; the excess of lactic acid in the blood, which is, according to Maclagan, the point of departure of rheumatism, is the cause of the excessive sweats. and as this lactic acid is eliminated by the perspiration its elimination irritates the cutaneous surface. This irritation enlists the thermic nerves as well as those of common sensation, and through the thermic nerves the thermic centres are affected. As treatment Maclagan proposes cold applications.(*a*)

[2] Woillez has written a valuable monograph on the treatment of cerebral rheumatism by cold baths. According to him the indications of this bath are as follows:

1. When to the delirium is joined diminution or disappearance of the articular fluxion, and, moreover, a fever heat of 40° or more.

2. When in cerebral rheumatism with the delirium there is no diminution in the joint symptoms, the fever heat being high.

The Clinical Society of London has made some researches on this subject. These are their conclusions:

1. The hyperpyrexia in acute rheumatism seems to prevail at certain epochs. Cases of this kind were very numerous between the years 1873–76. They have been more rare for the last few years. Without affirming that there exists a mathematical proportion between the number of cases of hyperpyrexia and of rheumatism, it may at the same time be admitted that there exists a certain relation between them. The hyperpyrexia was more common in spring than in summer, while rheumatism is more frequent in fall and in winter.

2. While the influence of sex on the frequency of rheumatism seems little marked,

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(*a*) Maclagan On Rheumatism, Its Nature and Treatment, London, 1882.

(*b*) Dujardin-Beaumetz on The Indications of Treatment of Cerebral Rheumatism by Cold Baths. (Union Med., 1875, and Bull. et Mem. de la Soc. Med. des Hôp., Mars., 1885.)

heat, one of the gravest of forms, and which speedily proves fatal unless you come to the rescue with active antipyretic treatment.

I shall have finished, gentleman, the hints which I wished to give you in reference to the treatment of acute rheumatism, when I shall have set forth the dietetic and hygienic principles which should govern you in these cases. These general rules, save always the milk regimen counselled by Biòt of Lyons,[3] are much more applicable to chronic rheumatism and to gout. I will then defer them till my next lecture, when I shall speak of the treatment of these two affections.

hyperthermia is more common in man than in woman, in the proportion of 1.8 to 1.; the influence of age and professional occupation is nil.

3. Hereditary predisposition to rheumatism is not a cause of hyper-thermia.

4. Generally hyperthermia complicates the first attacks of rheumatism.

5. It is not generally accompanied by accidents on the part of the viscera. The most common visceral complications are pericarditis and pneumonia.

6. The mortality of acute rheumatism with hyperthermia is very high; hyperthermia is one of the principal causes of death in acute rheumatism.

7. Sometimes, but not always, it is preceded by suppression of the joint pains and by perspiration.

8. It is often preceded by delirium or other nervous accidents.

9. The date of the appearance and the duration of the hyperthermia are very variable.

10. Death, when it takes place, comes on generally on the second or third week of the rheumatism.

11. It does not give place to the special lesions of the viscera; when there exist visceral lesions, these are not necessarily very extensive.

12. The best treatment consists in making cold applications to the skin; these are the more efficacious, the earlier they are resorted to. The temperature ought not to exceed 40.5° C. (105° F). If the baths do not suffice, one should have recourse to applications of ice, to cold lotions, to the wet pack, to injections of ice water, etc. (*a*)

[3] Biòt, of Lyons, employs the milk diet in rheumatism. According to him, this regime alleviates the pain and lowers the thermic curve. This effect is largely due to the activity given to the renal functions. (*b*)

(*a*) Woillez, Du rhumatisme cérébral et de son traitement par les bains froids (Bul. gén de Thér., p. 334 et 397, October et November, 1880). Report concerning hyperpyrexia in acute rheumatism, by a Commission of the Clinical Society of London (Med. Times and Gaz., June 3, 1882).

(*b*) Biòt, On Milk Treatment of Acute Rheumatism. Revue Mens. de Mèd. et Chir. Mars, Avril, Mai, 1879

ON THE TREATMENT OF CHRONIC RHEUMATISM AND GOUT.

SUMMARY:—Chronic Rheumatism—Origin of Gout and Chronic Rheumatism—Arthritism—Arthritis Deformans—Treatment of Arthritis Deformans—Internal Medication—Arsenic—Iodine and Iodides—Salicylate of Soda—External Treatment—Electricity and Massage—Thermal Treatment—Dietetic Treatment—Action of Cold—Gout—Pathogeny of Gout—The Uric Acid Diethesis—Etiology of the Uric Diathesis—Therapeutics of Gout—Treatment of the Fit of Gout—The Fit of Gout—Ought We to Treat the Fit of Gout—Visceral Complications of Gout—The Gouty Kidney—Bloodletting—Sudorifics—Guaiacum—Purgatives—Specific Treatment of Gout—Sulphate of Quinine—Colchicum—Preparations of Colchicum—Vegetal Treatment of Gout—Alkalies—Salicylate of Soda—External Treatment of the Fit of Gout—Resumé of the Treatment of the Fit of Gout—Treatment During the Interval—Alkalies—Lithia—Bitters and Tonics—Thermal Treatment—Hygienic Treatment.

GENTLEMEN:—I propose in this lecture to consider the treatment of chronic rheumatism and gout. By these words, chronic rheumatism, I do not mean all chronic forms of rheumatism, but rather that variety which affects the bones, and which is characterized by those deformities of the small joints which have given to this affection the name of *nodular rheumatism* or *arthritis deformans*.[1]

Confounded from remote antiquity under the name of arthritism, gout and chronic rheumatism have been now grouped in the same description, now constituted as distinct entities, according as writers have taken for their basis the etiology, the symptomatology, or the pathological anatomy of these two affections. To-day this question, after many vicissitudes, seems to have reverted to the point from which it started, and if we observe between gout and rheumatism differences radical and complete, we recognize also that they may derive their origin from one common hereditary source.

[1] Charcot has referred chronic articular rheumatism to three principal types: 1. Chronic, primitive, articular rheumatism, generalized or progressive; this is the nodose or deforming rheumatism of authors, a rheumatism remarkable especially for its tendency to become general, by beginning in the little joints and particularly those of the hands, by the deformities and disorders which it occasions.

2. Chronic, primitive articular rheumatism, fixed and partial. This is the dry arthritis of surgeons; it generally affects only one joint, preferably that of the hip (*morbus coxæ senilis*).

3. Heberden's nodosities (*digitorum nodi*) which occupy the joints of the phalanges and palangettes, while sparing the matacarpo phalangeal articulations. Besnier has divided the forms of chronic articular rheumatism into three groups:

Simple chronic rheumatism, chronic fibrous rheumatism, chronic bony rheumatism. The latter is subdivided into three groups: Chronic multi-articular bony rheumatism; chronic partial bony rheumatism; chronic rheumatism of the phalanges. (*a*)

(*a*) Charcot, Lecons sur le rhumatisme chronique, recueillies par Ball. Besnier, Art. Rhumatisme, in Dictionn. encyc. des sciences méd.

To this hereditary cause of these two diseases we give the name of arthritism, and if gout and rheumatism have at their origin many points of contact, they soon separate in two divergent directions, of which the two extremes are chronic arthritis deformans, on the one hand, and acute gout on the other. This opinion, which I defended at the time of the discussion which arose in the Society of Hydrology, between the partisans of arthritism and those who, like Durand Fardel, persist in seeing in gout, chronic rheumatism, and acute rheumatism, distinct morbid entities, I maintain to-day, for when you carefully trace back the genealogy of arthritic patients, you almost always find rheumatism in all its forms, or gout in all its modalities. At the same time, take note that quite recently our colleague Lancereaux has withdrawn arthritis deformans and dry arthritis from the category of arthritism to place this affection in the gronp of herpetic disorders. But this is a new view which needs to be discussed before being adopted.

Scarcely recognized at the beginning of this century,[1] chronic rheumatism with articular deformity, which is described under the name of *nodular rheumatism*, has not been well understood till within a few years, and it is especially to the School of Salpêtrière and its eminent master, Prof. Charcot, that we are indebted for the exposition, both from the standpoint of symptomatology and pathological anatomy, of the palpable and striking differences between gout and arthritis deformans, to the latter of which even now some authorities persist in giving the name of *gouty rheumatism.*

Even if we well understood the lesions of chronic rheumatism (arthritis deformans), the pathogeny and the course of the affection,[2] it must be confessed that the therapeutics of this disease has made little progress, and our efforts remain well-nigh impotent to arrest the progressive and invading march of those

[1] The description of chronic deforming rheumatism is of recent date, and the first writing respecting it goes back to the beginning of this century. It was Landré-Bauvais, interne under Pinel, who, in his inaugural thesis in 1800, was the first to call attention to this form of rheumatism under the name of *primitive asthenic gout.* Heberden in 1804 discribed the nodosities of the joints in rheumatism; Haygarth in 1805 reviewed and completed this description. Lobstein, in 1833, described in his treatise of pathological anatomy the eburnated state of the bones; Deville, in 1845, called the attention of the Anatomical Society to the alterations of chronic rheumatism; finally, Charcot, in 1853, completed this description and established the anatomical and clinical distinction which separates gout from rheumatism. (*a*)

[2] The patho-anatomical lesions of chronic rheumatism affect the constituent parts of the joint: synovial membrane, diarthrodial cartilages, bones, and ligaments.

The synovial membrane at first slightly injected, and of pinkish color, soon becomes thickened, intensely red, and is traversed by numerous blood-vessels, varicose, more or less dilated, and surrounding the borders of the diarthrodial cartilages like a collar; it presents a roughened appearance and is covered with little prominences of variable size, from a millet-seed to a bean; these little bodies constituted by young connective tissue cells, and sometimes also by cartilage corpuscles, are pale or rosy in hue, and resistant to the finger;

(*a*) Vidal, Considérations sur la rhumatisme articulaire chronique primitif (Thèse de Paris, 1853). Charcot, Leçons de la Salpétrière, recueillies par Ball. Lobstein, Traité d'anatomie pathologique, t. II, p. 207. Landré-Bauvais, Doit on admittre une nouvelle espèce de goutte sous le nom de goutte asthénique primitive? (Thèse de Paris, 1800.)

lesions which eventually constitute incurable infirmities, and condemn the unhappy patient to a life of invalidism.

The treatment of chronic rheumatism comprises external and internal means. The internal treatment comprehends but few medicaments; those most in use are arsenic and arsenical preparations, iodine and the iodides, and salicylate of soda. Arsenic is given internally, as Charcot recommends, or employed in the form of arsenical baths (which have been especially vaunted by Noel Gueneau de Mussy); this treatment, whether it consists in the internal administration of arsenic or in the use of the baths, often provokes a return of the painful crises; hence this medicament should not be resorted to when there are any acute symptoms.[3]

the vascularization of the synovial fringes may give to the membrane a fleecy and fungous aspect.

The foreign bodies which are met with in the joint are sometimes free, sometimes pedunclated, sometimes sessile; they are constituted either of masses of fatty or connective tissue or of cartilaginous or bony substance; according to their age they are more or less large, more or less soft; when the transformation into bone takes place they become hard, resistant and opaque.

The synovial liquid is wanting or exists in very small amount and contains blood globules, epithelial or cartilage cells.

The cartilages lose their bright, smooth, lustrous appearance. Their surface is irregular, with velvety aspect and presents here and there ulcerations of greater or less depth. Here there are erosions, superficial, elliptical, or ovoid, as if lightly scooped out; in other places there are veritable losses of substance with complete disappearance of the cartilage to a greater or less extent, and this especially in places where the articulating surfaces are subject to much friction. On the margin of the articular cartilage you observe, on the other hand, a multiplication of the cellular elements contained in the cartilaginous capsules; numerous enchondroses are formed which unite in the form of crowns and by their ultimate transformation give place to a zone of osseous tissue over the entire circumference of the diarthrodial cartilage.

The extremities of the bones entering with the composition of the joint are swollen and covered at the margin with osteophyte productions, disseminated, or united and forming a sort of crown at the surface of articulation.

In the points where the cartilage has disappeared, the bone is more compact, it is an eburnated substance, formed of a layer of osseous lamellæ in which one fails to find Haversian canals; the surface is white and smooth, sometimes furrowed with grooves, due to friction of the two articulating surfaces.

Below the eburnated layer, the medullary spaces are, according to Vergely, filled with a great number of medulloceles and blood-vessels, while still deeper the spaces are enlarged, deprived of medulloceles, and filled with fat, and the osseous trabeculæ are diminished or reduced to the state of tenuous filaments, whence results the friability of the tissue of the epiphyses, which may be perforated by the scalpel or broken down under the finger.

The ligaments undergo variable modifications; sometimes there is nothing appreciable to the sight, at other times they are indurated or shortened, thinned, atrophied, and even occasionally encrusted with calcareous salts.

The tendons may undergo the same modifications; greater thickness, less resistance, atrophy or even disappearance.

The muscles which are in the vicinity of the articulation often present atrophy, thinning and decolorization, they are infiltrated with fat, and even at times undergo fibrous degeneration, with or without the bony transformation.

[3] Gueneau de Mussy has recommended two kinds of arsenical baths; the arsenical

However different these two modes of exhibiting arsenic may be, their principle of action is essentially the same, namely, by absorption of the medicament and its penetration into the economy, the rate of whose nutrition is raised. It must be confessed, however, that cutaneous absorption from baths is infinitesimal or nil.

Iodine has been employed in chronic rheumatism by Lasègue. He made use of the tincture, of which he was in the habit of giving large doses, as much as a drachm and a half a day (six grammes). It is given diluted in water, or, what is better still, in a little old Spanish wine, which constitutes a mixture which is but slightly disagreeable and is easily taken with the meals. Instead of iodine, iodide of potassium may be given. Besnier proposes to give the iodide in syrup of coffee, which he thinks is the best adjuvant, and from one to three grammes a day (15 to 45 grains) may be given in this way. Iodine and the iodides in these cases act especially by stimulating the organism and energizing nutrition. These are the most important indications to fulfil in the treatment of chronic rheumatism, and Garrod has justly insisted on this point in showing us that the dominant fact of the treatment ought to be to fortify the system and to excite the nutritive activity, which is considerably lessened; consequently, he recommended ferruginous preparations, cinchona bark, and, above all, cod-liver oil.

These indications are quite different from those which are applicable to the treatment of simple gout, and which should make us altogether discard in the treatment of chronic rheumatism the alkalies, which are heroic medicines in the gouty diathesis. This proscription of alkaline preparations ought not to include salicylate of soda. Whatever Sée may have said, who has affirmed that salicylate of soda may cure chronic rheumatism, I have never obtained the same effects from it. Nevertheless, while recognizing that if it is impotent in combating chronic rheumatism with joint deformities, the salicylate may be employed to advantage in the acute exacerbations which attend this disease; it diminishes then both the acuteness of the pain and the intensity of the febrile manifestations.

The internal treatment, then, of chronic rheumatism, may be summed up in a few words: arsenic in appropriate cases, iodide in others, and salicylate of soda in the periods of exacerbation.

The external treatment is much more complex. It comprises, first, all the local means which I enumerated *à propos* of acute rheumatism, as well as most

bath pure, which contains from fifteen grains to two drachms of arseniate of soda per bath, and the compound arsenical bath, which with the same quantity of arseniate of soda has from three to five ounces of carbonate of soda. *Apropos* of the application of these baths, Gueneau de Mussy distinguishes two forms of rheumatism: chronic rheumatism with little pain, and rheumatism with subacute attacks. In the first kind he would employ the compound arsenical bath, in the second the bath containing only the arsenical salt. The temperature of the bath varies from 86° to 95° F. (30° to 35° C.); as for its duration that depends on the degree of excitability of the patient. (*a*)

(*a*) Gueneau de Mussy. Clin. Med., t. i. p. 271, Paris, 1874.

of the artificial baths which I have described ; but to these means we must join others which have a very marked action in chronic rheumatism, in the first rank of which we place electricity. Whether the rheumatism has exerted its action primitively on the muscular tendons, or whether it has affected first the bony or fibrous parts of the articulation, it seems to be demonstrated that the deformities of chronic rheumatism, which are so numerous, depend on the retraction of certain muscular groups. There are even cases in which rheumatism very speedily causes atrophy of the muscles, producing in this way considerable loss of power in the limbs, and without any apparent deformity.

It is easy to understand the utility of electro-therapeutics in such cases. If you employ this agent, you must use galvanic currents, which have an influence on nutrition in general, and that of the muscles in particular. Erb, Remak, Onimus, Jules Cheron, etc., have long insisted on the remarkable action of these currents in causing the articular deformities gradually to disappear, and, for my part, I have obtained successful results of this kind which are really marvellous.[1] You should then always have recourse to constant currents when the phenomena of muscular irritation have disappeared. If you resort to this powerful therapeutic agent in time, you will be able to restore movement, and the use of the affected joints, and to attain this you should, as Dally has recommended, associate massage with the employment of electricity. To these powerful means of treatment in chronic rheumatism, the methodical employ of mineral waters should be added.[2]

[1] These are the conclusions of Remak, respecting the applications of constant currents to the treatment of chronic rheumatism.

Electrotherapeutics has for its object :

1st. To provoke catalysis in the interior of the tendinous part of the joint which is affected with inflammation, exudation, or sclerosis.

2d. To excite or accelerate a flux of liquid by impressions made on the blood-vessels distributed to the joint.

3d. To remove the muscular inflammation which often complicates the arthritis.

4th. To relieve the secondary contractures of the muscles, contractures which are kept up by the pain and inflammatory irritation.

5th. To remedy the paralytic and atrophic states which affect all the muscles as a result of inflammation, inactive or impeded circulation.

Onimus maintains that in the joint pains, galvanism is of indisputable utility, and ought to be tried even when the disease seems to be incurable. (*a*)

[2] [Walton (Mineral Springs of the United States and Canada) very properly divides rheumatics into two classes, those of the lymphatic temperament, and those of the nervous. In the former, waters rich in the sulphurets have seemed to produce the best results, and baths of a high temperature are indicated ; in the nervous temperament, however, waters containing but a small proportion of these constituents and of moderate heat, like the Virginia Hot Springs, are preferable. The hot sulphur springs have been much recommended in the treatment of chronic deforming rheumatism ; these benefit more by their elevated temperature than by any saline or sulphurous constituents. We have a great variety of such springs in this country. We may instance the so-called Hot Springs, in Garland County, Arkansas, whose waters resemble those of Gastein, in Austria, and Pfäffers, in

(*a*) Remak, Galvanothérapie, trad. de Morpain, 1860.—Onimus et Legros Traité d'electricité médicale, Paris, 1872, p. 45.

Mineral waters play a considerable part in the treatment of rheumatism, and Aix in Savoy, and Plombières, Naris, Luxeuil, Dax, Chattauneuf, Chaudes-Aigues, Bains dans les Vosgés, Bourbonne-les-Bains, and Bourbon-l'Archambault, and many others not to mention any out of France, have been counselled in rheumatism. There is a great variety of these mineral waters. It may in fact be said in a general way that all the thermal waters of high temperature are useful in the chronic forms of rheumatism. Three stations have especially been recommended : Plombières, Aix in Savoy, and Dax.

To Plombières you should direct your lymphatic and anæmic rheumatics, and those who are affected with visceral troubles of arthritic nature. To Aix-le-Bains where massage is practiced in a marvellous manner, you should recommend patients of a plethoric and congestive type. Lastly to Dax, where mineral mud baths are employed, you should send your chronic rheumatic patients ; moreover, these spas present the great advantage that they constitute rather a winter than a summer station.

To these waters you should join the ferruginous springs, as Garrod recommends ; such are those of Spa, of Schwalbach, of Mauritz, etc., the tonic action of which gives good results in rheumatism.

The necessity of tonic treatment should influence you in advising the dietary of these rheumatic patients, and all your efforts should be directed towards augmenting their nutrition. You should order a substantial nourishment such as red meats, generous wines, for, contrary to what takes place in gout, the uric acid diathesis does not exist in chronic deforming rheumatism. Urge the need of out-door air and exercise, to combat the muscular atrophy of the members. You should especially insist upon the necessity of avoiding damp cold. The impression of cold is one of the most active causes in the production of rheumatism, whether it acts directly on the nervous system, as Heyman[3] thinks, or in modifying the functions of the skin, permitting, as Hueter and Klebs believe, the introduction of organized phlogistic agents in the blood. This effect of cold is admitted by all observers, and is especially seen at periods of life when the body is most likely to be exposed to sudden changes of temperature; you must

Switzerland ; the Calistoga Hot Springs in Napa County, California ; the California Geysers ; the Santa Barbara Hot Sulphur Springs in California ; the Middle Park Hot Sulphur Springs in Colorado ; the " Warm Springs," in Madison County, North Carolina ; springs of the same name in Meriwether County, Georgia ; the Lebanon Springs in Columbia County, New York ; the Hot Springs of Bath County, Virginia ; and, lastly, the Salt Lake Hot Springs in Utah. The hot springs of Virginia and Arkansas are very fashionable places of resort ; to the treatment by baths are conjoined massage and douches.]

[3] Heyman has studied the influence of cold in the production of rheumatism. He maintains that it is by the medium of the nervous system that cold causes rheumatism. According to his view, the action of dry or damp cold on the skin impresses the nervous centres, and these, by reflex irritation of the trophic nerves, determine various troubles at the point where the cold acts, or in other parts of the economy. (*a*)

(*a*) Heyman, Ein, beitrage zur rhumatische lehre (Arch. fur path. anat. and phys., t. vi, 3e livraison).

then avoid these variations of temperature,[1] and their results, which often depend on the rapid evaporation of perspiration, by making your patients wear flannel and shun exposure to the winds, and particular to the west wind.[2]

You should have a surveillance also of the dwellings of your patients, providing as far as possible that the conditions of the habitation shall be of a sanitary kind, with apartments airy and free from moisture and the moulds which moisture generates,—cryptogamic productions which Moses in Leviticus characterizes as the plague in the walls of the houses[3] (Leviticus, 14, 36, etc.). Therefore, whenever your patients are well enough off to afford it, you should insist upon their avoiding the autumn rains, by going early to the winter stations. In a word, do not forget, gentlemen, that rheumatic arthritis, which has been called "poor man's gout," affects only those individuals whose nutrition is impoverished and enfeebled, and that all your efforts should be directed toward restoring the forces of the organism and stimulating the nutritive exchanges. This it is that explains how the treatment by arsenic and the iodide of potassium, the tonic medication under all its forms, is of use in these cases without being able always absolutely to oppose the invading march of the disease, which is generally fatal in the end.

Gout presents quite different indications of treatment, and the adage that to contrary affections contrary remedies are indicated, is especially applicable to these two diseases, gout and chronic rheumatism, which, born of a common parent, are distinct diseases from a clinical as well as from a therapeutical standpoint. While we can observe at our hospital chronic rheumatism under all its forms (and grave cases are not wanting), we seldom or never meet with gout; or at least but one kind of gout is common in our wards,

[1] In making a summary of the statistics of the hospitals of Paris during the years 1868, 1869, 1872, and 1873, Besnier has shown that acute articular rheumatism, with respect to the frequency of its occurrence, is not influenced by the regular order of the seasons except in a very limited proportion; it is, nevertheless, in the spring that more cases are observed in Paris. (*a*)

[2] Peters has studied the influence of climates on the production of rheumatism. According to this writer, in chronic rheumatism the aggravations coincide with a considerable fall in the mean temperature from one day to another, with a very moist atmosphere, a prevalence of west winds, and a large proportion of ozone in the atmosphere. (*b*)

[3] Charcot has dwelt at great length on the action of damp tenements in the production of rheumatism: "A dwelling on the ground floor, dark, damp rooms, wet garments, paper peeling from the walls—this is the condition in which we find the homes of most of those who are attacked with chronic rheumatism, and besides the patients have lived a long time in these sorry surroundings—for four, six, eight and ten years."

Gueneau de-Mussy also, has pointed out the unwholesomeness of the walls of tenements, characterized as they often are, by the presence of cryptogamic growths or moulds which Moses has described in Leviticus under the name of the "plague of the houses." These cryptogamic growths may possibly have an influence on the development of rheumatism. (*c*)

(*a*) Besnier, Art. Rhumatisme, in Dict. Encyc. des. Sc. Med.

(*b*) Peters, in Berlin, Klin. Wochens. nos. 1 and 3, p. 15 and 33. Jan'y. 13 and 20, 1879.

(*c*) Charcot on "The Diseases of Old Age." Wood's Library Series, 1881, p. 151. Gueneau de-Mussy, Clinique Medicale, Paris, 1874, t. 1, p. 305.

that from lead-poisoning,[1] and I have already shown you, in my service, curious examples of this affection, whose description we owe to Charcot, Garrod, Ollivier and Lancereaux. But in your private practice it will not be so, and you will there meet with a considerable number of gouty patients, although their number tends to become less every day. This diminution results chiefly from the fact that the number of idle men tends also to decrease and that the struggle for existence demands of almost everybody a certain amount of daily labor.

Without entering here into the details of the different theories that have been put forth as to the pathogeny of gout, it may be said that the humoral theory of the disease has always counted the most adherents. According to Sydenham, gout is the result of a peccant humor, a morbific matter, which nature endeavors to get rid of. Substitute for these words *peccant humor*, *morbific matter*, uric acid and urate of soda, and you will have the theory to-day admitted by physicians generally; and notwithstanding the reserves recently formulated by Bouchard, it seems to be proved that every attack of gout is due to excess of urate of soda.[2] But is is not sufficient to know that this excess

[1] Falconer in a work on the waters of Bath says that the *colica pictonum* is often accompanied with gout. Hillier-Parry in his medical work has a long chapter entitled "Gout from Lead." Garrod affirms with great positiveness the existence of this form of gout. Charcot, Ollivier, and Lancereaux also point out the frequency of saturnine gout.

Lead gout is accompanied, like ordinary gout, by the uric acid diathesis, and this diathesis results from the interstitial nephritis which is common to persons suffering from lead poisoning, and which hinders the elimination of uric acid. (*a*)

[2] The nature of gout has given rise to several theories which may be ranged in two groups: in the one has been considered the action of the solids as the starting point of the disease, in the other an alteration of the humors has been invoked in explanation.

The "solidists" have enumerated three orders of primordial causes of gout: stomach troubles, disturbances of the nervous system and of the joint elements.

Boerhaave and Van Swieten located the cause of gout in the stomach; whence the celebrated aphorism of Boerhaave "Ejus vitii origo proxima in indigestione viscerum."

Cullen is the principal defender of the nervous doctrine, according to which gout is a disease of the entire economy, but in particular of the nervous system. Like Boerhaave, he assigns an important part to the stomach. This doctrine has been revived by Braun who maintains that the fit of gout consists in a primitive and idiopathic alteration of the peripheral nerves, and that we ought to range it in the group of neuroses.

As for the writers who have assigned to joint troubles the origin of gout, we must mention in the first place, Hoffmann and Musgrave; the first has attributed the gouty paroxysm to violent spasm lacerating the fibrous ligaments of the joint. This spasm is produced by a depraved and acrid serosity, furnished by the little arterioles and glands of the ligaments. Musgrave makes gout consist in a disease of the minute follicles situated around the articulation and in the articulation itself. According to him gout, like scrofula is an alteration of the glands.

Alard and Ficinus refer the cause of gout to alterations of the joint lymphatics.

(*a*) Falconer, *Essai sur les eaux de Bath*, 1872.—Musgrave, *De arthritide symptomatica* (Genovæ, 1752, cap. x, art. 5, p. 65).—Hillier-Parry, *Collections of the unpublished medical writings of the late C. Parry*, London, 1855, p. 243.—Garrod, *Medico-Chirurg. Trans.*, vol. XXXVII., 1854.—Charcot, *Soc. de biol.*, 1871.—Ollivier, Thèse de Paris, 1863, et *Arch. Gén. de méd.*, t. II, p. 430 et 709.—Lancereaux, *Soc. de biol.*, 1870; *Union méd.*, 15 Décembre, 1863, p. 513.

of uric acid is the first cause of gout, we need chiefly to know the reason of this accumulation.

Since the time when, in 1793, ninety years ago, Forbes Murray affirmed the starting-point of gouty symptoms to be the presence of uric acid in the humors of the economy, many hypotheses have been advanced to explain the first cause of this uric diathesis. Residuum of the imperfect combustion[3] of albuminous matters, cinders, as it were, of the economy, uric acid is the result of the incomplete nutritive operations of the human system. Urea, which is a more perfect product of organic combustion, has an origin which varies according to the ideas advanced as to its production; thus it is that Provost and Dumas regard this substance as the result of an oxidizing process

The group of humorists is far the more numerous. Sydenham was one of the most illustrious representatives of this doctrine; in his estimation gout depends on a morbific matter produced by imperfect coctions, and the symptoms of gout are an expression of the efforts of nature to expel this peccant matter.

In 1797, Wollaston and Tenon proved that the concretions of gout are composed of urate of soda, and for the peccant matter of Sydenham was substituted the uric acid diathesis, and it is Garrod who has given this theory its greatest completeness. According to him, uric acid in gout, under the form of urate of soda, exists always in abnormal proportion in the blood, and this is a necessary condition to the production of the paroxysms which are characterized by the presence in the interior of the joint of crystalline deposits of the urate.

This doctrine, supported by Charcot, has been combatted by Bouchard who affirms that there is not always in gouty persons an excess of uric acid in the blood. He believes gout to be a disease characterized essentially by retardation of nutrition.(*a*)

[3] Uric acid ($C^5H^4N^4O^3$) is a product of the oxidation of urea. Submitted to the action of oxidizing agents it furnishes three series of bodies, alloxane ($C^4H^2N^2O^4$), parabanic acid ($C^3H^2N^2O^3$), and allantoid, ($C^4H^6NO^3$).

Uric acid by oxidation and hydration breaks up into urea and alloxane.

Urea is the ultimate term of the azotized matters of the economy. Bechamp and Ritter have obtained urea directly by oxidizing albuminoid matters with permanganate of potash.

There has long been earnest discussion concerning the origin in the organism of urea and uric acid; some authorities have maintained that urea is formed in the kidneys. This opinion has been combated by Prevost, Dumas, and Grehant, who have disproved it by showing the accumulation of urea and uric acid in the blood of animals in which the kidneys had been extirpated. Dumas has maintained that it is in the ultimate capillaries that the oxygen of the arterial blood destroys the tissues which have become unfitted for life, and Hirtz calls urea the ashes of animal combustion.

Bouchardat and Robin think that urea and uric acid result from the process of dis-

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(*a*) Sydenham, *De podagra et hydrope*, London, 1683.—Musgrave, *De arthritide symptomaticâ dissertatio*, 1707.—Hoffmann, *De doloro podagrico*, 1701.—Garrod, *the Nature and treatment of gout, and rhumatic gout*, London, trad. par Ollivier et annoté par Charcot, Paris, 1869.—Charcot, *Etudes pour servir a l'histoire de l'affection décrite sous le nom de goutte asthénique primitive, nodosité des jointures* (thèse inaugurale, Paris, 1853.—*Sur les concrétions tophacées de l'oreille externe chez les goutteux* (*Gaz. hebd.*, 1860). *L'intoxicat ion saturnine exerce-t-elle une influence sua le développement de la goutte* (*Gaz. heb.*, 1863).—*Leçons sur la goutte* (*Gaz. des hôp.*, 1866).—*Leçons sur la goutte* (*Gaz. des hôp.*, 1867; *Bull. de thérap.*, 1867).—*Leçons sur les maladies des viellards el des maladies chroniques, recuellies par B. Ball*, 1867.—Braun, *Deutsche Klinik*, 1854, p. 22; *Beitrage qu einer monographe de Gicht*, Wiesbaden, 1860, trad. par Méder, Paris, 1862.—Bouchard, *Maladies par ralentissement de la nutrition*, Paris, 1882, p. 264.—Paul Pouzet, *Contribution à l étude de la goutte* (thèse de Paris, 1878).

in the capillaries, while Robin and Bouchardat consider it as a product of disassimilation, and, on the other hand, Brouardel, Charcot, and Murchison, think that the liver chiefly is concerned in its elaboration.

Whatever theory one may adopt, the main fact that you should bear in mind, is that there will be increase or diminution in the production of uric acid according as nutrition is perfect or imperfect. As for the accumulation of urea and uric acid, it may result from two causes which shed light on the pathogeny of gout. In the one case the uric diathesis has for its origin excess of production; in the other, the production remains the same, but there are troubles in the function of the kidneys which prevent the elimination of uric acid, and it is these two great factors which we shall have to study when we examine the prophylactic treatment of gout.

The medicines recommended for gout are very numerous; their number was considerable in the time of Lucian, if we may judge by his dialogue on gout.[4]

similation in the economy. Finally within a short time, Brouardel has claimed that the production of urea or uric acid is limited to a single organ, the liver, and Murchison and Charcot have adopted this view, a view on which Murchison has even based a new theory of gout.

The congestion of the liver is the central point of gout; this congestion occasions an augmentation of the secretion of uric acid which is the point of departure of a condition of uricæmia; the latter inducing, by the passage of urine too much charged with uric acid a granular nephritis which in its turn opposes the elimination of uric acid. (*a*)

[4] "What mortal knows not me, unconquered gout,
Great queen of pain, whom not the reeking blood
Of many victims on the altars slain,
Nor richest incense, nor the votive gifts,
O'er the proud temples hung can e'er assuage,
Nor mighty Pæan's self, with all his herbs
Medicinal, nor Phœbus's skillful son,
Great Æsculapius, can subdue: since man
Was first created, hath he rashly strove,
But strove in vain, with every fruitless art
To check my conquests and elude my power.
Whilst some their plantane and their smallage bring,
Lettuce or purslane, hore-hound, nettles sharp,
Fen-gathered lentiles, or the Persian weed,
Leeks, scallions, poppies, henbane or the rind
Of ripe pomgranate, frankincense and fleawort,
The root of potent hellebore or nitre;
Some steeped in wine, the husks of beans prescribe,
Or spawn of frogs, a sovereign cataplasm,
Carrot, or pimpernel, or barley flour,
Or gall of cypress tree, the healing dung
Of mountain goat or still more fetid man,

(*a*) Béchamp et Ritter, compt. rend. de l'Acad. des Sc., 2 novembre 1872.
Bouchardat, De l'urée (thèse d'Agreg., 1869).—Hirtz, art Fièvre (Dict. de méd., t. iv, p. 707). Murchisson, Diseases of the Liver, p. 72.—Brouardel, Arch. de physiol., 1876.—Charcot, Leçons sur les maladies du foie.

In order to give system to the exposition of this subject, I shall consider it under several heads, and examine successively the treatment of gouty paroxysms, the treatment of gout apart from the paroxysms, and finally the hygienic and thermal treatment which occupies the first place among the prophylactic means.

Gout, as you know, manifests itself in paroxysms,[5] and without giving you here a symptomatic description of these attacks, which have never been more

> Colewort, or gypsum, or the well-ground sand
> Of Asia's powerful stone, with bean-flour mixed,
> Others, sagacious tribe, call in the aid
> Of weasels, toads, hyenas, ruddocks, stags,
> And foxes; every metal, and the teas
> Distilled of every tree; bones, nerves, and skins
> Of every beast, milk, urine, marrow, blood.
> A portion some of four ingredients, some
> Of seven or eight prefer, some oft repeat
> The sacred bitter; some to the pure spring
> Medicinal, whilst others trust to charms
> And incantations, which the wand'ring Jew
> Hath ever ready for his gaping throng.
> Meantime I laugh and bid the fools go weep,
> Who mock me thus, and but incense my rage,
> Whilst to the humble, who oppose me not,
> I'm ever mild and gentle." (*a*)

[5] Gout may be divided into acute and chronic, normal and abnormal, simple or complicated. Acute gout manifests itself by energetic attacks, separated by variable intervals. Gout is normal, that is to say, regular when it affects only the joints; abnormal when it appears only under the form of metastatic visceral accidents; complicated, when to the joint symptoms are added visceral affections. The first fit of gout comes on ordinarily between the ages of 30 and 35, but it may be for a long time preceded by certain morbid phenomena which are under the influence of the gouty diathesis, such as gravel, neuralgic pains, migraine, gastralgia with pyrosis, certain dermatoses, such as acne, eczema, psoriasis, etc. These phenomena constitute what has been sometimes described under the head of larvated gout.

The first paroxysm may be ushered in by certain prodromes consisting especially in dyspeptic symptoms, but the invasion is generally abrupt. The patient goes to bed the evening before in good health and falls asleep, then at the end of several hours he is awakened by a pain of greater or less severity, seated in the metatarso-phalangeal articulation of one of the great toes, ordinarily the left; he has at the same time a slight chill, the pain soon increases in violence, and becomes atrocious, with sensations of burning, throbbing, stinging, tearing, etc., then little by little it becomes subdued, perspiration breaks out, and the patient goes to sleep. On awaking, the toe is found inflamed, the skin is red, swollen, of shiny aspect, sometimes livid and furrowed with vessels distended with blood; the whole joint is painful to pressure and to movement. The fit is over. During the day the morbid symptoms are absent, and the patient thinks himself well, but the following night the pain returns, at first dull, then with the same acuteness as the night before. For several days the attacks may thus burst forth every evening and cease in the morning. When the paroxysms are nearly over, the fits are less violent and shorter, the great toe takes on a bluish hue, the tumefaction, the œdema, the redness cease, and there is a desquamation of the epidermis. In the interval of the fits of one attack, if during the day the pain is com-

(*a*) From Lucian's Gout-Tragedy, Francklin's translation.

admirably portrayed than by Sydenham in his treatise[6] on gout, I will mention especially the dyspeptic prodromes and the pains in the joints which acute gout determines.

The perturbation of the functions of the stomach plays a considerable part in the attacks of gout, and this is so generally known that gout has even been attributed to functional derangements of the stomach. I have already spoken of these gouty dyspepsias in those lectures which treat of diseases of the stomach.

As for the pains in the joints, these affect, as you well know, in the great

pletely alleviated, the digestive functions remain good, but if the case is otherwise, there is anorexia and dyspeptic disorder.

During the febrile paroxysm the urine is scanty, and deposits a great quantity of crystallized uric acid (Scudamore, Proust, Rayer).

The first attack of gout may be the only one, but this is not generally the case, and often at the end of several months there is a second, then a third, then other attacks occur at intervals more or less wide apart, and leave certain traces behind them. The gout does not remain limited to one joint, it attacks several; resolution is not complete in the diseased parts; the joints keep stiff, are tender and sensitive to pressure and movements; the gout passes to the chronic state.

Chronic gout may be chronic from the outset; generally it succeeds the acute form. The attacks are less violent and are apyretic, but they are longer, and in the interval of the fits the health does not become fully restored as before. The local state undergoes changes; in the ligaments and periarticular tissues there are deposits of urates. Concretions appear under the form of fine sand, or mortar like masses, which are diffused among the tissues, become hard and form solid bodies, sometimes of considerable size, which provoke disorders more or less, grave on the part of the joints, distort the bones, and render movements impossible. In the feet the tophus has its favorite seat around the first joint of the great toe. When the disease has lasted a long time, it is quite common to note other alterations. The articulating surfaces may be disjoined, concretions of urates and of uric acid cause incomplete luxations, the bones themselves are affected, and anchyloses ensue; sometimes the periarticular tophus becomes the origin of inflammation, followed by ulcerations of the skin, which lead to sloughing out of the concretions. These lesions are met with chiefly in fixed gout. The cretaceous deposits are not only found in the bones, joints, and periarticular tissues, they are also observed in the cartilages, and Garrod relates cases of gouty patients who had no joint troubles, and where but one or two patches were observed of urate of soda seated on the cartilage of the external ear.

[6] Sydenham's description of the fit of acute gout is as follows :

"Whenever the gout is regular, this is its mode of manifestation:

"About the end of January, or the beginning of February, it bursts forth abruptly, almost without warning, if we except a certain crudity of the stomach with dyspepsia, from which the patient has for several weeks suffered. He has been (it may be) complaining of a feeling of flatulent distension, and of a heavy pressure, which increases from day to day till the fit occurs. For a few days he has suffered from a sense of torpor, with cramps or muscular spasms running down the limbs. Sometimes the evening before the attack, the appetite is more voracious than natural. He goes to bed, however, in a fair state of health and sleeps. About two o'clock in the morning he is awakened by a pain which is generally confined to the great toe, sometimes to the heel or the calf of the leg. This pain resembles that which accompanies dislocation of these bones, plus the sensation of hot water poured on these parts; soon a creeping sensation with a chill comes on, and a little fever. The pain, at first moderate, gradually increases, while the crawling sensations and the chill disappear. At length, as the morning comes on, the pain arrives at its maximum, spreading over the differ-

majority of cases, the metatarso-phalangeal articulation of the great toe, and cause horrible suffering. The skin over the inflamed joint takes on a violaceous tint, and has a shining aspect which enables you to diagnosticate a fit of gout at first sight. You know to-day that these joint phenomena are due to the presence in the interior of the articulation of crystals of urate of soda, and you are aware that the least disturbance of the limb will exasperate the pain; you also know that the urate of soda, the morbific agent of the gout, may cause certain saline deposits, known as *tophus*, around the joints.

But there is a disputed question which we must now meet, viz., whether it is best to treat at all a fit of gout. Moved by the grave accidents which may

ent bones of the tarsus and metatarsus and gaining possession of the ligaments, sometimes manifesting itself under the form of violent tension or laceration of these investments, or gnawing, racking, rending torture.

The part affected has acquired so exquisite a sensibility that it cannot bear the weight of the bedclothes, nor even the jarring produced by a person heavily walking across the room. The night passes in this excruciating suffering and in perpetual jactitation of the entire body. The patient vainly seeks for rest, and for some easy position for the suffering member, and relief does not come for several hours, or till after a sort of digestion or dispersion of the morbid matter. The patient at last feels a sudden lull in the pain, and generally he attributes it, though wrongly, to the last position in which he placed the painful member.

Covered with a gentle perspiration, he yields to sleep. On waking, the pain is very much lessened, but he perceives that the affected part has become the seat of a tumefaction, while previously there was nothing to be seen but swelling of the veins in the vicinity. The next day, or two or three days later, according as the matter suitable to engender the gout is more or less abundant, the part attacked remains more or less painful; the suffering augments towards night and diminishes towards morning. At the end of two or three days the other foot is tormented by a pain similar to that which affected the first member. If the latter is now free from pain, the resulting debilitation soon vanishes; the bodily forces are restored as before, unless the pains which affect the second member should become equally atrocious, in which event there would be a renewal of the previous scene of suffering. After the two feet have been thus affected, the successive paroxysms become abnormal as respects the time of the invasion and the duration. They keep always this characteristic, that the pain has its nocturnal recrudescences and its morning remissions.

It is the congeries of these fits which constitutes the paroxysm of gout. It is not to be inferred that the individual afflicted by the malady for two or three months is all the time under torture; he is subjected to a series of paroxysms which go on decreasing in severity and duration till the peccant matter is exhausted and the health is restored.

In strong individuals and those whom gout has rarely visited, this return to health often takes place after a fortnight; in old men and those who have often been afflicted by the disease, it is accomplished at the end of a couple of months. Those, in fine, who have become infirm from age, or in consequence of long subjection to the disease, do not generally experience any improvement till summer.

The first fourteen days the urine is more highly colored than natural, and on standing it deposits a red and sandy sediment; the patient scarcely gets rid of a third of his ingested liquids by the urinary passages; the constipation is almost constant. The loss of appetite, the chilliness experienced toward evening, the sensation of weight and of malaise even in the parts which have not been affected, are continued throughout the sickness. Towards the end there comes on an almost intolerable itching of the foot, especially between the toes where there is a furfuraceous desquamation. The feet themselves undergo desquamation just as after certain poisonings.

The sickness is over, health and appetite return, and this in proportion to the pain

occur in the case of a gouty paroxysm, and especially struck by the disappearance of the gouty symptoms when visceral complications arise, the older physicians assigned an important part to metastasis in the production of these phenomena of visceral gout. Adopting in their entirety the ideas of Sydenham,[7] they thought that it was dangerous to interfere in the gouty paroxysm for the reason that the attack was the result of a tendency on the part of the economy to throw out peccant humors; if this elimination did not take place, they thought that this morbific matter, attacking the lungs, heart, and brain, would produce very serious complications referred by them to retrocession.

Thanks to the progress of pathological anatomy, we have an explanation more true, more scientific, and more exact of this metastasis, and we know to-day that it is occasioned by uræmia. In fact, the kidney plays an important *rôle* in the symptomatology of gout. Under the influence of the constant irritation which is determined by the passage of urine loaded with uric acid, the renal canaliculi become inflamed or obliterated in part, and then supervenes either

and discomfort experienced during the long attack. If the last attack seriously prostrated the patient, the next one will not reach the same point of severity during the year following. This is the behaviour of regular gout which manifests itself with the frank symptoms which are proper to it. (*a*)

[7] Gout, whether acute or chronic, is not always regular, is often unfortunately abnormal, and the articular fluxions may be replaced by visceral troubles.

The articular crises may cease abruptly, the pains disappear; whereupon sundry metastatic affections manifest themselves: dysentery, enteralgia, cardialgia, angina pectoris, pericarditis, endo-carditis; the breathing may be asthmatic; on the part of the brain there may be delirium, apoplexy, coma, ending fatally.

The visceral manifestations may also appear in the interval and independently of the fit of gout (alternating or sub-articular gout).

The abnormal manifestations of gout pertain to divers systems and functions, and the following kinds of gout have been described:

1. Gout of the muscular system (myosalgia, paralysis, contracture).

2. Gout of the nervous system (cephalagia, cephalia, melancholia, hypochondriasis, oddities of character, frontal, facial, sciatic neuralgia, etc.)

3. Gout of the respiratory and circulatory apparatus; pulmonary or bronchial congestions, asthma, nervous palpitations, cardi-algia, angina pectoris, gouty heart, fatty degeneration of the heart, atheroma of the arteries, whence ensue hæmorrhages, cerebral or spinal ramollissement, constituting gouty apoplexy or gouty paraplegia.

4. Gout of the digestive apparatus (gouty dyspepsia), characterized by pains, gastralgia, eccentricities of appetite, pyrosis, vomiting of glairy mucous, intestinal pneumatosis, enteralgia, constipation, hæmorrhoids, hepatic congestion, biliary lithiasis.

5. Gout of the genito-urinary apparatus; gouty kidney (gravel, renal colic), gout of the genital organs (blenorrhœa, retention of urine), gout of the skin (arthritides).

Chronic gout, by the disorders which it produces, by the trouble which it provokes in the organism, may reduce the patient to cachexia. Exhausted by the pain, condemned by immobility, sometimes complete, by reason of the articular lesions, he leads a languishing life; appetite fails, the stomach no longer digests the food which oppresses it, and the patient grows feebler from day to day, unless some intercurrent disease or complication supervenes to put an end to his sufferings.

(*a*) Sydenham, Tractatus de podagra, 1683. Lasègue, Traité de la goutte de Sydenham, partie descriptive, Paris, 1882, p. 7.

interstitial nephritis, or fatty metamorphosis of the kidneys, and it is to this aggregate of lesions that the name of gouty kidney has been given. These lesions, by impeding the functions of the renal filter, entail consequences more or less grave, some pertaining to uræmia, others having a marked influence on therapeutics, and explain why certain medicines administered to the gouty, have even been attended with fatal results.

We find here also an application of a fact to which I have called attention before in the course of these lectures. It is that when elimination by the kidneys is at fault, you obtain not the medicinal effect desired, but the toxic action of the substance which you employ. This, too, explains why our forefathers were afraid of active interference in gout; it also shows the necessity of great prudence in the treatment of this disease, and careful daily examination of the urine, and this, not only with reference to the albumen which it may contain, but also to the extractive matters in that excretion. These reserves being made, I believe it to be the duty of the physician actively to treat attacks of gout, discarding altogether the precept of Cullen, who summed up in the two words, "patience and flannel," the whole treatment of gout.

A great number of medicaments have been proposed for acute gout—anti-phlogistics, purgatives, sudorifics, specifics, etc. Bloodletting, whether general or local, once much in usage, as, for instance, in the celebrated remedy of Paulmier,[1] which consisted in the application of twenty or thirty leeches around the joints, is completely abandoned. Nevertheless, Garrod thinks that in certain exceptional circumstances one may have recourse to local emissions of blood with advantage, and Gairdner is of the same opinion. However, it is not easy to see what good this local bleeding can have in acute paroxysms, being powerless to modify the uric diathesis—the cause of the affection.

As for sudorifics and purgatives in this disease, their value has long been discussed. Among the first, guaiacum deserves a place, once of great reputation as a specific in gout, and Ackermann, Metzger, Weismantel, have vaunted its anti-arthritic properties. The essence of guaiac serves as the basis of the celebrated remedy of Caraibes, the anti-gouty syrup of Boubee, and the syrup of Vicq d'Azyr and of Gall.[2]

[1] Sydenham, who was a great partisan of blood-letting in rheumatism, does not approve of it in gout, except during the first attack. Todd thought that bleeding favored metastasis. Gairdner, on the contrary, approves highly of blood-letting, and affirms that he has met with cases of atonic gout with plethora, before which he found himself powerless without the help of blood-letting, which brought instantaneous and complete relief.

The remedy of Paulmier consists in applying from 20 to thirty leeches around the joints. Roche maintains that the application of leeches may cut short an attack of gout; it will at least shorten the sickness.

[2] The famous remedy of Caraibes is principally composed of the alcoholic tincture of guaiacum. The anti-gouty syrup of Boubee has this formula:

℞	Sarsaparilla root	40 parts.
	Resin of guaiacum	15 "
	Jalap	9 "
	Mustard	9 "

Mix.

To-day guaiacum is almost completely abandoned, and if it were desirable to resort to sudorifics it would be better to employ jaborandi and pilocarpine. But although urea does to some extent undergo elimination by perspiration, this elimination is too insignificant to afford a real relief to the patient, and while recognizing that it is a good thing to promote the functions of the skin during the fit of gout, I do not think that we can count much on sudorifics to the exclusion of other remedies.

It is the same with purgatives, to which Scudamore had attributed curative virtues in the attack of gout, while Sydenham, on the contrary, discarded them altogether. Purgatives have no other effect during a fit of gout than to keep the bowels open, and this is generally necessary by reason of the constipation which is habitual in such cases. The purgatives to which you should always have recourse are chiefly mineral waters, such as those of Hunyadi Janos, Püllna, Carlsbad, the American Hathorn water, etc., which should be given only in sufficient quantity to maintain regular action of the intestines.

I pass rapidly over mercurial treatment, vaunted by Musgrave and Hamilton; antimonials which serve as a basis for Quarin's cure (of Sarza, licorice, anise and antimony), and James's powder (of precipitated antimony and phosphate of lime), to come to medicaments which have a real specific action in gout. I refer to sulphate of quinine, to colchicum, and to salicylate of soda.

Influenced by the intermittency which characterizes the gouty paroxysm, quinine has been recommended in its treatment, and it is doubtless true that this medicine mitigates, to some extent, the intensity of the attack. Quinine may be given with other medicines, and especially with colchicum. Colchicum is the veritable specific in gout, and Fievée has gone so far as to affirm that colchicum is to gout what quinine is to fever and ague. Nevertheless, colchicum is absolutely an empirical medicine, for if clinical experience every day witnesses its good effects in gout, experimental physiology has little to say in explanation of those effects.

Colchicum is a bulbous plant with violaceous flowers, which flourishes in abundance in our meadows, and which our herds carefully shun, for it constitutes for them a poison of great activity.[3] The bulb, the seeds, and the flowers

Boil in three hundred parts of water for two hours, and add sugar enough to form a syrup.

The anti-arthritic pills of Vicq d'Azyr have also guaiacum for a basis; the formula is as follows:

℞ Castile soap..... 4 parts.
Ox gall..... 2 "

Mix and incorporate guaiacum resin, calomel, of each 1 part.

M.—Make into pills each weighing 20 centigrammes. Dose, one or two morning and evening

The pills of Gall contain, besides the extract of guaiac, a little antimony and opium.

[3] Colchicum is an emeto-cathartic medicine. Its mode of action on the kidneys and circulation is under dispute. While Hammond, Christison, Maclagan, Bouchardat and others claim that colchicum acts as a diuretic and augments the excretion of uric acid and

are used in medicine, being made into tinctures, alcoholic extracts, and wines, which are the modes of administration most often employed. As the different parts of the plant do not contain the same quantity of active principle, it is necessary to specify in your prescriptions the part of the plant which you desire to administer. Although the tincture of the flowers, known under the name of Hahnemannian tincture, has been vaunted by several authorities, and in particular by Debout, it is generally preparations of the seeds which you should order, and you can administer the tincture and the fluid extract in the dose of ten drops to a teaspoonful daily watching carefully the result of your doses, for the therapeutical effect varies according to individuals. Some can bear large doses without inconvenience, while others experience toxic results from very small doses. These troubles consist, as you know, in diarrhœa and vomiting; these effects you should avoid. You ought then to order the tincture of colchicum in doses consisting of a certain number of drops, remembering that twenty drops weigh thirty-nine centigrammes. You can give twenty drops morning and evening without any inconvenience, and increase the dose according to the needs.

But you will ask, since the active principle is unequally distributed in the

urea, Gairdner, Garrod, Oberlin, Boecker, affirm that it does not act on this excretion which is the rather diminished according to Garrod. These are, moreover, Garrod's conclusions:

1. There is nothing to prove that it is one of the effects of colchicum to provoke an increased elimination of uric acid; when this medicine has been continued for a long time it seems to produce the contrary result.

2. We cannot affirm that colchicum has any influence on the excretion of urea or any of the other solid principles of the urine.

3. Colchicum does not always act as a diuretic; on the contrary, it often diminishes the quantity of urine, especially when its action on the digestive tube is very marked.

Graves pretends that colchicum if it does not act as diuretic, prevents the production of uric acid in the blood. Bouchardat and Maclagan claim that colchicum has a sudorific action.

The action on the heart is still more uncertain. According to some authorities, as Albers, of Bonn, the movements of the heart undergo no change under colchicum, while Maclagan and Garrod have always noted a diminution of the pulsations in man.

In fine, colchicum and colchicine act, according to Albers, as paralyzers of the sensibility and motor functions.

Jolyet, on the contrary, maintains that it is an excito-motor medicament analogous to strychnine.

Nothnagel and Rosbach pretend that colchicine acts very slowly and determines the death of animals; three centigrammes suffices to kill a man. The heart is not influenced by colchicine, but the medicament acts on the nervous system, producing complete paralysis. (*a*)

(*a*) Garrod, la Goutte, son traitement (trad. par Ollivier, Paris, 1876, p. 445).—Maclagan, On Colchicum Autumnale in Monthly Jour. of Med. Sc., t. xiii, 1851, et xiv, 1852).—Boecker, Beitræge zur Heilkunde, t. II, p. 204.—Hammond, Experiments Relating to Diuretic Action of Colchicum (in Glasgow Medical Journal, t. ix, 1861).—Jolyet, De l'action physiologique de la colchicine chez la grenouille (Compt. rend. de l'Acad. des sc. et Mém. de la Soc. de biol., 1867).—Albers (de Bonn), Deutsche Klinik, 1856.—Goupil (de Rennes) Mémoire sur le colchique d'automne, son action physiologique, ses effects therapeutiques dans le rhumatisme et dans la goutte (Arch. gén de méd., 5e série, t. xviii, p. 57, 1861, et Bull. gen de thér. t. lxi).—Nothnagel et Rosbach, Elements de matière médicale et de therapeutique (trad. par Alquier, Paris, 1880, p. 681).—Dujardin-Beaumetz Dictionn. de Thér., art. Colchique.

plant, why not give this active principle itself? Here we find ourselves in the same embarrassment as in the case of digitalis; and just as there have been found several digitalines, so there have been found several active principles in colchicum. Hess and Geiger, for instance, have extracted from colchicum, *colchicine;* Oberlin, *colchiceine;* Hubler, still another alkaloid; so that the question of the veritable active principle of colchicum is still undecided. Therefore, in the midst of this uncertainty, I think it is better, as in the case of digitalis, to employ the plant itself, indicating, as before said, the tincture of the seeds, or root, or whatever other preparation you wish to employ. The tincture of colchicum may be associated with other substances, and it is this combination which characterizes the majority of the popular remedies for gout, such as Laville's tincture (liqueur Laville), the wine of Anduran, the tincture of Cocheux, the pills of Lartigue, and many others which I pass over in silence. If you do not desire to recommend any of the proprietary nostrums, you can prescribe combinations just as useful, such as the following, which is a good formula: [1]

The European ash has had a great reputation in the treatment of gout, and Pouget and Peyraud consider it as a genuine specific. Moreover, the number of indigenous plants regarded as antiarthritic is considerable, and, to give you an idea how numerous they are, you have only to refer to the electuary[2] once vaunted by Sydenham (this electuary consists of twenty-nine articles). Among these plants I will mention only one—aconite—whose administration mitigates the pains from which gouty patients suffer; therefore, I think that it is always well to combine aconite with your colchicum. Alkalies have little curative action in acute attacks of gout, and constitute only an adjuvant medication. During my trials with propylamine and trimethylamine, I obtained in certain patients (and in particular an illustrious marshal of France) disappearance of the gouty attack under the influence of these medicaments; but now these ammoniacal compounds deserve to give place to a medicine much more energetic and certain, viz., salicylate of soda.

Salicylate of soda has an evident curative influence in gouty paroxysms, and it owes its action to several causes: first, because it favors elimination of urea and uric acid (you know, in fact, that salicylic acid is eliminated in the urine

[1] ℞ Tincture of colchicum,
Alcoholic tincture of aconite root,
Compound tincture of jalap,
Tincture of quinine—āā ʒ ss.

M. Sig.—Thirty drops, morning, noon and night, in a wineglassful of some bitter potion, such as infusion of *fraxinus excelsior.*

[2] Sydenham vaunted highly the following electuary: Take of angelica root, sweet cane masterwort, elecampane, absinthe, centaury, white horehound, germandry, ground-pine, calamint, matricaria, meadow saxifrage, St. John's wort, golden rod, wild thyme, peppermint, sage, rue, blessed thistle, pennyroyal, southernwood, flowers of tansy, lily of the valley, saffron, grains of thapsia, cochlearia of the gardens, caraway seeds, and juniper berries; of each a sufficient quantity. Take of each of these plants six ounces, and enough honey and Canary wine to make the electuary of the required consistence. Give of this every morning and evening about a tablespoonful.

under the form of *salicyluric* acid); next, because this medicament is a powerful analgesic of the articular pains; and, finally, because it has an antipyretic action similar to that of quinine. Therefore, German Sée[1] has rightly insisted on the advantages which may be derived from salicylate of soda in the treatment of attacks of gout, and here the rules of administration are the same as for acute articular rheumatism. But it is necessary in these cases to pay particular attention to the state of the kidneys, for, as I have already told you, the impermeability of the renal organs may render the administration of salicylates dangerous, and this it is that explains the divergence of opinions which have been put forth respecting the advantages and inconveniences of this medication in gout.

The external treatment of gout is a matter of much less importance than internal medication. Many local means[2] have been recommended in the acute paroxysms, from ointments and pomades in current use, to more complex formulas, and even to *horse-chestnut oil*; from applications as hot as can be borne, to the use of ice around the joints;—all have been counselled in these arthritic inflammations. I believe, and in this I am supported by Garrod, that all these applications are useless, and even dangerous. It suffices to consider the state of these joints, the fiery redness of the skin around them, the pain of which they are the seat, to convince one that frictions of an irritant nature may inflict grave disorders on the cutaneous surface thus inflamed. Therefore, in view of

[1] Germain Sée explains the favorable action of salicylate of soda as due to its analgesic power, to its revulsive or resolvent action, to its eliminating properties in certain cases, and also to its power of destroying glycocol, which constitutes an albuminoid excretory substance of considerable importance. According to him, the salicylic medication ought to be employed from the commencement in an attack of gout.

The best mode of employ consists in the administration of a drachm and a half daily during the first three days, of one drachm daily during the three following days, and alternating in this way each successive three days, for three weeks.

Out of one hundred gouty patients whom he has treated by salicylate of soda, he has had four or five failures, and out of the ninety-five remaining cases, more than half were cured immediately.

Sée's view is not shared by all physicians. Lecorché has obtained very unsatisfactory results. Freney and Gueneau d'Mussy, have observed grave complications following the salicylic medication. Bouloumié, in six gouty patients treated by the salicylate, noticed no favorable results. (*a*)

[2] Various local measures have been employed against gout; Cartwright used blisters. The fly blister was also a secret remedy which made the reputation of a woman of Horsham. Turck employed lotions of albuminate of potash. Scudamore recommended applications of tepid water. Others, as Harvey, Small, and Bouchut extol applications and irrigations with cold water. Galtié Bossiere made use of carbonate of potash; Goeden, frictions with phosphorus; Bartella, compresses saturated with chloroform. Then we come to the more complex formulas, one of the most noted of which is the remedy of Pradier. This consists in the application to the member of a large flax-seed poultice wet with a lotion composed of balm of mecca, red cinchona bark, saffron, sage, sarsaparilla and alcohol. The tincture obtained by this maceration was also given internally. (*b*)

(*a*) G. Sée, on "The Treatment of Acute and Chronic Rheumatism and Gout, Paris, 1877. Bouloumié, on "Salicylate of Soda, and its Employ in the Fit of Gout (Union Med., May 15, 20, and 25, 1879).

(*b*) Garrod, De la goutte et de son traitement, trad. d'Ollivier, Paris, 1867, p. 421. Monneret et Fleury, Compendium de Médecine, t. II, p. 359.

the trifling benefit of these local applications on the one hand, and their danger on the other, I advise you to discard all these pomades and ointments, and to surround the foot with a layer of finely carded cotton, which will give immobility to the affected joints and protect them from the air.

To sum up then, when you are called to treat an attack of gout, you should first assure yourself of the integrity of the kidneys, then you should administer salicylate of soda in doses of from one to one and a half grammes, or, if you prefer, the tincture of colchicum combined with quinine or strong tincture of aconite root. If, on the contrary the kidneys are damaged, or if the heart seems to be degenerated, you will have to content yourselves with giving alkaline diluents and keeping the bowels open with saline purgatives; besides enswathing the affected member with wadding around which is placed oiled silk.

But it is not enough to combat the attack of gout, something must be done to prevent its return, and here we have many means at our command, both pharmaceutical and hygienic. Whatever theories may be admitted in explanation of uricæmia, it is against this condition that all our efforts should be directed; here then is the place for the alkaline medication under all its forms. I will be more brief in the exposition of this part of my subject, because I have already, in a former lecture, spoken to you of the treatment of the uric acid diathesis.[1]

All the alkalies may be employed, soda as well as potassa, but there is one that seems to be better than all the others, viz: lithia, which Garrod recommends. I need hardly tell you that the dose of carbonate of lithia is seven or eight grains (fifty centigrammes) given at meal-time in carbonic acid water; the effervescent salts of lithia are good preparations. Benzoic acid and the benzoates have also been highly extolled, and combinations of benzoic acid with alkalies are in use, such as the double benzoate of soda and lithia, which is an excellent preparation.

By the side of the alkaline medication, certain tonics and stomachics deserve a place, being much in repute. These are principally bitter preparations furnished by our indigenous flora, constituting antiarthritic remedies more or less complex, such as (to name those most known) the "electuary of Sydenham" which I have before mentioned, and the famous remedy of the "Duke of Portland." These nostrums, once the subject of much discussion, have now happily passed into oblivion, and given place to quassia and cinchona bark, which are of some little efficacy in atonic gout.

As you perceive, the pharmaceutical treatment of gout in the interval of the attacks is limited to the administration of alkalies in all their forms and and bitters and other tonics. Add to these means the thermal treatment, which plays a considerable part in the therapeutics of this disease. Three stations

[1] Garrod has been enthusiastic in extolling the salts of lithium in the treatment of gout. The salts the most employed are the carbonate and citrate, these salts have a double therapeutic action; they produce marked diuresis, and they form with uric acid a compound essentially soluble which is easily eliminated. Garrod employs this medicament with success, both internally and in the form of local applications to the inflamed joints.

among all those which have been considered as suitable for podagrous patients ought to attract your attention, viz: Vichy, in France; Wiesbad, in Germany; Carlsbad, in Bohemia.

There has been much discussion concerning the mode of action, the advantages and disadvantages, of Vichy water in gout. To-day this question seems to me decided, and I have already given expression to my views on this subject under the head of "renal lithiasis." It is not by neutralizing the excess of uric acid that these alkaline waters act, it is by their influence on the general nutrition, whose functions they regulate. But I am well aware that it will not do to exceed certain quantities, and that the treatment by alkaline mineral waters is not altogether unattended with evil. You should then send to Vichy your strong and plethoric patients whose nutritive functions are below par, and you should proscribe these waters to weakly patients whose attacks are but little accentuated—in a word, who have the symptoms of what has been described under the name of atonic gout and gouty cachexia.

The Carlsbad waters act like those of Vichy, always with this difference, that they are purgative. They suit admirably gouty patients with hepatic congestion and gastro-intestinal troubles, characterized by constipation or irritation of the stomach and bowels, provoked by excesses of the table. Weisbad belongs to the sodic chloride waters, and is applicable rather to the arthritic diathesis than to gout itself. The Aix la Chapelle waters, as well as those of Ems and Royat, which are all sodic chloride waters, act also by the lithia which they contain, and combat rather the multiple manifestations of the arthritic diathesis than the excess of uric acid itself. These are very useful spas, to which you would do well to refer a large part of your chronic rheumatic patients.

Hygiene plays a considerable part in the prophylactic treatment of gout. Everybody is agreed that gout, aside from the laws of heredity, is the consequence of defective hygienic conditions; the uric diathesis, which is its starting point, being an evidence that the azotized materials introduced into the economy there undergo an incomplete combustion. We have, then, two great factors in the pathogeny of gout: too abundant alimentation, too little muscular exercise. Gout is a disease of the rich,[1] and this is a fact on which have insisted all writers, from the most remote antiquity. You should, then, have a care over the alimentation of your gouty patients, and proportion it to their muscular work. You should look after not only their solid food, but also their daily beverages,[2] alcoholic excesses having an important influence in the

[1] It would take a whole volume to include the substance of what has been written respecting the influence on gout of excesses in diet. Petrarch says, "If you wish to live free from gout, you should be poor, or live like a poor man." Sydenham expresses himself thus: "Gout has this in particular which distinguishes it from all other diseases: that it kills more rich people than poor people, and more men of wit than men of dullness and stupidity."

Gout has also been called "morbus dominorum."

Van Swieten has this sentence appertaining to gout: "*Ut divitiarum pedibus bene culta sedit.*"

Like excesses of the table, excessive venery has been accused of giving rise to gout: "*Unde Bacchi et Veneris filia salutatur a poetis podagra.*"

[2] There has been much discussion concerning the nature of the wines which have been

etiology of gout. In fact for ages, attention has been called to the influence of spirituous liquors on the development of this disease. Wines that contain too much alcohol, as well as strong beers, should be interdicted altogether; although Garrod has condemned cider, I do not believe that this beverage can give rise to gout; I think there may be cases in which it may be beneficial.

But if the dietary of the gouty patient needs to be carefully regulated, it is just as necessary to prescribe suitable muscular exercise of all kinds; gymnastics, fencing, pedestrianism, all should be employed, and as our immortal fabulist has said:

"Goutte bien tracassée,
Est, dit on á demi pansée."

prescribed or forbidden gouty persons. Van Helmont condemns the white and sour wines; the white wines of Bohemia and of Hungary are also forbidden. Champagne, according to Scudamore, is even more detrimental. Nevertheless, Bouchardat is of the opinion that the white and moderately sour wines, cut with the alkaline waters, are very useful in the case of polyuria.

Beer is absolutely proscribed by Garrod; Van Sweiten, however, claims that it is useful. But there is a general agreement in proscribing the alcohols, so-called, and liquors. Rabuteau has even pretended that alcohol in the blood precipitates uric acid.

[Dr. J. Mortimer Granville (*Lancet*, Aug. 16, 1884) has an interesting article on the "Mental Element in Gout," in which he sets forth the view which he says is accepted generally, now "that there is a uric acid centre, either eliminative or destructive," probably located beneath the floor of the fourth ventricle, not far from and in functional relation with the so-called diabetic and polyuric centre. An attack of gout is likely to occur in the gouty subject at either of two mental or cerebral crises. First, on the eve of a great mental effort, when the brain is charged to the highest point of tension with "nervous energy." The type of a paroxysm so occurring is likely to be "nervous," with severe neuralgic pains, if the patient be neurotic, or *visceral*, in the sense of attacking one of the large organs, if he be robust or of active habit. Second, an attack of gout is likely to occur at the end of an intellectual effort, when the centres are exhausted, and in this case it may take on the form of an epileptiform fit, or syncope, followed by more or less prolonged depression, or it may rapidly develop into a formulated arthritis of the ordinary type. In the break-down, before action, he thinks the cerebral strength itself gives way; while in the paroxysm, after exertion, the attack occurs because the inhibitory control of the cerebral centres over the spinal medullary and organic centres is suddenly suspended. The former class of cases is the most serious, and attacks of this kind go far to prove the existence of a neurosis, for which the patient will require to be specially treated. The second class is one in which the malady proper rather than the patient demands the practitioner's greatest attention. His therapeutic suggestion is that the uric acid can only be got rid of by a process of oxygenation, and that it must pass off by the kidneys, and not by the bowels. Purgatives in gout are always harmful in direct proportion, as they promote discharge of fluid from the intestinal surface, and leave the urine concentrated so that the uric acid, which requires a very large amount of fluid for its elimination, blocks the tubes of the kidneys in the form of crystals. One reason for the specially frequent occurrence of gout in warm weather is the loss of fluid by perspiration, and the consequent concentration of the kidney excretion. If uric acid can crystallize, it will. Below is Granville's famous anti-gouty mixture, which he says always immediately relieves pain, reduces swelling and raises the proportion of urea in the urine, as estimated by the hydrobromate test, from 50 to 100 per cent. in a few hours. He never starves patients or gives colchicum, believing nitrogenous food to be necessary, a vigorously trophic state being needful to facilitate the oxidation of uric acid. ℞ Ammon. chlorid, ʒ iv. Pot. chlor., ʒ ij. Glycerine, ʒ xij. Tinct. iod., ʒ ij. Aquam ad, ℥ xij. M. Sig. Take two tablespoonfuls every third, fourth or sixth hour. Granville's theory, in the present state of science, can be looked on as only an ingenious and plausible speculation, provisionally, perhaps deserving acceptance.—TRANSLATOR.]

ON THE TREATMENT OF DIABETES.

SUMMARY.—Concerning Diabetes—Its Frequency—Its Pathogeny—Physiological Glycæmia—Theory of Diabetes—Alimentary Theory—Nervous Theory—Theory of Disturbance of Nutrition—Glycosuric Urine—Tests for Glycose—Heller's Process—Boetger's Process—Trommer's Process—Dosage of Glycose—Duhomme's Method—Prognosis of Diabetes—The Diabetes of Fatty People—The Diabetes of the Lean—Grave Diabetes—Diabetes of Medium Intensity—The Mild Form—Hygiene of the Diabetic—Alimentary Hygiene—Bases of the Alimentation of the Diabetic—Regime of Cantani—Regime of Bouchardat—Regime of Seegen—Gluten Bread—Soups—Legumes—Fruits—Pastries—Alcoholic Beverages—Beverages in General—Glycerine--Resumé of the Alimentary Hygiene—Exercise—Results of Treatment—Pharmaceutical Treatment—Anti-fermentescible Medicaments—Lactic Acid—Narcotics—Valerian—Ergot of Rye—Iodine and the Iodides—Alkalies—Their Action in Glycosuria—Arsenic—Bromide of Potassium—Thermal Treatment of Diabetes—Electricity—Hydrotherapy—Local Treatment of Diabetes.

GENTLEMEN: Diabetes[1] is a very common affection, which you will often be called upon to treat when you shall have entered upon your practice; I pro-

[1] Cantani has given a full history of diabetes, which he divides into four periods:

The first, which commences with Aretæus and Galen, and during which the presence of sugar in the diabetic urine was recognized though ill-understood.

The second, which commences with Willis, and in which the symptomatology of diabetes was accurately established.

The third, which is associated with the name of Rollo, who, more than any of his predecessors, pursued a practical end while discussing, with more method than they, certain theories which were largely adopted.

The fourth, which commences with Claude Bernard, and in which diabetes is studied by the aid of the experimental method from the standpoint of pathogeny and therapeutics at the same time.

Diabetes was known from the most remote antiquity by the physicians of India, where it was described under the name of *sweet urine*, or urine of honey. In two books translated from the Sanskrit, diabetes is called *madume'hé*, which means *urine of honey*.

The ancients knew little about diabetes; at the same time, Cornelius Celsus mentions it, and Aretæus gave it the name of *diabetes*, from the Greek word διαβαινω, implying that the sweet drinks of persons so affected *passed through* the body unchanged.

Galen also considered diabetes as a disease of the kidneys attended with elimination of sweet beverages unaltered, and these ideas were adopted by Willis. Moreover, Vittorio Trincavella, in support of these Galenic notions, cites a case where the urine of a diabetic patient had the same taste as the drinks which he imbibed. During this period Paracelsus alone took a stand against this theory of Galen, and affirmed that the cause of diabetes was in the blood, and not in the kidneys.

In 1675 Willis detected sugar, or rather honey, in the urine, and thenceforth the symptoms of this disease came to be better known. Sydenham thought that it was a disease of malassimilation; and Dobson proved, by the fermentation test, the presence of sugar not only in the urine, but in the blood. Lastly, Rollo inaugurated the dietetic treatment of diabetes, which hygienic regime has been crowned by the labors of Bouchardat dating from 1841; and within the present epoch Claude Bernard has given to the world his valuable discoveries concerning glycæmia and the glycogenic functions of the liver. (*a*)

(*a*) Cantani on Diabetes. Paris, 1876.

pose, therefore, to devote a lecture to the therapeutics of this disease. So frequent, in fact, is this complaint that Bouchardat affirms that out of every twenty men between forty and sixty years of age, and pertaining to the wealthier classes, you are sure to meet with at least one diabetic patient.[1]

Whence comes this really large nnmber of glycosuric patients? It results, first of all, from the fact that we are better acquainted with the affection, and, moreover, with the conditions of modern life, which, in exciting unduly the digestive functions and those of the cerebro-spinal axis, predispose notably to this disease. There is, then, a preponderating interest in knowing the therapeutic rules which ought to be observed in such cases, especially since, when these rules are followed, they cause disappearance of sugar from the urine, and all the troubles which rise from glycosuria. But before entering upon the main part of my subject, there are two preliminary questions which must be decided: the pathogeny of diabetes, and the tests which determine the presence of sugar in the urine.

Pathogeny plays an important part in the therapeutics of diabetes; it constitutes ætiological therapeutics, and we cannot discuss scientifically the influence of medicaments and medications till we have examined the mechanism of glycosuria. Thanks to the brilliant researches of Claude Bernard—researches which constitute, perhaps, his best title to glory—we know to-day what is the origin of the sugar which is found in the normal state in the blood of animals.[2]

[1] Bouchardat affirms that in every twenty men from forty to sixty years of age, belonging to legislative assemblies, the great learned societies, elevated positions in commerce, finance, and even in the army, you are sure to find one glycosuric patient. As for the frequency according to age, he adds that glycosuria is the more formidable the younger the subject, and that the epoch when it is most often observed is between the ages of forty and sixty years. Griesenger's statistics give the greatest frequency between the ages of twenty and forty. This is perhaps true as far as hospital practice is concerned, but it does not represent the frequency of this disease in private practice, and especially among persons in easy circumstances. Andral's table, which concerns 84 cases of diabetes, gives the following figures:

AGE.	CASES.
From 0 to 5 years	2
" 10 " 20 "	3
" 20 " 30 "	12
" 30 " 40 "	20
" 40 " 50 "	20
" 50 " 60 "	13
" 60 " 70 "	12
" 70 " 80 "	2 (*a*)

[2] Claude Bernard has dwelt particularly on the origin of the glucose which is found in the blood. This glycæmia comes from two sources—from alimentation, and from glycogen formed in the liver.

The glucose furnished by food is a product of the digestion of amylaceous matters by saliva and the pancreatic juice, and also of saccharine articles of diet which are transformed from saccharose into glucose by the action of the intestinal juice; this juice contains a ferment, which Claude Bernard calls *inversive ferment*. The rôle of the liver in this case is

(*a*) Bouchardat, On Glycosuria and Saccharine Diabetes.

This physiological glycæmia has two origins. Either it is a fact of alimentation—the feculents and cane sugar being transformed into glucose by the intestinal juice, the salivary disatase and by the pancreatic juice, constitute the first of these sources—or else it is a product of the glycogenic functions of the liver. Claude Bernard has, in fact, shown us that there exists in the liver an animal amyloid principle, glycogen,[3] and that this starchy principle, under the influence of an hepatic ferment, furnishes glucose. Notwithstanding the vehement attacks which Pavy[4] and Lussana have made upon the doctrine of the normal glycogenic action of the liver, pretending that this sugar formation was simply a pathological or post-mortem phenomenon, the views of Claude Bernard are none the less admitted by the majority of physicians.

Rouget, on his part, generalizing the glycogenic functions, has strongly maintained that all parts of the body, and particularly the muscles, possess glycogenic properties. But we are not obliged to enter into the discussion of all these objections; it suffices us to know that glycosuria, or the passage of sugar in the urine, is the exaggeration of a normal phenomenon, physiological glycæmia, that is to say, the presence of glucose in the blood. The conditions which, exaggerating this physiological glycæmia, transform it into a persistent glycosuria, are numerous; and, according as they have been exclusively adopted to explain the mechanism of diabetes, a great many theories have been proposed.[5]

said to be that of a reserve depot for this alimentary sugar, and to supply it to the blood in proportion as it is required. The glycogen or animal starch (which forms a singular explosive substance with nitric acid, takes a violet color with iodine, and passes to the state of dextrine) in presence of a hepatic ferment is transformed into glucose.

Claude Bernard insists that the formation of sugar in the liver is a normal fact. The liver, then, is the seat of two orders of phenomena—phenomena of assimilation, and phenomena of disassimilation. The first correspond to the formation of glycogen, the latter to its transformation into dextrine and glucose. The more active the life, the more pronounced the phenomena of disassimilation. (*a*)

[3] Glycogen is a hydrocarbonaceous substance isomeric with starch; has for formula $C^6H^{10}O^5$; dissolves in water forming a milky opalescent liquid with right-handed polarization. Under the influence of dilute mineral acids, saliva, pancreatic juice, blood serum, and of hepatic extract (prepared cold), glycogen is transformed first into a variety of dextrine, then into glucose. This transformation demands for its production a temperature of 30° C. Cold nitric acid transforms it into xyloidin, and warm nitric acid into oxalic acid.

[4] Pavy maintains that the sugar produced by the liver results from a cadaveric transformation, or from pathological conditions. These pathological conditions have their source in the non-fixation by the liver of an excessive quantity of sugar derived from food, and we ought to distinguish here the amylaceous aliments and the azotized aliments. As for the former, we are concerned with the product of an incomplete digestion; as for the latter (the azotized aliments), three conditions may aid their transformation into sugar: (1) general venous stasis, from exaggerated muscular movements, from asphyxia, etc.; (2) troubles in the portal circulation; (3) section of the filaments of the great sympathetic, disturbing the hepatic circulation. (*b*)

[5] The number of theories put forth as to the cause of diabetes is considerable. As

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(*a*) Claude Bernard on Diabetes and Glycogenesis, in Revue des Cours Scientifiques, 1873.

(*b*) Pavy on Diabetes, London, 1862. 1868. Also lectures in the Lancet.

From the exclusive point of view on which I am placed, that is, the standpoint of treatment, all these theories may be referred to three heads: the hepatico-intestinal or alimentary theory; the nervous theory; and, lastly, the theory of nutritive disturbance.

According to the first theory, the glycosuria results either from the too great abundance of saccharine and starchy aliments, or from an excess of activity of the digestive ferments, or from exaggerated action of the functions of the liver. In the normal and physiological state, the glucose which has been formed in the intestinal tube passes into the circulation, and the liver becomes the regulator of this normal glycæmia; when the glucose is in too great quantity, it stores it away; when deficient, it furnishes this principle to the economy, thanks to the glycogen which its cells contain. But let some circumstance arise to trouble this harmony,[6] and we pass from the physiological to the pathological state, and glycosuria appears. This glycosuria then entails a series of modifications, more or less grave, in the economy, and we soon have all the symptoms of the confirmed disease. This theory is one of the most seductive,

many as fifty have been designated, but all may be referred to five principal theories, which are the following:

I. The gastro-intestinal theory.
II. The hepatic theory.
III. The nervous theory.
IV. Theory based on disturbance of nutrition.
V. Pancreatic theory.

I. *The Gastro-intestinal Theory.* This is the theory of Bouchardat. It is divided into two parts, the alimentary theory and the digestive theory. In the first, the sugar of diabetic patients comes from a dietary overcharged with feculent and saccharine matters; in the second, the habitual action of the ferments of the digestive tube is too energetic.

II. *Hepatic Theory.* This theory is supported by Claude Bernard. The cause of diabetes consists in a circulatory trouble, in a secretory trouble, or in a simple exaggeration of the function of the liver. It is supported by clinical observations in which diabetes has been observed to arise from hepatic derangements, such as congestions, or even cirrhosis.

III. *The Nervous Theory.* This theory is based on physiological, anatomical, ætiological phenomena. Patho-anatomical observations have found, in diabetic patients, lesions of the floor of the fourth ventricle, congestion, ramollissement, sclerosis of the spinal cord and of the brain, alterations more or less profound of the great sympathetic. From an ætiological standpoint, contusions of the encephalon and excesses in the functionating of the nervous system have produced diabetes.

IV. *Theory of Nutritive Troubles.* This is the theory which has recently received the support of Bouchard. The glycæmia of diabetes depends on a fault in the consumption of sugar by the tissues, due to a diminution of their nutritive activity. The cause of this retardation is a vicious habit, congenital or acquired. Gout and a sedentary life are the most important factors in diabetes. Jaccoud also admits that the cause of this disease is an alteration of nutrition, over-production or lessened destruction of sugar.

V. *Pancreatic Theory.* This theory is based exclusively on pathological anatomy. Lancereaux is its chief supporter. Diabetes is due to lesions of the pancreas, such as atrophy, fatty degeneration, cancer, obliteration of the pancreatic duct.

[6] Colrat and Couturier, taking as their basis certain experiments of Claude Bernard—who showed that when the portal vein is tied the glucose passes directly into the blood, and produces an alimentary glycosuria—have noted that, in animals affected with total or partial obstruction of the portal vein, from any cause whatever, glycosuria always exists.

and has for its consequence therapeutic applications which dominate in the treatment of diabetes. I refer to the alimentary regime. My venerated master, Bouchardat, has won the claim to public gratitude by founding, on this theory, that admirable hygienic treatment which enables us, through its rigorous application alone, to cause the sugar to disappear from the urine of diabetic patients, at least in the great majority of cases; and when this hygienic treatment fails, be assured that the disease will almost invariably resist all other therapeutic means.

The nervous theory is also based on experimentation,[1] on clinical experience, and on the results of therapeutics. We know, in fact, since the celebrated experimentation of Claude Bernard, that we can in animals cause a temporary glycosuria by irritating or wounding the rachidian bulb.

Schiff, by traumatic lesions of the entire cerebro-spinal axis, and even of the sciatic nerve, Pavy, Eckhard, Cyon, Aladoff, by traumatisms of the ganglia and filaments of the great sympathetic, have arrived at the same result, and have in this way determined a glycosuria equally transient.

I insist on the word *transient*, for it shows us that, unable to produce true diabetes in animals, we cannot practise on this disease experimental therapeutics, for the glycosuria which results from our experiments gets well of itself in the course of several days.

In support of the nervous theory of diabetes, clinical medicine furnishes a great number of observations where we see violent blows on the head, or great cerebral excitation, the consequence of too prolonged intellectual labors, painful emotions, chagrin and disappointment, become the starting-point of diabetes. This it is which explains why this disease is so common among certain classes of the population, such as literary men and persons devoted to scientific and academical pursuits. You will not, then, be astonished to see a considerable number of authorities claiming that diabetes is always of nervous origin.

As for that theory which refers diabetes to disorders of nutrition, it has been quite recently defended, and with considerable success, by Professor Bouchard,[2] who has classed diabetes with affections due to retardation of

[1] Claude Bernard showed, in 1849, that pricking or puncture of the fourth ventricle below the origin of the vagi causes glycosuria. Section of the splanchnics after the puncture does not modify the glycosuria, but it prevents it when made before the puncture.

Schiff produced glycosuria by section of the optic thalami, crura cerebri, pons, middle and posterior peduncles of the cerebellum, also by section of the spinal cord on a level with the second dorsal vertebra, by extensive lesions of the anterior and posterior columns, and even by section of the great sciatic nerve. Richter has shown that lesions of the sympathetic have the same effect; Pavy, that section of the superior cervical ganglion occasions glycosuria. Eckhard, Cyon and Aladoff have attained similar results with sections of the inferior cervical and superior thoracic ganglia. (*a*)

[2] Bouchard shows the difference which exists between arterial and venous blood *à propos* of sugar. In animals this is 40 centigrammes; that is, one kilogramme of arterial blood in becoming venous blood loses 40 centigrammes of sugar. When you take into

(*a*) Schiff, Jour. d'Anat et de Physiol., 1866. Cl. Bernard, Arch. gen. de Mec., 1849. Bouchard, Maladies par Relentissement de la Nutrition, Paris, 1882.

nutrition. Here also we can deduce facts in support of this theory from physiological and clinical experimentation. The glycogenic function is not, in fact, exclusively a function of the liver; all the tissues participate in it. Have we not seen Rouget demonstrate this power of sugar-production in all organs of the fœtus? Have we not seen Schiele detect glycogen in stratified pavement epithelium? In fine, do not the muscles themselves participate in this glycogenic function, as Boehm[3] has pointed out? We can, then, say, with Bouchardat, Jaccoud and Bouchard, that every circumstance which troubles the inmost processes of assimilation and of disassimilation of all the tissues may be a cause of diabetes.

One other consequence of this theory is to call attention to the elimination of urea in diabetic patients, and to cause this azoturia to play a preponderant part as Lecorché has done.

Ought we to take sides with one or the other of these theories, and base exclusively on any one of them our therapeutic endeavors? By no means; and we ought instead to draw from all them the elements of our treatment. But I must, before approaching this main subject of my lecture, set forth the clinical means which you ought to make use of in order to determine the presence of sugar in the urine, and the quantity of this abnormal ingredient.

You should, in fact, be aware that we cannot judge of the effects of our treatment but by a daily examination of the urine; our prognosis, moreover, is based on such examination; you should then perfectly understand the modes of testing urine for glucose.

Glycosuric urine is generally abundant in quantity, of a high density, which sometimes attains even 1050; it is frothy, stains the clothing, and has the curious property of attracting flies.

To detect glucose in the urine we avail ourselves of the curious oxidizing and reducing property of this substance in presence of alkaline agents, and without stopping to consider the numerous processes which have been proposed

consideration the total quantity of blood which is transformed into venous blood, it is susceptible of demonstration that a man loses in a day, at the least, 1,850 grammes of sugar; now one gramme of sugar demands, for conversion into water and carbonic acid, 1 gr., 066 of oxygen, and as a man in health never consumes more than 850 grammes of oxygen a day, this oxygen is incapable of burning all the sugar; there remains, then somewhat more than 1,000 grammes of sugar which is not consumed by oxygen, but which is destroyed by molecular metamorphoses of the entire organism. So, according to Bouchard, the conditions which give rise to hyperglycæmia may be referred to the following heads: (1) everything which prevents the sugar and starch of food ingested from fixing itself in the liver in the state of glycogen; (2) everything which increases the formation of sugar in the liver; (3) everything which interferes with the destructive metamorphosis of sugar in the economy or its fixation in the tissues. (*a*)

[3] According to Boehm, the muscles behave with regard to glycogen like the liver; that is to say, glycogen augments in the muscular tissue after meals, and is destroyed in muscular work.

(*a*) Bouchard, Maladies par Ralentissement de la Nutrition. Paris, 1882.

by Krause,[1] Luton, Muller,[2] Maumené,[3] Neubauer, and Vogel,[4] will mention only those of Heller, Boettger, and Trommer.

The first of these processes is based on the oxidation of glucose by potassa, which by heat generates glucic and melassic acids which give to the liquid under examination a more or less black color according to the quantity of sugar in solution. Bouchardat has substituted for the potassa a chemical which is much more easy obtainable, slaked lime or milk of lime.[5] This test, which is a good one when the urine has a large amount of sugar, loses its value when the quantity of glucose is small; then there is liability to several sources of error; the coloring matter of the urine, for instance, may turn brown under the agency of alkalies. Moreover, albumen and mucus may give a dark discoloration, and even an impure preparation of potassa may give the same color.

The process of Boettger is altogether different; it consists in heating urine supposed to contain glucose with a mixture of subnitrate of bismuth and carbonate of soda; in this white liquid thus formed there is soon seen a black precipitate of oxide of bismuth.[6] Although this test has been modified by my master, Behier, and more recently by Primavera, it is subject to numerous fallacies, and the reduction of bismuth may be accomplished by substances other than glucose. Attfield affirms that almost any kind of urine will effect the reduction of bismuth. Therefore this test is inferior to those which have for basis the cupro-alkaline liquors.

Trommer was the first to recommend testing for sugar in urine by utilizing the reducing properties of glucose on salts of copper, and it is upon this

[1] Krause and Luton employ the same test as for the detection of alcohol, namely the solution of bichromate of potash in sulphuric acid; this solution, of an intense red color, becomes emerald green in the presence of sugar.

[2] Muller uses the following test: To the urine heated over a spirit lamp he adds a solution of indigo-carmine made alkaline by bicarbonate of soda. If glucose be present this mixture passes from blue to green, then red, purple, and finally yellow. Jaccoud recommends this process.

[3] In Maumené's process, strips of woolen cloth are soaked in a solution of perchloride of tin; then moistened with the urine to be examined and heated over a spirit lamp. If sugar be present the strips are blackened.

[4] This test consists in adding to urine supposed to contain sugar, a few drops of solution of ammonio-nitrate of silver; if glucose be present there is a black precipitate of reduced silver.

[5] Saccharine urine when mixed with an equal volume of liquor potassa and heated, turns yellow, and, if sugar be abundant, brown; a molasses-like odor is at the same time observable.

[[6] Boettger's test, which is much in use in this country, is practiced in the following manner: A few cubic centimetres of the urine are mixed in a test tube with an equal volume of solution of sodium carbonate (one part crystallized carbonate and three parts water) a few granules of bismuth subnitrate are added, and the mixture boiled for some time. If sugar be present the bismuth turns brown or black by reduction to elementary bismuth. (Witthaus' General Medical Chemistry.) Witthaus affirms that no other normal constituent of the urine reacts with this test, but there may be some substance present which, by giving up sulphur, may cause the formation of a black sulphide of bismuth.—TRANS.]

basis that a number of test liquids have been devised, Barreswil's and Fehling's solutions for instance.[1]

Fehling's solution is the most used at the present day; the reaction is very pronounced, and it suffices to heat in a test tube a mixture of glycosuric urine with one of those cupro-alkaline solutions to see the liquid change from a beautiful blue to a pale yellow, then a lively red, in consequence of the precipitation of the oxide of copper, which gradually settles down to the lower part of the test tube.

At the same time with this method, which is much the most certain, all chances of error are not avoided. Uric acid, urinary pigment, tyrosin, may cause the precipitation of oxide of copper, but this precipitation is much less clear and pronounced than that with glucose. Moreover, albumen prevents this reaction from taking place, therefore it will be necessary to have care when you are examining urine that contains both albumen and sugar (which frequently happens) first to precipitate and filter out the albumen before proceeding to test for sugar.

The employment of the cupro-sodic liquors enables us not only to recognize the presence of sugar, but also to determine the quantity, and this is a matter of great importance. I shall not here speak of the polarimetric processes while admitting that they are the most sure and precise, and that one ought always to have recourse to them when desirous of attaining mathematical exactness in the dosage of glucose, but these are methods of the laboratory, and few physicians can have at their disposal a saccharimeter, whether it be that of Soleil, or the one with a *penumbra*, or the diabetometer of Yvon. I shall only mention the clinical processes which are quite sufficient in practice.

Of all the clinical processes the most simple, the most ready, and the most

[1] There are several formulæ for cupro-potassic or cupro-sodic solutions. These are the principal:

SOLUTION OF BARRESWIL.

℞.	Carbonate of soda	4 grammes.	
	Cream of tartar	5 grammes.	
	Caustic potash	4 grammes.	
	Water	40 grammes.	M.
Add.	Sulphate of copper	3 grammes.	
	Water	25 grammes.	M.

FEHLING'S SOLUTION.

Take the pure	Sulphate of copper	4 grammes.	
	Distilled water	16 grammes.	
	Caustic soda	13 grammes.	
	Neutral tartrate of potas	16 grammes.	
	Distilled water	60 grammes.	M.

Trommer's test, the first in use, is employed as follows: Take a sufficient quantity of liquor potassæ and a solution of sulphate of copper. Into a certain amount of urine in a test tube add an equal quantity of liquor potassæ and two or three drops of the solution of cupric sulphate. If the urine contains sugar the blue mixture with hydrate of copper clears up by agitation, and if the tube is heated a precipitate of reddish cupric oxide is formed.

economical is that of Duhomme,[1] which we use every day in the hospital and in private practice, and every physician, it might almost be said every diabetic patient, ought to have one of these little instruments for measuring the amount of sugar in the urine.

It is composed of a little box which has in its interior some test tubes, a spirit lamp, two vials, the one containing a little liquor sodæ, the other Fehling's solution, and finally, two dropping tubes.[2] These two dropping tubes are graduated, the one which is reserved for urine by a mark which indicates a cubic centimetre, the other, which is destined to contain Fehling's solution, by a mark which measures just two cubic centimetres. You begin by taking up one cubic centimetre of urine of which you take care first to count the number of drops by pressure on the rubber ball. Then with the other dropper you aspirate two cubic centimetres of Fehling's solution. This you place in a test tube, and add the same quantity of solution of soda. You then heat the mixture, and after having taken up some of the urine of which you have just counted the drops, you let it fall, drop after drop, into your test liquid, heating the latter from time to time till the entire mixture takes on a reddish color. You have counted the number of drops necessary to obtain this reaction, and you have only to refer to the table herewith given (see adjoining page) to know the quantity of sugar contained in a litre of the urine. This table contains in one column the number of drops present in one cubic centimetre of urine, and in another the number of drops made use of in order to get the characteristic color.

As this method of analysis is very rapid it is desirable, before taking a definite figure, to repeat the process three or four times, in order to know exactly the number of drops necessary to obtain the red color in the mixture.

It may be necessary when the percentage of sugar is very large to dilute the urine with an equal quantity of water, which you can easily do by means of your dropper, and in estimating the result you have simply to double the figure obtained. Duhomme has, moreover, given a method for utilizing his saccharimeter for the detection of very feeble quantities of sugar. It suffices in these cases to employ only one cubic centimetre of Fehling's solution, and to count the number of drops necessary to effect the disappearance of the green color you can make use of the same table, but you must carry the decimal point one line toward the left.

With this analytical process you can sufficiently estimate the effects of your treatment. You will also have a basis for your prognosis. You are aware that there are two kinds of diabetes. The one is the mild form, *diabetes benignus*, the diabetes of fat people, an affection which permits a person to live a good many

[1] Duhomme, Clinical Saccharimetry, Bull. de Ther., t. lxxxviii, 1875, pp. 163, 214, and 261.

[[2] The dropping tubes graduated to indicate cubic centimetres can easily be obtained of instrument makers, Codman and Shurtleff of Boston, for instance.

The method of Duhomme is so handy and simple that it ought to come into general use; it is, in fact, in general use on the Continent. Besides the dropping tubes and the printed table all that is required is the ordinary cupro-sodic testing solutions.—TRANS.]

TABLE GIVING THE RESULTS OF THE RAPID ANALYSIS OF SUGAR BY THE METHOD OF DUHOMME WITH THE GRADUATED DROPPING TUBE OF LIMOUSIN.

Number of Drops contained in one Cubic Centimetre of Urine Examined.	Number of Drops Employed.																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.	Gr.
XVIII.	180	90	60.00	45.00	36.00	30.00	25.71	22.50	20.00	18.00	16.36	15.00	13.85	12.85	12.00	11.25	10.59	10.00	9.47	9.00	8.57	8.18	7.83	7.50
XIX.	190	95	63.33	47.50	38.00	31.67	27.14	23.75	21.11	19.00	17.27	15.83	14.61	13.57	12.67	11.87	11.18	10.55	10.00	9.50	9.05	8.64	8.26	7.92
XX.	200	100	66.67	50.00	40.00	33.33	28.57	25.00	22.22	20.00	18.18	16.67	15.38	14.28	13.33	12.50	11.76	11.11	10.53	10.00	9.52	9.09	8.69	8.33
XXI.	210	105	70.00	52.50	42.00	35.00	30.00	26.25	23.33	21.00	19.09	17.50	16.15	15.00	14.00	13.12	12.35	11.67	11.05	10.50	10.00	9.55	9.13	8.75
XXII.	220	110	73.33	55.00	44.00	36.67	31.43	27.50	24.45	22.00	10.20	18.33	16.92	15.71	14.67	13.75	12.94	12.22	11.58	11.00	10.48	10.00	9.56	9.17
XXIII.	230	115	76.67	57.50	46.00	38.33	32.86	28.75	25.55	23.00	20.91	19.17	17.69	16.43	15.33	14.37	13.53	12.78	12.10	11.50	10.95	10.45	10.00	9.58
XXIV.	240	120	80.00	60.00	48.00	40.00	34.28	30.00	26.66	24.00	21.82	20.00	18.46	17.14	16.00	15.00	14.12	13.33	12.63	12.00	10.43	10.91	10.43	10.00

Figures indicating in grammes the quantity of sugar contained in each litre.

EXPLANATION.—The figures in the first horizontal line correspond to the number of drops employed. The Roman numerals in the first vertical column correspond to the number of drops in a cubic centimetre of the urine under examination. The table reads like the table of Pythagoras. For example, suppose that the urine which you are examining gives 22 drops to the cubic centimetre, and 11 drops are required to decolorize the cupro-sodic solution, you take the figure 11 in the first horizontal line, corresponding to the number of drops employed, and you glance down the vertical column till you come to the point of intersection of the horizontal line which begins with the Roman numerals XXII, and you find the number 20, which indicates that the urine you are testing contains 20 grammes of glucose per litre.

years. The other is grave diabetes, the diabetes of lean people, which disturbs profoundly the nutrition of the individual, and determines in quite a short space of time cutaneous, pulmonary, or other complications which rapidly prove fatal.

There has been much discussion as to whether we ought to give the name diabetes to both these affections, some maintaining that the diabetes of the corpulent is nothing but a symptomatic glycosuria, and reserving the name diabetes to the more malignant disorder of lean people; others hold that the two affections are the same, but of different degrees of intensity.

Without entering into the discussion I can affirm that from a therapeutic point of view the examination of the urine will enable you to class your patients in three principal groups: the light forms of diabetes, those of medium intensity, the grave forms. Note first of all that the quantity of sugar which you find is no criterion for prognosis; you may find as much as one hundred grammes per litre, and at the same time have a very mild case. A much more important indication is the persistence of a certain quantity of sugar in the urine in spite of the most rigid dietetic règime.

When, after having made your patient follow scrupulously a rigorous alimentary regimen, you discover that the figure of sugar in the urine keeps at from thirty to fifty grammes per litre, be persuaded that your case is a grave one, and that your pharmaceutical measures, however judicious and appropriate, will not stay the progressive decadence of the organism and the death of your patient. Generally these patients are thin, debilitated, presenting pulmonary complications of a tuberculous nature, and their forces are rapidly exhausted. I have often been called during my medical career to treat such diabetic patients, and despite all my endeavors have not been able for an instant to interrupt the steady decline of the organism.

When, on the other hand, the quantity of sugar, owing to your alimentary hygiene, has fallen to nine or ten grammes a day, you have a case of diabetes of medium intensity. These are the patients who may live many years, but in whom there supervene, when the digestive functions become enfeebled, pulmonary complications, a peculiar comatose state, or it may be cerebral ramollissement, an accident so frequent in those whom Bouchardat calls *petits diabetiques* (that is, persons slightly diabetic). These diabetic patients are amenable to a treatment which opposes to a certain extent the production of such accidents.

In the third group are cases of diabetes of feeble intensity. Here we witness the triumph of alimentary hygiene, for it alone effects very rapidly and in a few days the disappearance of the glucose from the urine, however great the previous quantity. How often have I seen such obese patients, generally arthritic and gouty, who had been voiding two hundred to three hundred grammes of sugar per day, and in whom the règime of Bouchardat had enabled us in a few days to bring down the figure to zero. Nevertheless in these patients the sugar reappears whenever they commit errors in diet.

You see, then, that this dosage of sugar, or, in other words, the determination of the quantity of sugar in urine, is a matter of capital importance to your patients both from the point of view of therapeutics and of prognosis, and I

pass now to the consideration of the hygienic and medicinal means applicable to the treatment of diabetes.

The dietetic treatment of diabetes deserves the first place. Ever since John Rollo, at the end of the last century, first called attention to the influence of foods in the production of glycosuria, all authorities have felt the obligation to regulate rigorously the diet of diabetic patients. At their head is Bouchardat; after him I will mention especially Seegen, a German writer, and Cantani, an Italian, and what I have now to offer respecting the hygienic régime of this affection will be based on a careful study of the contributions of these three men.[1]

The hygienic treatment is founded on the endeavor, as far as possible, to exclude from the food all substances capable of forming glucose. This glucose may be derived from sugar in the ingesta, or from starch which has undergone conversion in the alimentary canal. These glycogenous principles, then, should be suppressed. All this, however, though simple in theory, is difficult in practice.

I told you in a former lecture, when on the subject of Digestion, that an adult man loses by day 20 grammes of nitrogen and 310 grammes of carbon, and that in order to avoid emaciation he must obtain in his food this quantity of nitrogen and carbon; it is well always to have these figures before you when you wish to lay down dietetic rules for your diabetic patients. The 310 grammes of carbon are furnished by sweets, feculents and fats, and the suppression of the first two of these alimentary substances must considerably modify the conditions of alimentation. For, in order to suffice for this combustion of 310 grammes of carbon, if a man eats nothing but meat, he must consume two kilogrammes, so that a diabetic patient confined to a diet exclusively of animal food must be made to eat about four pounds a day! This enormous amount of meat is not without its inconveniences; by the quantity of nitrogenous material not utilized it augments waste-production, and provokes lithæmia; it moreover fatigues unduly the functions of certain portions of the digestive tube.[2]

Therefore Cantani, while suppressing entirely sugar and starch, has replaced these principles by fat, establishing thus what he calls *adipo-albuminous* diet; but as sometimes these oleaginous substances, which ought to be absorbed in great quantity, are of difficult digestion for certain stomachs, he first submits

[1] Rollo, on Diabetes Mellitus, London, 1790. Seegen, on the Diet Cure of Diabetes (Wien. med. Woch., 1873). Bouchardat, du Diabetè-Sucrè, Paris, 1875. Cantani, on the Diet Treatment of Diabetes, 1876.

[2] Bloch has studied the action of régime on diabetic patients. He has shown that animal food is capable of diminishing the proportion of sugar in the urine without causing it to disappear; fasting has the same effect; and, moreover, the absorption of fats is very active in diabetic patients. So, according to him, a flesh diet, while causing sugar to disappear, hastens denutrition. (*a*)

(*a*) Bloch, Absorption of Fats in Diabetes, etc., Deut. Arch. f. Klin. Medicin, Bd. xxv., Hft. 4 and 5, p. 470, 1880.

them artificially to the action of the pancreas, and administers to his patients *pancreatized fats.*

The régime of Cantani is difficult to follow in all its rigor; there are so few who can for a series of months subsist on meat and fat alone, for Cantani aims to have this adipo-albuminous diet continued till the complete disappearance of sugar from the urine.[1]

[1] This is the alimentary régime of Cantani :

Broths. Made with any sort of meat.

Beef. Muscle, brains, tongue, etc.

Veal. The muscle, all the internal organs, brain, sweet-bread, lungs, kidneys, but not the liver.

Mutton. The same as above.

Fowl and game of all kinds. Fish, frogs, and crustaceans.

Salt or canned meats or fish, but in moderation.

All the above may be either boiled, roasted, broiled, or fried in fat, and salted to the taste. They may be seasoned, but no sugar or starch must enter into the composition of the seasoning ingredients; also no wine, vinegar, butter, or lime juice. Olive oil and animal fats may be used freely, and dilute acetic acid may be substituted for vinegar, and citric acid for lime juice.

The quantity of food should be about 600 grammes a day, of cooked meat, and more if the scales show that the patient continues to emaciate.

In cases where denutrition is very pronounced,in very lean patients, 60 to 200 grammes of *pancreatized fat* are given daily; this is prepared as follows: Cut into small pieces the fresh pancreas of a beef creature or sheep, intimately blend with it a small quantity of fat, and leave it for three hours or so submitted to this artificial digestion,then cook slightly.

Drinks. Water, pure, or artificial seltzer water, to which from 10 to 30 grammes daily of rectified spirits may be added, and some aromatic waters (fennel, canella, balm, mint, orange) if desired.

If, after a month's trial, this régime does not cause the glycosuria to disappear, it will be best to make the patient fast 24 hours, taking nothing but water and some rich broth. Then the above regimen is resumed, but in half the quantity; little by little it is increased till the normal quantity is attained. But if the glycosuria reappears, another day of fasting, then the half diet again; which is not to be increased, unless the scales show that the patient is losing flesh.

In very recent cases, or cases of little gravity, eggs may be permitted, the liver of animals, cod-liver oil (two to four ounces a day), and shell fishes, such as oysters, snails, and clams. A little old red wine (Bordeaux wine is the best), a little tea or coffee without sugar.

Exercise in the open air, gymnastics, muscular labor; this régime should be rigorously persisted in for two months at least in light and recent cases; for three, six, and even nine months in the severer cases.

The return to saccharine and amylaceous articles of diet should be gradual, in accordance with the indications given below.

The following aliments may be permitted to a diabetic patient who for two months at least has had no sugar in his urine:

Gradual return to a mixed diet. Spinach, chiccory, endives, water-cresses, lettuce, dandelion, corn salad, olives, etc.

A little later. Chards, white beets, celery, artichokes, leeks, truffles, mushrooms.

A month after. Sweet almonds, nuts, pistachios, a little red wine.

Still later. Gooseberries, peaches, apples, and other fresh ripe fruits, fresh cheese, butter, etc. Little by little vegetables abounding in starch, such as potatoes, are allowed.

During the entire duration of this return to a mixed diet the quantity of these permitted aliments to be very moderate, and, on the least reappearance of glycosuria, the meat régime

Hence the dietetic régime of Bouchardat[2] is more generally adopted; the principal characteristics of this alimentary system consists in the substitution of gluten for starch, and in the employ of gluten-bread.[3]

This question of bread is of great importance. Habituated from their infancy to this sort of aliment, bread is to some persons quite indispensable, so that it is hardly possible for them to make a meal without it. This with our diabetic patients is a feeling which ought to be overcome. Insufficient alimentation is with these patients one of the gravest evils. You may by severe diet-restrictions cause sugar to disappear from the urine, but it is at the expense of the well-being of the entire organism. So your efforts ought to be directed toward instituting a regimen which, while excluding starchy and saccharine elements, may satisfy in a certain measure the taste and appetite of your patients.

Gluten bread and gluten cakes have been given to diabetic persons. Unhappily the mode of preparation of this kind of bread is not always what it

must be resumed in all its rigor. As for cane sugar, it must be absolutely prohibited at all all times. (*a*)

[2] These are the general precepts of Bouchardat concerning the dietary of glycosuric persons:

Eat moderately and slowly; food should be well masticated.

As long as the quantity of urine passed in 24 hours exceeds a quart and a half, drink as little as possible.

Eat sparingly of liquid food, such as soups, broth, consommé; take your drink in sips: the sensation of thirst can sometimes be alleviated by simply rinsing the mouth with ice-water; if ice-water is drank, let it be taken only in sips.

Combat the sensation of thirst by chewing parched corn, roasted coffee, or olives.

Two meals a day are preferable to three; let the one be at 10:00 a. m., the other at 6:00 p m. Eschew repose, and especially sleep after meals; a good long walk after the repast is beneficial.

Never lie down for four or five hours after the last meal.

Abstain as far as possible from the use of tobacco.

As for aliments, avoid feculents and sugars.

Abstain from bread of cereals, pastries, rice, maize, potatoes, arrow-root, sago, tapioca; the starchy parts of all vegetables; peas, beans, lentils, nuts of all kinds, radishes, turnips, carrots, squashes, all kinds of fruit, and especially the saccharine fruits, such as prunes, grapes, figs, bananas, pears, apples, melons, should be interdicted; the same may be said of preserves of all sorts and all acidulated or saccharine drinks.

Wheaten or rice flour should not be employed as an ingredient of gravies and sauces; but gluten flour, yolks of eggs, butter or cream should be used instead. (*b*)

[3] It was in 1841 that Bouchardat first called attention to gluten-bread. To obtain gluten the flour is first washed for some time (20 minutes to several hours, according to the purity of the flour) in a metallic sieve, No. 120. A paste is first made, and it is this paste which is submitted to constant irrigation. The fresh gluten thus obtained equals about one fourth the weight of the meal employed. The gluten should be used fresh and made into bread or cakes for glycosuric patients.

Boussingault and Mayet on analyzing the gluten cakes and this flour have shown that they still contain a considerable proportion of starch; from 16 to 44 per cent.

Bran bread has been highly extolled by Camplin in the treatment of diabetes. (Camp-

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(*a*) Cantani, Du Diabete et de son Traitement, traduction Charvet. 1880.

(*b*) Bouchardat, Treatise on Saccharine Diabetes, Paris, 1875.

should be, and when these culinary products have been analyzed, as they have been recently by Boussingault and Mayet,it is seen that they contain from ten to 40 per cent. of starch. Therefore there has been a disposition to substitute for bread of gluten badly prepared, bran bread, as recommended by Camplin, or bread or biscuits of sweet almonds, as Kronser and Pavy have advised, or bread made of parched flour after Dannecy's formula, or the bread which Dahmen counsels.

You would do well, gentlemen, to use all these products, as well as the crust of ordinary bread and stale bread, for it is not so much the amount of starch and sugar contained in bread that is to be taken into account as the quantity which the patient eats. The dry gluten bread recommended by Bouchardat and the almond cakes and the bran cakes being generally hard and firm, the patient, whose gums are almost always affected with that diabetic gingivitis which loosens the teeth, is able to eat but a small quantity, and this is the reason why I prefer bread crust or hard, stale bread, for the patient can eat but a little of it. Add, moreover, that gluten bread is much less agreeable to the palate than ordinary bread, and that this circumstance contributes to minimize the quantity of this kind of food taken with meals.

Pastries ought absolutely to be prohibited. Do not forget, in referring to the intersting analyses of Boussingault and Mayet, that there is an alimentary preparation, *échaudé* or simnel, which has as much starch as ordinary bread (the first containing fifty-three and the second fifty-five per cent.), and this should be proscribed. Other kinds, as *brioche*, may be permitted as including no more starch than the gluten biscuits, or about forty per cent.

These same analyses enable us to establish a diabetic régime from the point of view of feculents; potatoes, turnips, and rice contain relatively a small proportion of sugar (seven to eight per cent.), while gluten bread has 27.70 per cent.; hence the former are less objectionable in this respect than the latter. But I repeat, all depends on the quantity of these aliments taken by the patient. If the diabetic eats largely of potatoes, notwithstanding the small quantity of

lin, on Diabetes and its treatment, London, 1864.) This is his recipe for bran cakes: Take three ounces of wheat bran, three fresh eggs, two ounces of butter, one pint of milk, stir well together, and flavor with nutmeg or ginger. Place this dough in hot cast-iron baking pans, well buttered, and put in an oven for half an hour. Eat these biscuits instead of ordinary bread.

Pavy's bread of sweet almonds is made by first treating the almonds, reduced to fine powder, with boiling water slightly acidulated with tartaric acid, which deprives them of six per cent. of sugar. Of the paste thus obtained biscuits are made.

Dahmen's bread is made as follows: Soak wheaten groats half an hour in cold water; knead the dough thus formed in a stream of cold water, desiccate the glutinous residue, and triturate in a mortar. Take 165 grammes of this powder, mix thoroughly with one third quart of sour milk, add 125 grammes of melted butter, ten eggs, a little salt, and some carbonate of ammonia. When this mixture has acquired a pasty consistency place in French roll pans, well buttered, and consign to a hot oven till well cooked. (*a*)

(*a*) Berlin. klin. Woch., September, 18 o.

sugar in them, he will obtain the same amount of sugar as if he were to eat sparingly of gluten bread.[1]

As for soups, I would advise you to keep clear of those made with gluten grains, as well as all rich broths. Here Boussingault has given us interesting facts showing that there is a large percentage of feculent matter in these soups.

As for green vegetables, I think that they may safely form a part of the dietary of diabetic patients, and in this opinion I am supported by Bouchardat. Water-cresses may be freely indulged at meals, also dandelion greens, artichokes, spinach, celery, cooked salads, etc. I know that green vegetables include notable quantities of saccharine matters, but they contain also potash, which is good for diabetic patients.

As for fruits, you should be very chary in their employ. The analyses of Mayet are very conclusive in this regard. Nevertheless, melons, raspberries, gooseberries, and even oranges may be permitted under certain restrictions.[2]

As for alcoholic beverages, there are certain which are permitted, and others which are forbidden. Champagne, malt beer, and ale are interdicted; the same may be said of the effervescent, non-intoxicating drinks, lemonade, ginger beer, etc. Bordeaux and Bourgogne wines may, however, be allowed, as well as coffee and tea without sugar.

But you must avoid the deleterious effects of alcohol on the economy. A great many diabetics, to satisfy their intense thirst, drink great quantities of wine and other alcoholic preparations. Such excesses are very detrimental. Bouchardat would limit diabetic patients to one quart of wine a day.

[1] Amount of sugar in 100 grammes:

Turnips	7.00.	Lentils cooked and drained	22.50.
Baked potatoes	8.30.	Rice cake	25.00.
Rice (cooked in water)	8.00.	Fresh gluten bread	27.70.
Peas (boiled)	12.00.	Lancry's gluten bread	31.15.
Pea soup	15 60.	Bread of the Vichy Company	31.00.
Beans	16.00.	Ordinary bread	60.00.
Carrots	16.60.	Ordinary flour	71.00.
Chestnuts	20.00.	Ordinary starch	83.00.

[2] The analysis of Boussingault shows that cabbages, chiccory, turnips, carrots, beets, potatoes, and spinach contain from two to four per cent. of potassa.

The analysis of Mayet shows that the following fruits contain the per centage of glucose herewith given:

	In 100 grammes.		In 100 grammes.
Gooseberries	1.50 to 8.00.	Peaches	10.50.
Melons	7.50.	Figs	15.00.
Raspberries	1 to 8.00.	Prunes	16.00.
Oranges	10.00.	Dried prunes	42.00.
Cherries	10.25.	Dried figs	71.00.
Dried raisins	76.00.	(*a*)	

(*a*) Mayet, Note on Sweet Fruits from the Point of View of their Introduction into the Dietary of Diabetics, Union Med., 1873.

This subject of drinks is a very important one, for it is a pressing indication to diminish the excessive thirst which plagues diabetic patients, and many of them will keep demanding of you what they shall drink. I am much in the habit of ordering Vichy water, or water holding in solution from five to ten grammes of Seidlitz salts, or even mild bitter infusions, as of cinchona, hops, quassia, camomile, but it is well to urge the patient not to yield to his thirst, but to combat it as far as possible.

Apropos of these beverages I ought to mention the employment of glycerine[1] in the treatment of diabetes. This triatomic alcohol gives good results in this disease, if we may trust to the experience of Schultzen, Harnach, and Holtz. In fact in the case of those patients who cannot tolerate the entire suppression of sugar in their drinks glycerine may sufficiently replace it, but it is necessary to protest against the large doses which have been recommended, but we have demonstrated (Audigé and myself) that glycerine may become toxic. (*a*)

Therefore, to recapitulate, these are the rules on which you should found the alimentation of diabetic patients; total abstinence from sugar and from sweetened food; diminution as complete as possible of amylaceous substances; animal food and fresh herbs, care being taken to select such vegetables and such feculent articles as have the least quantity of saccharine matters; almost entire abstinence from bread; Bordeaux wine, bitter drinks; no distilled liquors nor sweetened beverages.

The diabetic invalid, habituated to good cheer, or ordinarily a high liver, will ask of you not only general indications but also particular details respecting the manner of varying his daily bill of fare. You will be able to satisfy this demand by consulting the "*ménus*" of Bouchardat, that I place in part before you,[2] and which should guide you in the choice of your culinary preparations,

[1] Schultzen, of Dorpat, has counseled the use of glycerine in diabetes, which he considers a powerful adjuvant to the ordinary alimentary regimen. The same may be said of Garnier; both give twenty to twenty-five grammes (or somewhat less than an ounce) daily. Harnach recommends still larger doses, from 180 to 360 grammes a day (or from six to twelve ounces), and affirms that these quantities have no injurious effect, have no influence on the amount of sugar eliminated, and rather favor the amelioration of the patient. Holtz believes that glycerine has not merely a neutral effect as far as the glycosuria is concerned, but that it decidedly lessens sugar excretion. (*b*)

[2] [The "*ménus*" of Bouchardat are omitted, as being more applicable to the gourmands of France than of this country. In brief, soup with cabbages and leeks, without bread or flour, are permitted, also rich broths with gluten crackers. Meats of almost all kinds are allowed, with *hors d'œuvre*, as before given (*vide supra*); eggs, shell fish, salads, and *entremets* of gluten cakes, waffles of gluten flour or pure bran, jelly with rum, *kirsch*, or coffee without sugar, omelets with rum (not sweetened), and vanilla. He also specifies as allowable, among the *entremets*, artichokes, cabbage with salad oil, griddle cakes of gluten flour, with

(*a*) Dujardin-Beaumetz and Audigé, on the Properties of Glycerine. (Bull. gen. de Ther., t. xci., pp. 51 and 135.) Also, Experimental Researches on the Toxic Power of the Alcohols. Paris, 1879.

(*b*) Garnier, on Glycerine in the treatment of Glycosuria, Comp. Rend. de l'Acad. des Sc., 10 Mai, 1875. Harnach, on the Treatment of Diabetes by Glycerine, Deutsch. Arch. f. klin. Med., vol. xv., p. 449, Holtz, Ueber Diabetes, Petersburger. Med. Woch., No. 3, 1880.

but do not forget that the rules which I have just prescribed, and which have been also adopted by Seegen,[3] are not absolute, and that you will be compelled in many circumstances to make compromises in the rigorous application of this dietetic regimen, for if it is dangerous for a diabetic to eat feculent and saccharine substances, it is more so to see him reject all kinds of food with disgust. In fact I cannot do better than to remind you of what has taken place in our female wards, where we had lately occupying No. 1 a lady patient suffering from the grave form of diabetes, and whom we have sent to Vichy. This woman, much emaciated, was losing more than 400 grammes of sugar a day. We desired to submit her to an exclusive regimen of meat and herbs, but she could not make a meal without bread, and gluten bread, as well as other kinds of hard bread, were intolerable to her. Therefore this privation of bread had resulted in loss of appetite, and if under the influence of abstinence we indeed did see the sugar diminish, we observed at the same time a circumstance of great gravity, namely, enfeeblement of the forces. On this account we yielded to the desire of the patient, and allowed her a small quantity of bread with each meal. What we did you will often have to do, but take care always to test the results of your dietetic prescriptions by daily analyzing the urine, and in this analysis the saccharimetric process of Duhomme will render you great service in enabling you expeditiously to examine each day the effects of alimentation. The hygiene of the diabetic does not exist exclusively in attention to diet, it is necessary also by physical exercises, varied and multiple, to energize the combustion of hydro-carbonaceous matters. Here, moreover, it is Bouchardat[4]

Parmesan cheese; chiccory, lettuce, and other herbaceous vegetables; asparagus, spinach, mushrooms, etc. If tea and coffee (which should never be sweetened) have no influence favoring the glycosuria they may be indulged in. Alcoholic liquors should be used with great moderation. Of wines (a quart a day for a man, a pint for a woman), choose the old red wines or the old white wines (Madeira, Chablis, Pouilly, Sauterne, Rhine, etc.)—TRANS.]

[3] The alimentary régime of Seegen is very similar to that of Bouchardat, only it is more strict. He allows without restrictions all meats, all kinds of fish, mollusks, and crustaceæ, gelatine, eggs, cream, butter, cheese, pork, spinach, lettuce, chicory, asparagus, pumpkins, cresses, artichokes, mushrooms, nuts, and among the beverages, soda water, tea, coffee, Bordeaux and Rhine wine, and all the other wines such as are mostly devoid of sugar and alcohol. He also permits in small quantity, cauliflowers, carrots, parsnips, cabbage, green beans, raspberries, gooseberries, strawberries, oranges and sweet almonds; in very trifling quantity, milk, cognac, bitter ale, milk of almonds, lemonade without sugar. He absolutely forbids all farinaceous substances (except a very small quantity of bread, which the physician may permit in certain instances), sugar, potatoes, rice, tapioca, sago, arrow root, semoule, legumes, green peas, beets, sweet fruits, especially grapes, cherries, peaches, prunes, apricots, and all dried fruits, sweet and frothy wines, sherbet, cocoa, chocolate, etc. (*a*)

[4] These are Bouchardat's views respecting exercise:

Considering the importance of exercise, it is well to recommend such exercises as will tempt the patient to indulge in them every day.

Among these we recommend to persons fond of the chase, fencing, military exercises, rowing, skating, lawn tennis, ball playing, billiards, croquet; in a word, all the active sports,

(*a*) Seegen on Saccharine Diabetes. Leipsig, 1870.

who has furnished the best indications to follow in the forced exercise of diabetic patients, and you will find described with a great deal of humor the main features of these forced exercises in the spirited work of Jules Cyr. All that can augment the forces of the economy ought to be employed in these cases, and it would be well to vary these exercises according to the needs of the patients. Gymnastics, fencing, forced marches, work in the garden, manual exercise, carpentry, all have their place and their use. You may even add to these means, inhalations of oxygen, baths of compressed air, inhalations of compressed air, in a word, all measures which may increase the organic combustions in rendering more active the respiratory functions. In fine, Bouchardat has also insisted on the necessity of special attention to the functions of the skin. You know, in fact, that in grave cases of diabetes the skin becomes dry and rugose, hence warm baths followed by massage are useful in such cases, and may be taken two or three times a week.

With this hygienic treatment you can in mild cases cause the glycosuria absolutely to disappear. In diabetes of medium intensity you will considerably lower the amount of sugar, but you will have to conjoin certain medicines, and it is these medicaments which I am now going to consider. I propose to pass rapidly over the pharmaceutical agents whose medicinal action in diabetes is not satisfactorily demonstrated, to dwell more particularly on three of them which possess marked curative virtues. I refer to the alkalies, arsenic, and bromide of potassium.

Certain antiseptic remedies have been much vaunted these late years, such as salicylic acid and carbolic acid.[5] Ebstein and Muller, Ryba and Plumert, Fischer and Peters have recommended this method of treatment. According to Fürbringer, these anti-fermentescible substances are much superior to the

without omitting the ordinary manual labors, such as sawing, splitting wood, employment in the garden, digging, chopping, the care of animals, etc. For women we prescribe all the active labors of house-keeping, especially those which require walking about. For both men and women, long daily walks are beneficial, and if they exert themselves occasionally to run it is no harm.

Exercise which requires constant standing without walking is rather to be avoided as favoring swellings of the lower extremities, etc., and of all exercises those should be chosen which agree the best with the patient, and are sufficiently active to cause frequent perspiration, frequent changes of the undergarments being desirable, and all necessary precautions to avoid catching cold. (*a*)

[5] Wilhelm Ebstein and Julius Muller have employed carbolic acid in diabetes and obtained favorable results, especially in the diabetes of fat people; the dose which they gave was five grains daily in peppermint water (in divided doses). Salicylic acid had no effect whatever. In the experience of Purgesk phenic acid was without result, while salicylic acid, in doses from five to ten grammes a day, proved curative. Peters has also employed salicylate of soda in fourteen cases, in doses of eight to ten grammes a day. He affirms that by this means light cases can be cured, and grave cases considerably ameliorated. In Kamen's trials the result was *nil* as far as the glycosuria was concerned; in some cases serious gastric troubles resulted from the salicylic medication.

(*a*) Bouchardat, on Saccharine Diabetes. Paris, 1875.

other pharmaceutical agents.[1] The trials which I have made with these medicines on divers of my patients, both in hospital and private practice, have not given me such good results. I have not observed notable diminutions in the sugar, and I have seen, like Kamen, gastric troubles, and I believe there is risk in administering large doses of these phenols to some diabetic patients by reason of the bad state of their kidneys. To these medicaments we must add permanganate of potash, proposed some time ago by Sampson, of London, and which Masoin, of Louvain, has recently brought into vogue.[2] This permanganate of potash may have a good effect on diabetes of hepatic origin. Cantani has asserted the favorable action of lactic acid in the treatment of diabetes. He thinks that this acid favors the digestion of animal food and the organic combustions;[3] it is even, according to him, the unique medicine to give to the diabetic. As I have never advised the exclusive diet of the Italian physician, I have not used his pharmaceutical treatment. I cannot, then, give you any information on the employment of lactic acid. Ogles pretends that this medicament diminishes the quantity of sugar, but at the same time lessens the weight of the patient.

[1] Fürbringer has studied the action of different medicinal substances in diabetes. In the first rank he places salicylate of soda and phenic acid, which diminish notably the quantity of sugar eliminated by the urine.

Quinine, arsenious acid, pilocarpine and benzoate of soda have no influence either on the quantity of sugar or on the production of urea.

[2] Permanganate of potash was introduced into the therapeutics of diabetes by Sampson, of London. Masoin, of Louvain, made trials of it in 1875, and claimed good results. He explains the beneficial effects of permanganate of potash by the action which manganese exercises on the liver, which organ he believes to be the point of departure of saccharine diabetes. (*a*)

[3] Dr. Forster, in his "Contributions to the Therapeutics of Diabetes Mellitus," reports eleven cases of diabetes treated by the following medicaments:

Oxygenated water, ergot of rye, salts of potassa, opium, bromide of potassium, and lactic acid.

The oxygenated water gave no result; ergot of rye, in the form of extract, diminished the quantity of urine without diminishing notably the quantity of sugar; the salts of potassa carbonate and citrate had no effect; opium produced a diminution both in the quantity of urine and sugar; bromide of potassium caused also a diminution, but this was slight; lactic acid, in the dose of three drachms a day, diminished the quantity of sugar, and seemed to give good results along with a diet of skim milk. This is the way that Cantani administers lactic acid:

After each meal, *i. e.*, three times a day, the patient should take in six successive doses, half an hour apart, the following solution:

℞ Acid lactic, 2 grammes (ʒ ss).
Pure water, 120 grammes (℥ iv).

M. Sig.—Take ⅙ part for a dose as above directed.

He directs also to be taken, alternately with the alkaline waters of Vichy or Vals, a lactic acid lemonade, thus prepared:

(*a*) Sampson, Lancet, 1853. Masoin, on the Treatment of Saccharine Diabetes by Permanganate of Potash. Belgium, 1882.

Struck with the action of certain narcotics, such as opium, belladonna, valerian, on the quantity of urine voided each day, it has occurred to physicians to reduce the polyuria of the diabetic by the use of opium,[4] and it is on this principle that Willis, Rollo, and Tomasini have advised this medication. Diabetic patients, in fact, bear opiates well even in large doses, and you may note in some of them a diminution of urine and in the quantity of sugar, but this result is obtained at the sacrifice of the digestive functions and of the appetite. This is an evil which attends the use of a great many pharmaceutical preparations, and is to be avoided. To lessen the sugar in the urine by diminishing the appetite and troubling the digestive functions is to render a very poor service to the diabetic.

Valerian is more applicable to *diabetes insipidus* or polyuria than to saccharine diabetes. Trousseau has shown that under the influence of this medicament there is a diminution in the quantity of urine, on condition always of giving large doses, and he was in the habit of administering as much as an ounce a day of the extract. Ergot of rye acts also against polyuria rather than against glycosuria, and Huchard has recently shown the good effects which may be obtained from the spurred rye in *diabetes insipidus*.

Iodine and the iodides have also been employed in the treatment of glycosuria. Ricord, Berenger-Feraud, Rayer, and Seegen principally have exhibited the tincture of iodine in the dose of from twenty to thirty drops a day, and have seen the sugar disappear from the urine, but it is an irritant

℞ Pure lactic acid, 5 to 20 grammes.
Peppermint water, 20 to 30 grammes.
Spring water, 1 litre.

M. Sig. To be freely used as a drink.

Dr. Ogles has employed lactic acid in diabetes and noted a considerable diminution in the quantity of urine, but the patient lost his strength. (*a*)

[4] Opium has been given in the form of aqueous extract in the dose of 50 centigrammes, as in the practice of Christian, Ormerod, Schutenberger, and Pavy. Monez, Tomasini, and Kratchmer increase the dose to 3 grammes a day. There is not agreement as to the real action of opium in diabetes. Bouchardat thinks that it acts by promoting diaphoresis; Brouardel, by modifying the nervous system; Pecholier and Lecorché regard it as a tissue-sparing medicament, lowering the proportion of urea excreted.

[Codeia is much more generally used at the present day, especially in this country and in England. Dr. Pavy (Guy's hospital, Rep., 1870) was the first to recommend codeia as being signally efficacious in controlling diabetes without exerting the narcotic effect of opium or morphia. The proper commencing dose is gr. ss thrice daily, which may be gradually increased to gr. ij–iij. Dr. A. A. Smith, at a seance of the Academy of Medicine, New York, 1882, reported in favor of treatment by codeia, having found it curative, in conjunction with perchloride of iron, in several severe cases. The dose of codeia was the same as that above mentioned. The dose of the tincture of iron was 20 drops three times a day. A laxative aloetic pill was given at bedtime.

In my own practice I have seen glycosuria often disappear under codeia, coupled with an animalized dietary régime.—TRANS]

(*a*) Ogles, Two Cases of Saccharine Diabetes Treated with Lactic Acid. Brit. Med. Journal, March, 1879.

medicament and fatiguing to the stomach. I pass rapidly over the chalybeates, phosphorus, cantharides, pilocarpine,[1] the juice of *cana-agria*,[2] to arrive, at last, to the consideration of the alkalies, arsenic, and bromide of potassium.

The alkalies are the most precious pharmaceutical agents in the treatment of diabetes, although we have no very clear explanation of their therapeutic action. Mihale having pretended that glycæmia depends on want of alkalinity of the blood was one of the first to recognize the utility of alkaline medication, but, as Becquerel and Lapezzuoli have shown, this is a mistake, for the blood of diabetic patients presents no modification in its alkaline reaction.

It is probable that in diabetes the alkalies have a complex action; they regulate the digestive functions, and energize the functions of nutrition (as shown by the researches of Hyades and Martin Damourette), in fine, it is possible that they have, as Coignard thinks, a direct action on the glycogenic functions of the liver.[3]

Many alkaline preparations have been prescribed; some, as Rollo, Willis, Fothergill, and Wat, have counseled lime-water; others, as Dur, Neumann, Barlow, Adamkiewicz, prefer the ammoniacal salts; Bouchardat and Pavy have especially advised the carbonate of ammonia.[4]

Potassa has also been exhibited, and Bouchardat, who cannot be too much cited when diabetes is under consideration, has proposed to substitute for the common salt in the ordinary dietary of the diabetic the potassic tartrate of soda, known as Rochelle salt. This preparation he considers superior to citrates of soda and potassa, which he was formerly in the habit of prescribing. He even advises the use of the Seidlitz salt in the preparation of diabetic bread.

[1] Hoffer has made trials of pilocarpine in diabetes in the form of subcutaneous injections. He noted diminution in the quantity of urine and of sugar.

[2] The juice of *cana-agria* is a popular remedy for diabetes in South America. Botanical data concerning this plant are wanting. Gubler, in doses of three ounces a day of this juice, observed diminution of sugar. (*a*)

[3] Coignard has studied the action of alkalies on the glycogenic function of plants and animals. He shows that when you water vegetables, such as beets and gooseberry bushes, with alkaline solutions you notably diminish the quantity of sugar which they contain.

He pretends to have arrived at complete suppression of the glycogenic functions by means of these waterings. He reasons that the same phenomena may take place in man when alkalies are taken internally. (*b*)

[4] Bouchardat claims good results from carbonate of ammonia, which he administers in large doses (as much as can be borne without vomiting) in rum and water. Dr. J. M. DaCosta's formula (Naphey's Medical Therapeutics, Geo. S. Davis, publisher), is as follows :

℞ Carbonate of Ammonia ʒ ij— ʒ iv.
Aquæ Cinnamoni ℥ vi.

M. Sig. A tablespoonful three or four times a day.

(*a*) Journ. de Ther., 1877.

(*b*) Coignard: "Alkalies may annihilate the glycogenic function in plants and diminish its activity in man." Journ. de Ther. 1880.

But the alkaline salt the most employed in the treatment of diabetes is the bicarbonate of soda, and here we must give the preference to the natural alkaline waters over the artificial waters, which fatigue the stomach, and cannot be borne for any great length of time. You will then order your diabetic patients to drink with their meals waters with but a moderate degree of alkalinity, say two or three grammes per litre, and there is nothing better than the Vals or Vichy waters.

Arsenic has these late years been much extolled in the treatment of glycosuria.[1] It has been supposed that arsenic, in modifying the constitution of the liver, modifies also the glycogenic functions, and the recent experiments of my colleague, Quinquaud, have shown that this medicament always diminishes in animals glycæmia, glycosuria, and glycogenesis. This is a fact of great importance, and shows us the advantages which may be derived from arsenical medication in diabetes. Fowler's solution is the best form to choose; of this you need not fear to give large doses, even twelve to fifteen and twenty drops, according to the tolerance of the digestive tube.

Arsenic is not the only metal or metalloid used in diabetes, iodine has been prescribed, and even copper and mercury, the first by Franck and Berndt, the second by Brera and Scott. Burq has even thought that his process of metallotherapy and metalloscopy has a field of usefulness in these cases.

The attention of the medical world has of late been called to the curative action of bromide of potassium[2] in diabetes by a very interesting communication by Dr. Félizet to the Académie de Médecine. Félizet has shown that in certain cases in following the dietetic régime of Bouchardat and the alkaline medication by bromide of potassium, one may free the urine entirely of the sugar which thus far has persisted in making its presence manifest.

This is a kind of treatment which was counseled by Beghie in 1866,

[1] There has been much discussion as to the value of arsenic in diabetes, good authorities claiming that it is beneficial—and among these Jaccoud, Foville, Lécorché; others, as Fürbringer, that it is wholly without effect.

Quinquaud performed a curious experiment. He gave to animals subcutaneous injections of twelve to fifteen drops of Fowler's solution, then he pricked the floor of the fourth ventricle, and a subsequent examination of the urine, the liver and the blood found a notable diminution in the quantity of sugar; when the dose is sufficiently large to produce poisoning there is complete disappearance.

The same phenomenon takes place in patients to whom twelve to twenty drops of Fowler's solution are daily given medicinally. (*a*)

[2] The treatment by bromide of potassium was first employed by Beghie who published four cases where the employment of bromide effected cure of the diabetes.

Forster, in 1872, repeated the experimentation and obtained equally good results. Bouchardat has also made use of bromide; finally, in 1878, Fürbringer experimented with it and obtained bad results.

In his communication to the Acad. Med , Felizet has called attention to the clinical facts and the facts of experimentation.

As for the clinical facts he has shown that in fifteen cases of diabetes, bromide alone or associated with the dietetic treatment of Bouchardat, and the employment of alkalies caused

(*a*) Lécorché, Treatise on Diabetes, 1877.

but which being tried anew by other physicians, had not given very favorable results. In the trials which I made in my service, and in the report which I presented to the Academy of Medicine on this subject, while recognizing the fact that bromide of potassium in the dose of one to two grammes a day may cause glycosuria to disappear, just as Félizet had announced, I showed that the use of this medicine is not without inconveniences. It depresses considerably the forces, and this depression is sometimes so great that the patient is not able to leave his bed. I think, then, that it is necessary to be very prudent in the administration of medicaments of this character, and reserve them for cases of diabetes of nervous origin, and for patients sufficiently vigorous to support such treatment.

The thermal treatment of diabetes is of preponderating importance, and the results which may be derived from it are based on the physiological effects of alkalies and arsenical salts in glycosuria. It is, then, to the alkaline and arsenical spas that you should send your patients, and you may utilize the alkaline waters of Vichy and of Carlsbad, or those of Royat and Bourboule if you desire especially for your patients the constitutional effects of arsenic.

I shall have finished this long enumeration of the means of treatment of diabetes when I shall have said a few words about the local treatment of diabetes by electricity, hydrotherapy, setons, and cauteries.

It was Semmola who, in 1861, first recommended the employment of constant currents upon the pneumogastric in the treatment of diabetes. Leidel and Prof. Leon Le Fort have obtained good results from galvanism.

Fleury has counseled hydrotherapy. I believe that it is necessary to be very careful in the use of this hygienic remedy, and not to employ it except when your diabetic patients are robust, and capable of vigorous reaction.

The same prudence should be exercised in the use of setons and cauteries. Butura and more recently Boutigny have noted cases of diabetes where complete disappearance of sugar from the urine followed the application of cauteries and setons in the region of the neck. But you should remember the danger of wounds (which do not readily heal) in the case of diabetic patients, and be extremely cautious about attempting treatment of this kind.

Such are the therapeutic rules applicable to the treatment of diabetes. Here the dietetic regimen is far the most important, all other modes of treatment being accessory means whose real value is often more or less debatable. But whatever this value may be, the combination of these means none the less constitutes an efficacious system of therapeutics, and without daring

the disappearance of sugar in diabetic patients. Since then he has observed fourteen new cases where he obtained the same effects. Herard and Dreyfusbrisac noted the same results. Dujardin-Beaumetz made trials of bromide of potash in three grave cases of diabetes without result except a considerable lowering of the vital forces of the patient. He recommends to employ this medicine with extreme caution.(*a*)

(*a*) Beghie, Edinb. Med. Journ., Dec., 1866.—Forster, British and Foreign Med. Clinic Review, 1872, p. 48.—Fürbringer, Deutsche Arch. Klin. Med., p. 469, 1878.—Dujardin-Beaumetz, Sur le traitement du diabete par le bromure de potassium, Acad. de Med, séance du 28 Aug., 1883.

to affirm, as some have done, that diabetes is to-day a disease easily and certainly curable, I believe that in a very great number of cases we can have a useful and real influence on the disease, and this is why I have devoted so much time to the consideration of these details.

ON THE TREATMENT OF SYPHILIS.

SUMMARY.—Origin of Syphilis—Necessity of the Mercurial Treatment of Syphilis—Mercury—History—Absorption of Mercury—Its Elimination—Elimination by Milk—Mercurial Salivation—Anti-Syphilitic Action of Mercury—Mode of Introduction of Mercury—Dermic Method—Mercurial Frictions—Mercurial Baths—Hypodermic Methods—Injections of Ammoniaco-Mercurial Peptones—Respiratory Method—Dermo-Pulmonary Method—Mercurial Inhalations—Method per Os—Mercurial Preparations—Adjuvant Medications—Vegetal Treatment—Guaiacum—Pilocarpine—Iodide of Potassium—General Treatment—Method of Successive Treatments—Concerning the Cure of Syphilis—The Marriage of Syphilitic Persons—When Ought the Anti-Syphilitic Treatment to be Commenced?—Necessity of Treatment—Are all the Manifestations of Syphilis Tributary to the Specific Treatment?—Treatment of the Indurated Chancre—Iodoform—Sulphide of Carbon—Treatment of the Stages—Mixed Treatment—Treatment of Mucous Patches—Treatment of Tertiary Syphilis—Treatment of Venereal Affections—Soft Chancre—Blenorrhagia—Its Treatment—Cubebs and Copaiba—Urethral Injections—Treatment of Gleet—Abortive Treatment—Blennorrhagic Vaginitis—Vaginal Suppositories—Gurgun Balsam—Vaginal Injections.

GENTLEMEN: In the exposition which I desire to make of the treatment of syphilis, I shall endeavor to be as brief and as practical as possible. I shall, then, put aside the great questions which a consideration of treatment raises, and especially those pertaining to public hygiene and prophylaxis which are so earnestly discussed to-day, and shall concern myself exclusively with the means which will enable you to cure as speedily as possible the various manifestations of venereal disease.

Syphilis is unfortunately a malady whose frequency increases daily, and whose symptoms you will in your practice have to combat a great many times.

I shall not, then, discuss before you the origin of venereal disease.[1] It is probable that, like the greater number of diseases which afflict humanity syphilis was known in the first periods of the human race, and if we may credit

[1] Historians relate that at the end of the fifteenth century (1495) occurred the first outbreak of syphilis in France, at the time of the French expedition against the Neapolitans; the French called it Italian plague, the Italians gave it the name of *French plague*. Fracastor has given us the most complete description of this epidemic, but an attentive study of the facts shows that syphilis existed a long time before but was only known by certain isolated manifestations.

In China syphilis has existed from all antiquity, and in a book which goes back to B. C. 2637, and is attributed to Hoang-ti, you will find a description of all the syphilitic accidents; the account of chancre is especially good

In India also a very exact account of syphilis and its many symptoms is contained in the Sucrutas-Ayurvedas, which may be considered as the Hippocratic treatise of Indian medicine.

According to an Indian myth Cira, having given himself up to sensual indulgences, was punished by gangrene of the genital organs; and this disease spread over the whole world by contagion, only yielding, if ever, to the prayers of the penitents.

The Jews, Greeks, and Romans also had a knowledge of syphilis. The disease of Job bears striking resemblance to syphilitic dermatosis. The Greeks had a religious myth similar

Parrot, the prehistoric man was not exempt from it. Nor shall I discuss the necessity of mercury in the treatment of syphilis; this question seems decided at the present day, and it would be to gainsay the clearest evidence not to admit the efficacy of mercurials in this disease. I am well aware that abuses have been made of this remedy; that not all cases of syphilis are curable by quicksilver; that the treatment is not suitable to all periods of the malady; but what I cannot understand is the obstinacy of a small, though influential, number of physicians, who refuse to acknowledge, as demonstrated, the marvellous action of mercury in a great many cases of syphilis.[2]

It suffices to have been an attentive observer, during one's practice, of a few cases of syphilis with cerebral complications of great gravity, and to have seen them disappear as by enchantment under the influence of an energetic mercurial course, to compel one to admit, without reservation, the therapeutic power of mercury in syphilis. I am going, then, to set forth at some length the fundamental principles of this hydrargyrate medication.

Considered by the writers of antiquity as one of the most energetic poisons,[3] mercury was used externally by the Arabs; Rhazes recommended

to that of the Indians. Some of the Latin writers describe phenomena which clearly appertain to syphilitic affections.

Modern anthropological researches justify these views. Parrot has shown on the bones of prehistoric man morbid alterations clearly of syphilitic origin, at least according to Broca, who is good authority.

In the prehistoric burial places of the new world St. John has also found exostoses of the same nature.

[2] Although in the sixteenth century there was vehement opposition to the mercurial treatment of syphilis, and Fernel in particular protested against its employ in this disease, the war against the hydragyrate treatment has been waged with the greatest violence in this present century. Broussais began it in France by decrying the specificity of syphilis and recommending the antiphlogistic medication. His followers, Dubled, Bobillier, Richoud des Brus, have gone so far as to affirm that the accidents observed in syphilis are due to mercury.

Murphy, in England, took this view in 1839, and Joseph Hermann, in Germany, made a veritable crusade against this medication.

Lorinser has carried the opposition even farther, and basing his views on the researches of Kletzinsky, and Melsens, who affirm that iodide of potassium eliminates mercury, he maintains that this last medicament benefits only in this way in syphilis.

At the same period in France Anzias-Turenne repudiated mercury quite as absolutely, and proposed syphilization as a means of treatment, and he was followed in this line by two foreign practitioners, Sperino, of Turinne, and Boeck, of Christiana.

Coincidently with these labors there was made a study of the natural evolution of the disease which commenced by the observation of William Fergusson, who during the war between France and Portugal in 1813 noticed that the Portuguese soldiers treated without mercury got well quite as rapidly as the English soldiers treated with it. John Thompson, in England, Boerensprung, in Germany, and Diday, in France, showed that a considerable proportion of syphilitic cases get well without mercurial treatment. To these names we should add that of Désprès, who has distinguished himself as one of the most bitter adversaries of mercury.

[3] The ancients made little use of mercury as a medicine for they regarded it as a poison. Galen, Dioscorides, Aretæus, attributed to it tonic properties. The Arabs, while

mercurial applications as part of the treatment of tinea, of scabies, of the mange, and of all wounds of bad nature, and as it is the property of syphilis to produce cutaneous ulcers of foul aspect, it is easy to understand how, from the appearance of the epidemic of syphilis at the end of the fifteenth century, this medicament came to be used in the treatment of these sores. It is then a matter of history that Marcellus Cumanus in 1495, Casper Torella in 1497, Conrad Gilini still later employed mercurial ointment in the treatment of the grave cutaneous affections which were observed in France and Italy as a sequence of the siege of Naples.

The introduction of mercury into practice as an internal remedy was of later date, and it was not till 1536 that Matthiolus dared prescribe it internally for syphilis, and since this epoch down to the present time, the medical profession has not ceased to administer this medicament, and to note its good effects. Notwithstanding the multiplicity of works on this subject, we are ignorant of the *modus operandi* of this remedy, and while no medicine is in so general use in

admitting its deleterious properties, recommend mercurial preparations for outward use in itch, mange, and to kill lice. Rhazes and Serapion give for these purposes very precise formulas, which were brought again into vogue in the thirteenth and fourteenth centuries by Theodoric (1280), and Arnaud de Villeneuve (1300). It was as a result of these topical methods of using mercury that mercurial ointments came first to be employed in the treatment of syphilis, and they were utilized at the time of the first outbreak of syphilis in Europe, in the fifteenth century.

In 1495 Marcellus Cumanus, physician to the Venetian army, recommended a mercurial pomade consisting of quicksilver in combination with oil of sweet almonds and lead lotion.

Gaspard Torella in 1497, and Conrad Gilini in 1498, also speak of mercurial ointments as external applications in syphilitic ulcers. Metallic mercury was in use as well as cinnabar and corrosive sublimate in ointments, plasters and fumigations.

Jean de Vigo in 1518 was the first to administer red precipitate, not for pox, but for the plague. Several years later Matthiolus prescribed it in syphilis. The year following (viz., 1537), Pierre de Bayrs, physician to Charles II., gave a recipe for some pills which Barberousse, King of Algiers, Captain Gen. of the Turks, during the reign of Soloman II., had sent to his ally, Francis I., who was suffering from the venereal disease. These pills contained metallic mercury associated with rhubarb, aloes, amber, mastic and myrrh. At this epoch not only was the external and internal use of mercury known, but also all the dangers attending this medication, which was very popular and largely in the hands of quacks, and nothing is more curious than the narrative which Ulrich von Hutton has given, who, having had the pox, was subjected eleven times during nine years to mercurial treatment, from which he experienced cruel sufferings.

Astruc has also given us a touching account of the unhappy victims of syphilis under mercurial treatment: "As their mouth was one fetid ulcer, and their stomach was enfeebled, they had no appetite; many were attacked with vertigo, some with madness; they were seized with a trembling of the hands, of the feet, and of the whole body, and they were subject to a stuttering often incurable; I have seen a great many die during the treatment." It was at this epoch that the reaction against mercury took place, and sudorific woods, guaiacum in particular, were introduced into the treatment of pox. Physicians were then divided into mercurialists and anti-mercurialists. (*a*)

(*a*) Gaspard Torella, *Tractatus eum consiliis*, Romæ, 1497.—Rhases, *Ad Almansor*, 850, lib. IX.—Serapion, *Libro de simplici medicina.*—Mesue, *In antidotario.*—Ulrich de Hutten, *De guaiaci medicina et morbo gallico*, Magientiœ, 1519.—Hollopeau, *Du mercure* (thèse d'agrégation, 1878).

syphilis, there is none whose physiological action is more obscure. I am, nevertheless, going to give you some information which we possess relative to the ways of absorption and elimination of mercury, and I will do this, taking as my principal guide the remarkable work which my colleague in this very hospital, Dr. Hallopeau, has devoted to this medicament.[1] Mercury may penetrate the economy, either by the digestive tube, by the respiratory passages, or by the skin, and therapeutics utilizes all of these ways.

There has been much discussion about the penetration of mercury by the skin. It is known, in fact, that quick-silver, when finely divided, as it is in mercurial ointment, may enter the economy through the skin, when not devoid of its epithelium, and this is one of the methods by which salivation may be most rapidly produced. How does this penetration take place? Some, as Overbeck, Eberhards, Oesterlen, have pretended that mercury in the metallic state penetrates the subcuticular vascular network. Others, as Rindfleisch, have maintained that this penetration of mercury in the metallic state is impossible, and that it is only after having been transformed into a soluble chloride by the sudoral secretion, that quicksilver enters the economy. The recent experiments of Fleischer give much support to these last views.[2]

It is then in the state of chloride, and especially of bichloride, as Mialhe[3]

[1] Hallopeau. De Mercure Thesè d'agregation. Paris, 1880.

[2] The claim has been made that mercury may directly penetrate the vessels in metallic state, when frictions with mercurial ointment are made. Oesterlen pretends to have found globules of mercury in the blood of cats over whose skin he practiced mercurial frictions. Eberhard and Overleck affirm that mercury filters through the skin, and that they have found it even in the sub-pleural tissue, while Blomberg claims to have found metallic mercury in all the tissues.

Fleischer has recently taken up this study, and from very conclusive experiments he has proved that if mercury penetrates the more superficial layers of the epidermis, it never reaches the *rete mucosum*.

A great number of authorities agree in affirming that in the case of frictions with mercurial ointments, absorption takes place in two ways: by the lungs, and by the transformation of mercurous or mercuric oxides into chlorides. (*a*)

[3] Mialhe has pretended that mercury does not penetrate the system except in the state of bichloride, or in the form of an alkaline hydrargyrate-chloride. The protoxides undergo transformation, he thinks, into protochlorides, and then into bichlorides.

Voit admits the same thing—to wit, that the suboxides undergo transformation into calomel, and the oxides into bichloride; these last unite with the chloride of sodium and albumen of the blood.

The recent investigation of Bucheim, and of Ottingen, and those of Otto Graham make it appear probable (contrary to the views of Mialhe) that the protochloride combines with albumen to form an assimilable albuminate of protoxide of mercury.

Bellini has studied the modifications which the chlorides, the bromides, and the iodides undergo. Calomel, according to him, dissolves in the stomach and in the intestines under

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(*a*) Rindfleisch (Ed.), *Zur Frage von der resorption des regulinischen quecksilbers* (*Arch. der Dermatol.*, t. II, p. 309, 1879).—Overbeck (Rob.), *Mercur und syphilis. Physiologische-chemische und pathologische Untersuchungen das quecksilber and über die quicksilberkrankheit*, Berlin, 1861.—Blomberg, *Nagra ord om quicksilfvrets absorpcion af organismen*, Helsingfors, 1067.—Hallopeau, *Du mercure* (thèse d'agrégation, 1878.

affirms, that all mercurial preparations enter the blood, combined, be it understood, with the albumen of the blood, thus constituting a double albuminate or peptonate of hydrargyrum and of sodium.

When once it has penetrated the blood, mercury, after having sojourned a variable time in the economy, is eliminated by divers emunctories, in particular by the kidneys, by the fæces, by the milk, by the sweat, and by the saliva. The duration of this elimination depends on the duration of the mercurial treatment, and when this has been very prolonged, one may find mercury in the urine for several weeks after the treatment has been discontinued. Mercury seems, in fact, to fix itself in different viscera, and in particular in the liver.[4] It has been maintained that it is this fixation of mercury in the bones which provokes those osteocopic pains so frequent in the advanced periods of syphilis. This interpretation is absolutely erroneous, for there are syphilitic patients who, never having followed any mercurial treatment, have osteocopic pains of the most violent kind, and these pains seem to be mitigated under the influence of mercurial preparations.

Among the channels for elimination of mercury, there are two which interest the therapeutist—the mammary and the salivary glands. The fact of elimination by the saliva explains the cause of the salivation which so frequently attends the mercurial treatment. It is, in fact, maintained that it is the presence of chlorides of mercury in the saliva which is the point of departure of the

the influence of chlorides and lactic acid, being transformed into a double chloride of mercury and sodium and into lactate of mercury. The iodides and the bromides undergo a similar change, being transformed into double salts under the influence of the alkaline chlorides and lactic acid. A part of these salts enters the circulation, another part is transformed into sulphide of mercury in the large intestines, and eliminated in the fæces. (*a*)

[4] The elimination of mercury is effected by the kidneys, intestines, mammary glands, perspiratory and salivary glands. The utility of this last kind of elimination has been much disputed of late years, yet Bernaski has determined the presence of mercury in the saliva taken directly from Steno's duct.

Personne, Blinz, Lewald, and Klink have found mercury in the milk of nurses submitted to mercurial treatment.

Riedérer has examined experimentally the quantity of mercury eliminated by the different emunctories. In an animal which had taken, in twenty-nine days, nearly two grammes of mercury, during this time four per cent. was found in the fæces, nine per cent. in the urine, and during the succeeding eighty-one days there was still found in grammes and fractions of a gramme, .0568 in the fæces, .0040 in the urine, and .0026 in the liver.

Mayencon and Bergeret have studied the rapidity of elimination of the mercurial preparations. Experiments show that the greater part of the medicament is immediately eliminated in the urine, and that another part, after having become fixed in the tissues, is eliminated very slowly and insensibly, insomuch that several days after the cessation of the mercurial treatment the presence of mercury is detected in the urine. (*b*)

(*a*) Rindfleisch, Arch. de Dermatol., t. ii, p. 309. Overbeck, Mercure und Syphilis, Berlin, 1861. Hallopeau, Th. d'agregation, 1878. Voit, Physiologie, Chemische Untersuchungen, 1 Heft, Augsbourg, 1858. Blomberg, Nagra ord om quicksellfvrets absorpcion, af organismen, 1867.

(*b*) Bergeret and Mayencon, "Clinical Means for Recognizing Mercury in the Excretions, and principally in the Urine;" Lyon Medical, t. iv., 1873, p. 179.

irritation of the mucous membrane of the gums. At the same time this point of pharmaco-dynamic action demands to be studied anew, for the salivation seems to depend especially on the mode of administration of the mercury. Very easily provoked by cutaneous inunctions, it is exceptionally produced by hypodermic injections.[1]

Can we find in the physiological and toxicological action of mercury the explanation of its anti-syphilitic action? Unhappily, no; and the study of mercurialization, whether slow and chronic or sudden and acute, observed so often in men who work in industries where mercury is in use, does not furnish us any data for the solution of this important therapeutic question.

It has been said that mercury acts on the blood-globules and the plasma; this may be true in the normal state, and when it acts as a poison. But this is the very opposite of what takes place in syphilitic patients, where one constantly sees under the influence of a well-regulated treatment, the number of red globules augment, as well as their richness in hæmoglobin. The experiments of Wilbouchewitz of Moscow, of Keyes, of Robin, of Schlesinger, are absolutely confirmative in this respect. Mercury cures syphilitic anæmia, but it is powerless to benefit other anæmias.[2] It is necessary then to admit that mercury possesses a specific property in the treatment of syphilis, and we are obliged to content ourselves with the data which are furnished us by empiricism and tradition concerning the antisyphilitic action of mercury.

[1] Several hypotheses have been advanced as to the mechanism of mercurial salivation. It was at first maintained that mercury is eliminated by the saliva, its presence determining irritation of the gingival mucous membrane.

Fournier pretends that the initial fact of mercurial salivation is an alveolo-dental periostitis, which at its start affects the last molar of the side on which the patient sleeps. The salivation is secondary to the outbreak of this periostitis. As for the cause of this alveolo-dental periostitis it is believed to depend on a bad state of the teeth or on the local action of the mercurial preparations administered by the mouth.(*a*)

[2] It has been asserted that mercurial preparations have a special action on the lymphatic system. Some have affirmed that mercury is a lymphatico-glandular debilitant. James Ross, on the other hand, has proved that mercury stimulates the functional activity of the lymphatics and this explains the resolvent action of the medicament. Fonssagrives takes the same view.

Mercury, moreover, has, according to the experiments of Rutherford, an action on the liver, but while calomel is but slightly cholagogue, the bichloride is much more so.

Wilbouchewitz, of Moscow has studied the action of mercurial preparations on the blood by means of the numeration of the globules. He has always observed that the number of the red globules is greater in syphilitic persons during mercurial treatment than before; it is the contrary with the white corpuscles. He concludes from this that syphilis is the cause of the corpuscular diminution and that mercury by antagonizing this action causes the globules to increase.

In animals under experimentation the administration of mercury always occasions a diminution in the number of globules, and this globular deficiency ceases when the use of mercurial preparations is abandoned.

Keyes, in repeating these experiments by means of Hayem's hæmatimetre, finds that mercury in small doses augments the number of globules, but diminishes them in large

(*a*) Hallopeau de Mercure (Thése de Paris, 1878.)

The absorption of mercury may take place, as I have told you, by three ways: by the skin, by the lungs, by the stomach. Therapeutics utilizes these three modes of introduction, and thence result three different modes of treatment of syphilis: the dermic and the hypodermic method, the respiratory method, and finally administration by the alimentary canal.

Let us examine the advantages and disadvantages of each of these methods:

The dermic method is the most ancient. We have seen that it was by applications of mercurial ointment that attempts were first made to cure syphilitic sores. This method is still employed at the present day; nevertheless, since the improvements in hypodermic injections of our time, the dermic method is much less used than formerly. Frictions with mercurial ointment, if they cause mercury rapidly to enter the economy, have the very serious objection of speedily determining salivation. For these inunctions mercurial ointment is used; the "fortior" and the "mitior." The stronger ointment is called the Neapolitan cerate. As it is generally admitted that mercury does not penetrate the system till it has been subjected to the action of the sudoral secretion, the rule has been to practice these inunctions on parts of the skin where the sweat glands are the most numerous, as in the arm-pit, the groin, the soles of the feet. Denis Dumont has even proposed, under the name of *Neapolitan hose*, a very convenient method for making these applications, especially when the patient wishes to conceal the treatment which he is pursuing. This method consists in making the patient put on, at bedtime, a pair of *hose* or *long stockings*, the interior of which has been medicated with Neapolitan ointment. As for the frictions, they are repeated once or twice a day, according as one wishes to obtain a more or less rapid action. The rubbing lasts from five to ten minutes, and when once finished, it is the custom to wash the parts where the inunction has been made, to avoid the local irritant action determined by prolonged application of the mercurial pomade.

Mercurial baths form a part of the dermic method of treatment. Here the penetration of the mercury into the system is much less active, and if baths of corrosive sublimate render some service in therapeutics, it is simply by their local action. These baths, the only mercurial baths employed, contain 3 v of

doses. Robin has attained the same results, obtaining in patients treated with mercurial injections augmentation in the number of globules. Schlesinger's experiments lead substantially to the same conclusions.

Martineau has also noted increased production of globules under mercury; the number which is in general from two millions to two millions and a half, went as high as from four to five millions, and this chiefly under the influence of subcutaneous injections of ammoniaco-mercurial peptones.

(*a*) Wilbouchewitz, *De l'influence des préparations mercurielles sur la richesse du sang en globules blancs at en globules rouges* (*Arch. de phys.* juillet et septembre, 1874).—Keyes, *The effect of small doses of mercury in modifying the number of the red blood corpuscules in syphilis; a study of blood counting with the haematimetre* (*American Journal*, No. 17, Jan., 1873.—Em. Robin, *Recherches sur l'influence du traitement mercuriel sur la richesse globulaire* (thèse de Paris, 1880).—Schelinger, *Experimentelle Untersuchungen über die werkung lange zeit fortgegebenen kleiner dosen quecksilbers auf thiere* (*Arch. f. exper. pathol. u. pharmak.* (Bd. XIII, Hft. 5, p. 347).—Martineau, *Des injections souscntanées de peptones mercuriques ammoniques dans le traitement de la syphilis* (*Union medicale*, 20 août 1882).

corrosive sublimate for a full bath.[1] You can add to these baths common salt or sal ammoniac. It is also the local effect that is sought for when the various mercurial plasters are prescribed, the most known of which is that of Vigo.

The hypodermic method of the treatment of syphilis is of quite recent date, and thanks to the improvements which have been made in the liquids used in these injections by Martineau and Delpech, this method, which has all the advantage of the dermic mode without the disadvantages, namely, a very prompt and energetic action, without salivation, tends to take the place of the dermic method. It was Hebra and Charles Hunter who, in 1863, first practiced sublimate injections in the treatment of syphilis, and in 1868 Liegeois popularized this method in France; but these first trials were unsatisfactory, and the method was abandoned. Corrosive sublimate is in fact very irritating, and it is easy to see that these subcutaneous injections, very painful as they are, might cause grave local lesions. For the solutions of corrosive sublimate and chloride of sodium, which were employed by Hebra, Charles Hunter, Lewing, Liegeois, and Tachard, it was proposed to substitute the cyanide or the bicyanide of mercury as Mandelbaum and Guntz proposed. Others, as Luton and Fürbringer, advised injections of metallic mercury, rubbed up with glycerine and gum arabic. But all of these solutions were always painful, and it was only by combining albumen and peptones with corrosive sublimate that solutions were obtained having a very feeble irritant action. This is what has been accomplished by Neumann, Bamberger, Terrillon, and especially Martineau and Delpech, who, in uniting chloride of ammonium with peptones and with corrosive sublimate, have made a solution of mercuric ammoniacal peptone which is absolutely neutral, keeps perfectly, and rarely determines local lesions when properly injected.[2]

[1] The formula of corrosive sublimate baths is as follows :

1.

℞ Bichloride of mercury, 2 parts.
Alcohol, 5 parts.
Distilled water, 200 parts.

M.

2.

℞ Bichloride of mercury, 3 parts.
Chloride of ammonium, 3 parts.
Water, 1000 parts.

M.

3.

℞ Bichloride of mercury, 1 part.
Chloride of sodium, 1 part,
Warm water, 100 parts.

M.

[2] Neumann maintains the advantage of subcutaneous mercurial injections; he lauds especially solutions of corrosive sublimate with albumen and peptones as being but slightly, if at all, irritating. Bamberger uses the following solution: To 200 cubic centimetres of albumen, as pure as possible, add 300 cubic centimetres of distilled water, and filter. Mix 100 cubic centimetres of this albuminous solution with 60 cubic centimetres of a five-per-cent. solution of corrosive sublimate, and 60 cubic centimetres of a 20-per-cent. solution of

It is necessary, in order to avoid accidents, to make these injections as deeply as possible. And here, as in the case of subcutaneous injections of chloroform, you ought to thrust your needle perpendicularly into the tissues; therefore, it is almost always in the hips that we make these injections. In the thousands of subcutaneous injections which Martineau has performed in the Hospital of Lourcine, he has never observed any grave accidents. At the same time, it is well to remember that in the majority of cases these injections are painful, and that they leave behind them an induration of tissue which lasts for some time. There are even patients, women especially, so hyperæsthetic that they cannot bear these injections. Despite these cases, which are exceptional, the hypodermic method is excellent, especially in hospital practice, being sure and speedy. In private practice this mode of treatment is more difficult to

common salt, and 80 cubic centimetres of distilled water. Let it stand two days, and filter with care. 20 cubic centimetres of this solution contain gr. ij$\frac{3}{10}$ of metallic mercury.

Terrillon has made trials of hypodermic injections of peptones of mercury. He made use of Bamberger's solution, which is as follows: Take of meat peptones, 1 gramme water, 50 cubic centimetres. Filter; and add: Solution of corrosive sublimate (1:500), 20 cubic centimetres; solution of chloride of sodium (20 per-cent.), 16 cubic centimetres. Distilled water sufficient to make 100 cubic centimetres.

Each cubic centimetre of this solution contains gr. $\frac{1}{6}$ of mercury. In combination with peptones, these injections cause no pain, if made deeply in the subcutaneous tissue. Delpech has advised the following formula for the preparation of mercuric ammoniacal peptones. Take of

Dried peptone (Catillon), 3 parts.
Chloride of ammonium, 3 parts.
Mercuric chloride 2 parts.
M.

This powder is one-fourth part corrosive sublimate; hence one gramme contains 25 centigrammes of corrosive sublimate. From this formula divers preparations are made:

1. Hypodermic injections—

℞ Powder of peptonate of mercury, 1 part.
Distilled water 50 parts.
Glycerine, 10 parts.
M.

Each syringeful of this solution corresponds to gr. $\frac{1}{6}$ of corrosive sublimate.

2. A solution which is taken internally—

℞ Powder of peptone of mercury, 1 part.
Distilled water, 200 parts.
Glycerine, 50 parts.
M.

Each gramme of this solution contains 1:1000 of corrosive sublimate.

3. Pills—

℞ Powder of peptonate of mercury, ʒ ss.
Opium, grs. viij.
Powder of guaiac, ʒ ss,
Powder of ext. licorice, sufficient to make 100 pills.

Each pill contains gr. $\frac{1}{12}$th grain of corrosive sublimate.

carry out; you ought then to reserve it exclusively for grave cases, where you want a prompt and energetic action, as in syphilis of the brain and spinal cord. These injections contain in each syringeful, as you well know, gr. $\frac{1}{6}$ of corrosive sublimate. When you do not wish to go to the trouble of preparing the rather complex solution of Delpech, you can prescribe subcutaneous injections as follows :

℞ Powdered peptone (Catillon), 3 parts.
Chloride of ammonium, pure, 3 parts.
Corrosive sublimate, 2 parts.
Glycerine, 50 parts,
Water, 150 parts.
M.

Each syringeful of this solution contains gr. $\frac{1}{6}$ of corrosive sublimate. These injections are practised every day or every second or third day, according to the urgency of the case, and I shall return presently to the doses, when I come to the syphilitic complications.

The respiratory method, which has for its basis mercurial inhalations, is of very ancient origin. It has been restored to practice the past few years by Langston Parker, of England, by Bumstead, of New York, and by Horteloup, in France. This method, which may be called *dermo-pulmonary*, consists in placing the patient in a box in which are burned troches containing cannabar or corrosive sublimate. The penetration of vapor is effected chiefly by the lungs. The box, being of loose construction, allows the fumes to escape into the outside air. I have never employed this *dermo*-pulmonary method, but it seems to me every way inferior to the hypodermic mode, and is certainly less precise and sure. In fact, this kind of treatment is not likely ever to be popular.

I come now to the last method of administration, namely, that by the alimentary canal, which is by far the most available and practical. Mercury is employed under all its forms;[1] metallic mercury, the most common preparation

[1] The following are some of the forms of administration of mercury by mouth :

1. *Blue pills.* The formula is too well known to need repetition here.

2. *Sedillot's pills.* Each pill contains gr. iss of mercurial ointment, with gr. j. of castile soap, and gr. $\frac{1}{2}$ of licorice powder.

3. *Bichloride of mercury.* Van Swieten's formula is as follows:

℞ Bichloride of mercury, 1 part.
Rectified spirits, 100 parts.
Pure water, 900 parts.
M.

One teaspoonful contains gr. $\frac{1}{12}$ of corrosive sublimate.

4. *Mauriac's modification of Van Swieten's liquor—*

℞ Spirits of peppermint, 4 parts.
Hydrarg. bichlorid., 1 part.
Alcohol, 95 parts.
Syrup of morphia, 250 parts.
Orange-flower water, 100 parts.
Distilled water, 50 parts.
M.

of which is the blue pill; bichloride of mercury, which is the active ingredient of the liquor of Van Swieten; the pills of Dupuytren; and the ordinary solution of the British Pharmacopœia; the protiodide (Ricord's pills); and the biniodide, which is contained in the syrup of Gibert. These are the forms most in use in this country. There are, however, a prodigious num-

This preparation is twice the strength of Van Swieten's.

5. *Dupuytren's pills—*

℞ Hydrarg. bichlorid., gr. $\frac{1}{6}$.
Ext. opii, gr. $\frac{1}{3}$.
Ext. guaiac, gr. $\frac{2}{3}$.
M. For one pill.

6. *English anti-venereal drops—*

℞ Crystallized perchloride of iron, 1 part.
Corrosive sublimate, 1 part.
Distilled water, 1000 parts.
M.

Every f ʒ iij contains gr. $\frac{1}{6}$ of corrosive sublimate. A medium dose, one teaspoonful.

7. *Brazilian electuary of Carneiro, containing calomel—*

℞ Calomel, gr. xv.
Powdered sarsaparilla root, ℥ i.
Powdered senna, ℥ ss.
Simple syrup, sufficient to make an electuary.
M.

Every f ʒ ijss contains gr. jss. of calomel. Full dose, ʒ ijss.

8. *Ricord's pills—*

℞ Hydrarg. protiodid., gr. xlv.
Ext. lettuce, gr. xlv.
Ext. opii, gr. xv.
Ext. hemlock, ʒ iss.
M. F. S. A. 60 pills.

9. *Formula of French Codex—*

℞ Hydrarg. protiodid. gr. $\frac{3}{4}$.
Ext. opii, gr. $\frac{1}{3}$.
Conserve of roses, gr. $\frac{1}{6}$.
Licorice root, sufficient for one pill.
M.

10. *Gibert's pills of biniodide—*

℞ Biniodide of mercury, gr. iss.
Iodide of potassium, gr. lxxv.
Pulv. acacia, gr. vijss.
M. F. S. A. 20 pills. Two of these pills contain gr. $\frac{1}{6}$ of biniodide of mercury.

11. *Syrup of Gibert—*

℞ Biniodide of mercury, 1 part.
Iodide of potassium, 50 parts.
Water, 50 parts.
Simple syrup, 2400 parts.
M. Every dessert spoonful contains gr. iv. of biniodide

ber of hydrargyrate preparations in the shops of pharmacists—pills, solutions, potions, pastilles—whose formulæ you will find in most of your treatises on syphilis. What salt of mercury ought you to choose? It may be replied that all the preparations I have just enumerated are suitable. At the same time, for my part, I prefer the bichloride and biniodide, to all others, and I consider the bichloride, and especially the solution of Van Swieten which contains it, as the most active in the first periods of syphilis, of all preparations given by the mouth. This preference is not only based on the results of my practice, but it is also in conformity with what we know of the introduction into the economy of mercury, which always enters the circulation in the state of bichloride. If you employ the bichloride, whether in the form of Dupuytren's pills or Van Swieten's liquor, I advise you always to administer these preparations with food or with milk; you will thus avoid, as far as possible, the irritant local action of corrosive sublimate on the alimentary mucous membrane. Such are the principles of the mercurial treatment of syphilis. I must now point out certain rules which should guide you in this treatment—when you ought to commence it, and when you ought to leave it off. But before proceeding to this part of my task, I must say a few words about the accessory modes of treatment.

Mercury is not the only metallic substance which has been prescribed for syphilis.[1] Chrestein and Legrand have proposed preparations of gold, Serres of silver, Hoefer of platinum, and even of copper. All these preparations have been successively abandoned, but the treatment which has had the most repute is the vegetal treatment.

The anti-mercurialists, struck by the ravages which mercury occasions, had essayed to substitute for it sudorifics, and from the sixteenth century, as a result of the influence of Delgado and Ulrich Von Hutten, guaiacum was considered as one of the most powerful anti-syphilitic medicines known. The success which was then obtained by the sudorific woods depended more on the severe regimen to which the patients were subjected than to any remedial qualities in the drugs.

Since then many attempts have been made to return to the vegetal treatment,[2] and numerous have been the compounds of indigenous or foreign herbs in decoctions and alcoholic tinctures which have been prescribed, but these

[1] Although Fracastor made mention of gold in the treatment of syphilis, it is to Chrestien, of Montpellier, that we owe the principal indications of this medication. This practitioner employed gold in a state of fine division; also the oxide and the perchloride of gold and sodium, both internally and externally, in frictions over the base of the tongue, etc. Legrand has spoken in high terms of the advantages of this medication, which he considers as specific in syphilis. (*a*)

[2] The sudorific or vegetal treatment of syphilis goes back to the 16th century, and was especially recommended by Delgado and Ulrich Von Hutten about the year 1517. Astruc has given at considerable length the principles of the treatment by guaiacum.

The decoction of guaiacum was thus prepared: In an earthen pot was infused one pound

(*a*) Legrand, on Metallic Gold and its Employ in Syphilis. Paris, 1836. Serres, on the Employment of Preparations of Silver in Venereal Diseases. Hoefer, Gaz. med. de Paris, 1840.

anti-venereal specifics are utterly unreliable. In Italy, Ubicini Galassi and others have experimented with the root of a member of the *Cucurbitaceæ*, viz., tayuya. I have not heard of any good results from the medicinal use of this plant, and Sigmund and Geher have shown it to be completely inert. Pilocarpine, that powerful sudorific, would naturally have been employed in syphilis, and if the sialagogue and sudorific action of a medicament can have any favorable influence in the treatment of venereal disease, this alkaloid and jaborandi, which contains it, ought to be of efficacy.[3] Notwithstanding the results of Lewin, which have not been confirmed by other experimenters, jaborandi does not seem to have any curative virtues in syphilis.

Of this vegetal treatment, nothing remains for consideration but the ptisans and syrups called depurative, almost all of which have sarsaparilla for their basis.[4]

of guaiacum in twelve quarts of water; it was boiled down about one-third, or one-half, strained, and kept in tight stoppered bottles.

As for the patient, he was placed in a room which he was not allowed to leave for more than a month; was subjected to frequent sweatings by the frequent use of the guaiacum infusion, and was regularly purged. He was also kept on spare diet, such as simply bread and chicken broth, porridge, etc.

Many other plants have been employed in the treatment of syphilis, such as aconite, hyssop, honeysuckle, burdock, cherry laurel, lobelia, dog weed, persicaria, parsley, soapwort, polygala, and elder, all have had their turn. (*a*)

[3] Sigmund, of Vienna, and Geber, seem to have effectually disposed of the claim of tayuya to the possession of anti-syphilitic properties.

Lewin has experimented with pilocarpine in the treatment of syphilis, and has obtained 27 cures in 32 patients (70 per cent.) (The cases were grave.) The mean duration of the treatment was 34 days, the whole quantity of the drug employed averaging for each patient, gr. 0.372.

Lewin ordinarily employs pilocarpine in the form of subcutaneous injections in the dose of one centigramme (about the one-sixth of a grain), in the case of a woman, and two centigrammes when the patient is a man. (*b*)

[4] Sarsaparilla is a root furnished by several plants of the genus smilax, which grows in Central America and South America. Smilax belongs to the liliaceæ, and the roots furnish several sorts of sarsaparillas, which are divided into two groups, the farinaceous and the non-farinaceous, according as they do or do not contain starch. The first come from Honduras, Guatemala, and Brazil; the second from Jamaica, Mexico, and Guyaquil.

Galileo Pallotta, of Naples, has extracted from the root a special principle which he calls *parilline;* it is a saponide. On boiling with H^2So^4 it is decomposed into sugar and parigenine.

[This drug, formerly of much repute in this country, and still occasionally prescribed as an excipient of iodide of potassium and other anti-syphilitic medicines, has now almost completely gone out of vogue. The same may be said of stillingia silvatica, of which the once famous "compound syrup" remains as a medical curiosity. It is doubtful if any of the indigenous remedies of this country (and we must here include the much vaunted vegetal specific of McDade) have ever cured or benefited a genuine case of syphilis.—TRANS.]

(*a*) Delgado, *Del modo di adoperare il legno zancto d'India occidentale, orvero del modo che si guarise il mal gränciosо, e agni male ineurabile*, Venise, 1529.—Ulrich de Hutten, *De morbi Gallici curatione per administrationem ligni guajaci* (*Aprodisacus*, I, p. 275, traduit par Patton, Paris, 1865).—Astruc, t. II, édit. de Paris, Paris, 1777.

(*b*) Lewin, *Uber die Wirkung deis Pilocarpins im allgemeinen und auf die syphilitischen processe un besonderen* (*Chariti Annal* de 1878, Berlin, 1880, p. 489).

If the vegetal treatment is absolutely without effect, it is not so with the treatment by the iodides, and particularly iodide of potassium. Since Wallace, of Dublin, in 1832, introduced iodide of potassium in the treatment of syphilis, this medicine has always been employed in this affection, and if there is still some dispute concerning the relative value of the mercurial treatment and the iodide treatment, everybody seems agreed in acknowledging the efficacy of the latter in syphilis. It has been proposed to substitute bromide of potassium for the iodide, and I told you in a former lecture that it was these first attempts in this direction that brought the bromide before the profession. During the last few years, Garet, taking up anew the former tentatives of Richardson, Magendie, and Gambrini, has counseled the use of iodide of ammonium, but thus far iodide of potassium remains almost the sole haloid preparation used. It is given in solution, either in water or in syrup of orange-peel.[1]

I have spoken to you many times in the course of these lectures of iodide of potassium, and shall not now return to the use of this medicine and its therapeutic and physiological effects. I shall only add, that in syphilis iodide of potassium may be given in pretty large doses, and we have seen prac-

[1] Gritener was in the habit of prescribing burnt sponge for venereal ulcerations of the throat. Martini, of Lubec, in 1821, substituted iodine for the burnt sponge and obtained good results. Biett employed in the same year in his service in the Hopital St. Louis, iodide of mercury, which Coindet had proposed in 1820. In 1824, Richard de Brus gave the tincture of iodine in venereal complaints. In 1831, Lugol reported numerous cases of syphilis treated by iodine preparations.

In 1832, Wallace, of Dublin, was the first to employ iodide of potassium in the treatment of syphilis. The preparation which he prescribed under the name of mixture of hydriodate of potash, contained two drachms of iodide of potassium in five ounces of distilled water; of this solution the patients were to take a tablespoonful four times a day, the equivalent of somewhat more than two scruples of iodide of potassium.

From this date iodide of potassium has been made the subject of clinical experimentation in all lands, and its advantages in advanced stages of syphilis have been fully shown.

It has been proposed to substitute bromide of potassium for the iodide in the treatment of this disease; the results have not proved satisfactory. It was thoroughly tested by Ricord between the years 1840 and 1850.

Iodide of ammonium has also been employed by Magendie, Richardson and others. It is an excitant of nutrition; given in doses of seven and a half to fifteen grains, it is according to Carat and Druhen, (*a*) much more active than iodide of potassium in the treatment of the tertiary accidents of syphilis.

(*a*) Martini (de Lubeck), Hufelnd's Journal, April 1833.—Wallace, the Lancet, March 1836.—Trousseau et Pidoux, Traité de thérapeutique et de matière médicale, t. 1er, p. 267, 3e édit., Paris.—Ricord, Bull. gén. de thérap., t. XII, 1837, p. 241, et Gaz. des hôp., 1839.—Payan, Essai thérapeutique sur l'iode, ou application de la médication iodée ou iodurée, Bruxelles, 1850, et de l'emploi de l'iodure de potassium, Paris, 1847.—Gauthier, Observ. prat. sur le traitement des maladies syphilitiques par l'iodure de potassium, Lyon, 1845.—Costilhes. Des différents agents thérapeutiques employçs à Saint-Lazare contre les maladies syphilitiques et de leur appréciation (Gaz. méd. de Paris, 1847, p. 418).—Juda, A practical treatise on urethritis and syphilis, 1836, in-80. —Saville, London Med. Gaz., août 1835.—Bulloch, the Edinburgh Med. and Surg. Journ., January 1837.—Williams, dans Syphilidologie de Behrend, t. II, p. 316 et 331.—Gasca, Giornale delle scienze medicne, 1847.—Pellizzari, Gazzetta Toscana delle scienze medico-fisiche, 1845.—Gusman, Ledicin Jahrb des Œsterrstaates, 1843. —Pourchet, Observation sur l,emploi du brome et de l'hydrobromate de potasse dans la scrofule et le goitre (Ephémérides méd. de Montpellier, t. VIII, p. 45 à 54, 1828.—Carat, Usage de l'iodure d'ammonium dans la syphilis (Gaz. hebd., 1874, no 10).—Druhen, De l'iodure d'ammonium, son emploi en thérapeutique dans la syphilis et la scrofule (thèse de Paris, 1875, no 265).—Lancereaux, Traité de la syphilis, Paris, 1866, p. 700.

titioners like Puche administer from twenty to thirty grammes a day. I do not advise you to follow this example, and I believe that generally you should rest satisfied with a dose of from two to five grammes (from thirty to seventy-five grains), and that it is only exceptionally that you should administer as much as ten grammes a day, for in very large doses peculiar toxic phenomena are likely to ensue, described under the name of *iodism*.

Whenever you give iodide of potassium in massive doses, do not forget that you must prescribe at the same time the milk diet. Milk, in favoring the elimination by the urine of the iodine, and in preventing the irritant action of this salt on the digestive tube, antagonizes the baneful effects of this medication. The solution which I advise you to use is the following:

℞ Iodide of potassium, ʒ iij.
Water, ℥ vj.
M.

Each tablespoonful of this solution contains just one gramme (fifteen grains) of iodide of potassium.

You should commence with small doses, and when the iodic coryza appears, discontinue for several days the use of the medicine, to resume it in larger doses. The economy in fact habituates itself to the iodide, and persons who, at the commencement of treatment, suffer from irritations of the mucous membranes as a result of small doses, a little later may bear without inconvenience much larger doses of this medicine.

By the side of these iodine preparations, certain authorities have counseled arsenic and sulphur. The first of these has been associated with mercury in a compound which enjoys a certain popularity, and which is known under the name of Donovan's solution.[1] Ricord has also combined iodide of potassium with arseniate of soda. As for sulphur, it has, according to Martineau, a considerable place in the treatment of syphilis. It is a sort of touchstone, which enables us (by the exanthems which it promotes) to determine if the specific symptoms have entirely disappeared.

Such is the therapeutic arsenal from which you may obtain arms to combat this disease. But I have accomplished only part of my task in pointing out the armor. You must know how to use it. We shall now study in their order the treatment of the disease in general, and the treatment of the disease in particular, *i. e.*, in the patient.

We are chiefly indebted to Prof. Fournier for formulating in a masterly manner the general treatment of syphilis under the name of *method of successive*

[1] Donovan's solution is an iodo-arsenical solution of mercury; the formula, according to the U. S. P., is as follows: "Take of iodide of arsenic, red iodide of mercury, each, thirty-five grains; distilled water, half a pint. Rub the iodides with half a fluidounce of the water, and, when they have dissolved, add the remainder of the water, and filter through paper."

The dose is from five to twenty drops a day, given preferably in distilled water. The dose contains the twenty-fourth of a grain of arsenious acid, a little over the twelfth of a grain of deutoxide of mercury, and about a quarter of a grain of iodine.

treatments. Fournier's system is based on stages of treatment and periods of repose, which latter, called by him *periods of disaccustoming*,[1] enable the economy to obtain relief from habits imposed on it by mercurial treatment, and derive the utmost possible benefit from the medication during its entire duration. So the first year he prescribes for two months the mercurial treatment, to be resumed after two months of repose; and this practice is continued with similar alternations for two years in such a manner that during the twenty-four months the patient will not have been taking mercury but ten months. At the end of the second year he administers, concurrently with mercury, iodide of potassium, and this latter medicine during the third and fourth years.[2]

Martineau has somewhat modified the formula of Fournier, and, while following out his system of successive treatments, he gives sulphur preparations during the periods of repose. Moreover, these periods, which Fournier has traced with great care, must vary according to the patients, and no absolute rule can be laid down. I am therefore of the opinion of Mauriac, who advises that the treatment should be modified according to the march of the syphilitic manifestations.

Does this method of successive treatments rigorously followed *ensure* the cure of the patient? Unfortunately, no. If, in the great majority of cases, all specific manifestations are made to disappear by a well-ordered treatment, rigorously followed, nevertheless one can never be sure that the patient is rid forever of syphilis, and you will often see arise in patients who have been treated with the greatest care, at periods remote from the primary lesion, symptoms clearly the consequence of the first infection. This question of the cure of syphilis will present itself before you, gentlemen, especially when the marriage of syphilitic persons is talked of, and you will be consulted for information as to what moment a contaminated individual may marry without danger to his or her partner and the children which may be born to this union. Fournier has treated this question in an able manner, and has shown that generally you

[1] Stades de désaccoutumance. Fournier, Lecons cliniques sur la Syphilis. 2d ed. Paris, 1881.

[2] This is Martineau's process: During the first year he gives mercury for two or three months; then he follows it with iodide of potassium for two or three months, then a month of rest, and another month of mercury and one of iodide of potassium.

During the second year he gives mercury for one month and a half, followed by two months of iodide of potassium, and two months of rest. He resumes the mercury during one month, and iodide of potassium during three months, followed by three months of rest, when the patient is subjected to a course of sulphur waters.

During the third year he assigns a month and a half to mercury and two months to the iodide, followed by three months of rest, then one month of mercury, then two months of iodide, then three months of rest, during which the patient goes back to the sulphur waters.

If there are any further manifestations he recommends at the beginning of the fourth year, the treatment of the first year. (*a*)

(*a*) Martineau, Leçons sur la Thérapeutique de la Syphilis (France Medical, 1882).

cannot authorize such marriage till after a treatment scrupulously followed for three or four years.[1]

Now that we know the duration of the treatment, it remains for us to determine at what time we should commence it. The sooner the better, say Fournier and Mauriac. At the appearance of the first syphilitic manifestations, say Sigmund and Zeissl. I believe that the last advice is the safer and wiser.

The diagnosis of the primitive lesion often presents great difficulties, and unless one is an expert and an experienced clinician, it is quite easy to confound a hard chancre with ulcerations of quite different nature, and particularly with herpes. These difficulties are often such that we see experts, in doubt, practice inoculations in order to determine the nature of the ulcerations which they have before their eyes. Therefore the practitioner ought to wait for the appearance of the roseola to confirm his diagnosis, and indicate the time for commencement of treatment. When the rash shows itself all his doubts are dissipated, and he may begin the administration of mercury. This delay of a few weeks is a very little thing in comparison with the duration of a treatment which lasts several years, and it has no detrimental influence on the evolution of the disease.

We have already examined two important points in the question of the mercurial treatment of syphilis: the duration of the treatment, and the moment when it should be commenced. It may now be asked if all cases of this disease ought to be treated with mercury and the iodides? My reply is, Certainly; every syphilitic individual ought to undergo the specific treatment. I am well aware that in his remarkable work on the *Natural History of Syphilis*, Diday has shown us that a great many syphilitic patients get well without treatment,[2]

[1] This is the way Fournier expresses himself respecting the conditions which a syphilitic patient ought to comply with before thinking of marriage:

"The essential capital condition to fulfill consists in a thorough specific treatment, sufficient to confer complete relative immunity from the multiple dangers which syphilis imposes on the marriage relation.

For my part, I think myself authorized to say, as a resu t of all my past experience, that in no case the duration of an anti-syphilitic treatment should be less than three or four years, whatever may be the form of the disease, and however benign in appearance. Three or four years methodically devoted to an energetic treatment—such is the minimum necessary in my opinion, not merely to cure the pox, but to prevent dangerous manifestations in the future.

It is still farther advisable that the patient shall undergo from time to time, every two or three years for instance, a new course of treatment by iodide of potassium, in order to keep constantly in check the diathesis (if I may so call it), and preserve the benefit which he has gained."

In short, Fournier would deny marriage to every patient not fulfilling these conditions, while permitting it to patients who have methodically followed these rules. (*a*)

[2] Diday has comprehended in five categories the different forms of syphilis classed according to their gravity: these forms he has studied in 93 patients:

1. Cases of minimum severity (*syphilis ébauchée*)—7 out of 93. As sole manifestation the roseola; spontaneous cure without any treatment at the end of two months.

2. Mild syphilis—53 out of 93. Roseola, squamæ in the palmar and plantar regions;

(*a*) A. Fouriner, Syphilis and Marriage. Paris, 1880.

and I know also that syphilis, like any other disease, has its mild forms and its severe forms; and, according to the soil in which it is implanted, it may take on a more or less rapid course. But what I am also convinced of is, that we often see very grave tertiary symptoms supervene in persons who have had till then manifestations of syphilis so benign that this disease has passed absolutely unperceived by them. Therefore, it will not do to depend altogether on the more or less tardy appearance of the secondary symptoms and their benignity, and abandon the specific medication, and in directing this treatment one ought to think, not so much of the manifestations he has before his eyes, as of those which are likely to appear in the future.

Finally, to terminate these general considerations on the treatment of syphilis, a question remains to be answered: Does the specific treatment cure all the manifestations of venereal disease? Unhappily, no; there is a malignant syphilis with galloping march, of ulcerous form, which resists the best directed specific treatment. Nevertheless, these cases are exceptional to-day; thanks to the hypodermic method, we can master the greater number of specific accidents. It is well understood that this treatment will not repair the loss inflicted on the tissues by the presence of certain syphilitic neoplasms, like gummata, and when these have invaded a part of the cerebro-spinal medulla, the lungs, the liver, the pharynx, etc., the specific treatment will be powerless to restore the parts thus destroyed.

These points being duly established, we pass to the study of the syphilitic patient, and we will follow, step by step in their progress, the several manifestations of syphilis. Let us commence by the chancre.

The nature of the chancre being once determined, can we, by cauterization, or by excision, prevent the system from undergoing the syphilitic infection and its consequences? Such is the first question we have to solve. From data furnished by the test experiments of Sigmund, Chadzynski Auspitz, and Mauriac, we are warranted in affirming that the most energetic cauterization and even excision made during the first days of the chancre, and before the propagation of this induration to the neighboring glands, does not prevent the development of the secondary symptoms. I am well aware, according to the statistics to which I have referred, that successes have been claimed by both cauterization and by excision, but as the failures have always exceeded the successes, it may well be asked if, in the latter cases, an error of diagnosis was

mucous patches two or three days in succession. Cure in ten months and a half, without specific medication.

3. Grave syphilis; erythematous eruption, general debility, ulcerated mucous patches; tubercles, osteocopic pains. Necessity of specific treatment. (29 out of 93.)

4. Galloping syphilis—4 out of 93. Rapid progress of the lesions, relative impotence of the specific treatment.

5. Tertiary syphilis. The accidents of visceral syphilis. According to Diday only one syphilitic in six is likely to have tertiary symptoms. Mauriac finds that this proportion is not exact, and according to him the ratio is far less. (*a*)

(*a*) Diday, Natural History of Syphilis.—Mauriac, Lessons on Venereal Diseases. Paris, 1883.

not committed?[1] I believe, then, that this question of the excision of the chancre or its thorough cauterization demands new investigation before such treatment can be regarded as efficacious.

The treatment of the syphilitic chancre then consists in local means which have for their object to hasten the cicatrization of the sore; a curative process which, by the way, goes on normally with considerable rapidity. Pomades of calomel and cold cream (one part to four); lotions of chloral (half per cent.); light touches with lunar caustic, and, above all, special care about cleanliness, suffice generally to hasten the cure of the primitive lesion. Whenever the sore becomes deep and anfractuous, and presents a sanious and malignant aspect, you can employ tincture of iodine, or, what is better, iodoform. This latter is veritably a marvellous medicament in the local treatment of syphilis, and since Féréol showed us, in 1868, the happy topical effects of iodoform in chancre, it has daily been put in usage and always with success.[2]

You are well aware that of late years iodoform applications have had a great popularity, and that they occupy to-day the first rank among antiseptic

[1] Sigmond has furnished the following statistics:

	Number of cases.	Number of consecutive cases of syphilis.
Patients cauterized from the first to the third day after contagion	24	3
Patients cauterized from the third to the tenth day	11	7
Patients abandoned to themselves	22	11

To practice this cauterization, acid nitrate of mercury, caustic potash, or saturated solution of chloride of zinc are used.

Chadzynski has thirty times practised excision of the indurated chancre with these results: 16 failures, 7 cases doubtful, and 7 cases successful. He thinks that extirpation is indicated as prophylactic means in recent cases (two, three, four and five days) and before the glands are affected.

Auspitz has combated this view and maintained that excision has no therapeutic value whatever. Mauriac has practiced excision of indurated chancre three times; in one, four days after its appearance; in another fifty hours after its appearance; in the third at the end of forty-eight hours. In none of these cases was he able to prevent the appearance of secondary accidents. (*a*)

[2] Iodoform was discovered in 1822 by Serullas; its composition was given by Dumas, and Bouchardat in 1846 made known its principal therapeutic properties. Since then this medicament has been much studied, and it has been brought largely into use, in the last four years, as an internal and external agent.

As a local application it is both calmative and antiseptic. In 1853, Moretin pointed out the local anesthetic effects of iodoform. Sallier, Besnier, and Demarquay, in 1867, demonstrated the good effects of iodoform in the treatment of cancerous sores. Still later Féréol communicated to the Society of Therapeutics in 1868 the results which he obtained from this medicament in the treatment ot syphilitic sores of bad nature.

(*a*) Chadzynski, Sur la valeur prophylactique de l'excision de la sclérose syphilique initiale (Ann. de dermat., 2e série, vol. Ier, p. 461).—Auspitz, Zur frage der excision der syphilitische initial sclérose (Viertel-iahrs. fur Dermat., p. 281, 1800).—Jullien, Traité des maladies vénériennes, Paris, 1878, et Bull. de Thérap., t XCV, p. 49, 1878.—Mauriac, Traité des maladies vénériennes, Paris, 1883, p. 48.

dressings. I know of but one objection to this medicinal agent—its disagreeable odor. Attempts have been made to mask this odor, but none of them have been very successful.[3] It has been employed in pomades, powder, and, better still, ethereal solution. Berkeley Hill has proposed a very concentrated solution (one part of iodoform to eight of ether). I prefer a very dilute (five per cent.) solution, and I apply it to the genitals by means of a spray atomizer. You can thus cover the most anfractuous parts of the sore with a thin coating of iodoform, and you have often seen in my service the good results which we obtain from these ethereal iodoform sprays in the treatment of venereal sores in the female.

It has been proposed to substitute for iodoform, bisulphide of carbon; but

The following preparations containing iodoform are suitable for external use:

℞ Iodoform ..... 1 gramme.
Glycerine ..... 10 grammes.
Essence of roses, enough to destroy the odor.

The following is a good pomade:

℞ Iodoform ..... 1 gramme.
Balsam of Peru ..... 3 "
Vaseline ..... 8 "
M. (*a*)

[3] Various means have been tried to deodorize iodoform. We have seen recommended tonka bean, musk, balsam of Peru, essences of peppermint, lemon, vanilla, etc. Fourmont and Sherck have employed carbolic acid, which in minute quantity removes the odor of iodoform; camphor does the same.

The following formulæ have been recommended for deodorizing iodoform:

℞ Carbolic acid (crystallized) ..... 1 gr.
Iodoform ..... 10 gr.
M.

Iodoform ..... 10 gr. 00
Carbolic acid ..... 0 gr. 05
Essence of peppermint ..... 1 to 2 drops.
M.

℞ Camphor ..... 5 gr.
Essence of peppermint ..... 2 gr.
Iodoform ..... 15 gr.
M.

℞ Iodoform ..... 100 gr.
Essence peppermint ..... 5 gr.
Essence orange ..... 1 gr.
Essence citron ..... 2 gr.
Tincture of benzoin ..... 1 gr.
M.

The last preparation has the odor of "eau de Cologne." (*b*)

(*a*) Bouchardat, De l'iodoforme (Journ. de pharm., t. IV, p. 18, et t. XXIII, p. 1).—Ernest Besnier, Sur l'action thérapeutique de l'iodoforme (Bull de thérap, t. L. XXIII. p 493).—Féréol, De l'iodoforme employé comme topique pour cicatriser les plaies et ulceres non cancéreux (Bull. de thérap. t. LXXIV, p. 400, 1860).—Berkley-Hill, On the therapeutic use of Iodoform (Brit. Med. Journ., Jan. 1876, p. 127).

(*b*) De la déodorization de l'iodoforme (Journ. des So. Méd. de Lille, 21 juin, 1883).

the smell of this compound is quite as disagreeable as that of iodoform, and it is not proved to have any therapeutic advantage over the latter.

When once the chancre is healed, and the roseola makes its appearance, you begin the mercurial treatment, and I have already told you that, in my opinion, the best preparation is the liquor of Van Swieten; and you thus follow the various stages of the disease.[1]

[1] Syphilis is a constitutional disease caused by infection of the organism by a special virus (virus syphiliticus) giving rise successively to divers manifestations which have been divided into primary, secondary, and tertiary.

Syphilis may be hereditary or acquired. In common syphilis the first manifestation is a special ulceration called hard chancre, Hunterian chancre, infecting chancre.

This chancre, which generally appears six weeks after the infection at the point of inoculation, is in general solitary, and occasions in the great majority of cases engorgement of the lymphatic glands of the vicinity.

The chancre begins in a little brown papule or in an indolent ulceration or erosion, ordinarily about a centimeter in size, with adherent and sloping borders, with smooth, even base, of reddish-brown color with grayish serous secretion. The underlying induration may be parchment-like, is more apt to be of split-pea variety, or there may be an elevated tubercle with a dome-like ulcerated cap.

The affection of the glands (adenopathy) always follows the infecting chancre. Those of the neighboring clustre (glands of the groin) are swollen, movable under the skin and upon the deep parts ; they are hard, indolent, non-inflammatory, never spontaneously suppurate but undergo progressive regression. After the chancre gets well there is generally a period of calm, then after an average interval of forty-five days from the first appearance of the chancre (Diday) appear the accidents called secondary, which ordinarily affect the tissues in a manner both superficial and benign. These lesions pertain to the cutaneous system and its annexes (syphilides, alopecia, onyxis), lesions of the mucous system, mucous syphilides, adenopathies, and especially in the female painful phenomena, such as certain nervous troubles—divers neuralgias, "vapors," vertigines, hysterical fits, partial contractures, palpitations, etc., and general disturbances which may profoundly modify the functions of organs (uterine troubles, troubles of menstruation, abortion, etc.)

The cutaneous syphilides are indolent, apruriginous, affecting divers forms and frequently characterized by a special brownish or coppery coloration. They manifest themselves over the whole body, often beginning in the hypochondrial regions under the form of red spots of an indolent character (roseola) or squamous papules. On the hairy scalp they appear in the form of acne pustules which are destroyed by scratching and replaced by crusts. This eruption is accompanied by swelling of the post cervical glands.

Fournier divides the cutaneous syphilides into:

1. Precocious syphilides (roseola, urticaria, papular or papulo-squamous syphilide with small papules, and acneiform syphilide of the hairy scalp).

2. Tardy syphilides, *i. e.*, not appearing till at an advanced period of the second stage (pustulo-crustaceous syphilides of ulcerous form, deep ecthyma, rupia).

3. Intermediate, *i. e.*, not appearing either so early as the first series or so late as the second (papulo-squamous syphilides with large papules, palmar or plantar psoriasis, papulo-crustaceous, herpetiform, acneiform syphilides, superficial ecthyma, pigmentary syphilis).

The alopecia, the onyxis and the peri-onyxis are secondary accidents, the hairs become thin and light and fall out in more or less quantity, but they grow again at a later period unless the lesions of the scalp are deep.

The nails become frail and brittle and peel off; sometimes, on the contrary, become thicker and hypertrophied; the borders of the nail may be affected (uperonyxis) or become inflamed and ulcerated (ulcerous perionyxis).

The mucous syphilides present themselves later; they are seated on all the mucous

You all know that syphilis evolves by stages presenting characteristic symptoms, and to which has been given the name of secondary period, transition period, and tertiary period. In the secondary period we depend on mercury; in the period of transition we give mercury and iodide of potassium together. A convenient form of administration is the syrup of Gibert, which contains biniodide of mercury with iodide of potassium.

Lastly, in the tertiary period we use iodide of potassium almost exclusively.

There has been much discussion as to the precise time when the iodide

membranes but especially on the buccal mucosa, on the internal aspect of the tonsils, on the borders of the tongue, the inside of the labia, os uteri, margin of the anus; they develop spontaneously, secrete a virulent liquid, and affect divers pathological forms, hence called erosive, papulo-erosive, papulo-hypertrophic, ulcerous, etc.

To the second period belong also:

1. Certain ocular troubles, (iritis, ordinarily mono-ocular, keratitis, (rarely) choroiditis, retino-choroiditis).

2. Lesions in the genital regions (syphilitic albuginitis or sarcocele, syphilitic epididymitis).

3. Functional troubles of the locomotor apparatus, affecting the bones (peri-ostitis, peri-ostasis, ostealgia); the joints (arthralgia and arthritis), the tendons (inflammations and dropsies of the tendinous sheaths); the muscles (muscular pains, enfeeblement, tremblings, contractures).

4. Lesions of the nervous system, characterized by headache, neuralgias (facial and sciatic), troubles of the sensibility (analgesia, simple or complicated with anesthesia), certain paralyses almost always partial (facial, paralysis of the common motor oculi, or of the motor oculi externus); sometimes, but rarely, intellectual disturbances, especially in nervous women, troubles of caloricity (partial sensations of chilliness, bursts of perspiration).

The general troubles of the secondary period may pertain:

1. To respiration (rare).

2. To the circulation (palpitation).

3. To the digestive apparatus, especially in females or very nervous men; diminution or loss of appetite, exaggeration, perversion of the appetite, enteralgia, icterus. (Ricord and Gubler).

4. To the genital system (uterine neuralgia, menstrual troubles (rare), troubles connected with pregnancy, frequently abortion).

The tertiary period of pox is characterized by accidents which appear at an advanced stage of the disease and affect the central tissues and organs in a profound and grave manner.

To this group pertain the affections of the bones, which may sometimes manifest themselves in the second stage of the disease, but belong especially to the tertiary period.

They are almost always accompanied with the pains called osteocopic, more marked during the night. These are:

1. The periostites, peri-ostoses, osteites, eburnated exostoses, hyperostoses, caries, and necrosis.

2. The gummata which form in the subcutaneous and submucous cellular tissue acquire a volume more or less large, are indolent or painful and terminate often by softening and leave after them grayish excavated, sharply-cut ulcerations.

3. The deep affections, rupia, deep ecthyma, etc.

4. The ulcerations of the deep organs, ulcerations which some writers class in a fourth period and call quaternary accidents. These are the morbid determinations of syphilis to the brain, the lungs, the liver, the spleen, the kidneys, the syphilitic encephalopathies, syphilitic phthisis, the parenchymatous and gummy hepatites, the nephrites.

In the last stage of the disease, in subjects very much enfeebled, whether by the pro-

should be given. In a recent work, Gougenheim has shown that even in the secondary stages of syphilis iodide of potassium gives good results. Martineau, in opposition to Zeissl, who would give mercury after the iodide, recommends always to precede the iodide treatment by the mercurial, and I believe, judging from my own experience, that his views are sound.[2]

There are certain syphilitic accidents of a stubborn kind encountered in different periods of syphilis, and which resist to a certain extent the mercurial treatment. I refer particularly to the mucous patches that have for their seat the vulva, the pharynx, and even the labial commissure. These patches perpetuate themselves under the least local irritation. As for those of the vulva, you will need to enjoin the utmost care as to cleanliness, and local applications of iodoform and ether, or iodoform ointment, will be required; as for those in the mouth and throat, you must forbid the patient to smoke, and you will have to touch the sores with tincture of iodine or Van Swieten's solution.

The tertiary complications are often very serious, especially when they affect the nervous centres, and urgent measures will be required, such as the administration in large doses of mercury and iodide of potassium. Here we witness the triumph of hypodermic injections of peptonate of mercury, or frictions of mercurial ointment, associated with iodide of potassium; and I know of no more convincing evidence of the efficacy of this kind of treatment than the cures which are obtained in so short a time from cerebral complications so

gress of the disease or by excess or privations, supervenes sometimes a profound cachexia which undermines the constitution. The appetite is lost, the patient grows pale, languishes, becomes incapable of any physical or mental labor, and emaciates; ecchymoses form on various parts of the body; there is hectic fever, night sweats come on, and the debilitation makes rapid progress; the patients fall into a marasmus and succumb.

Such in our climate is the typical course of acquired syphilis, in its worst phases, and apart from a rational treatment.

[2] Gougenheim has shown that iodide of potassium is anti-syphilitic in the secondary stage, and he has treated, at the hospital of Lourcine, 220 patients affected with primary and secondary manifestations by iodide of potassium, in the dose of one to four grammes per day. Of these 220 patients, 144 got well, 32 were very much benefited, and 49 left the hospital during the course of treatment.

He made coincidently another series of trials with mercurial treatment, and showed that iodide of potassium, administered during the secondary period in doses of 1 to 2 grammes a day, acts with the same rapidity as the liquor Van Swieten in the dose of 15 milligrammes (of corrosive sublimate); but that the iodide treatment shows itself inferior to the mercurial when the resort is made to hypodermic injections of the sublimate, in doses of 12 to 25 milligrammes.

Ziessl is a partisan of the expectant method of treatment of syphilis; only as the symptoms tend to disappear he employs mercurial medication; but before making use of the latter, he always gives iodine preparations (protiodide of iron, and iodide of potassium), and follows it up for six weeks. Martineau administers iodide of potassium from the beginning of the first year of syphilis, and three months after the infection. According to him you should always precede the iodide treatment by mercury. (*a*)

(*a*) Gougenheim, De la valeur comparative de la médication iodurique et de la médication hydrargyrique de la syphilis, notmment à la période dite secondaire de la maladie (Bull. et Mém. de la Soc. de thér., 1883, p. 97.

grave that they would have caused the death of the patient in a few days if help had not arrived. Paralytic and meningeal symptoms all disappear as if by enchantment.

When lecturing on the treatment of myelitis, I told you of the difference which exists between the ataxia of syphilitic origin and other affections of the spinal cord due to syphilis; the first being well-nigh incurable despite the most energetic specific treatment, the second being amenable to such treatment.

Mineral waters have an important place in the treatment of syphilis, and especially the sulphur waters. Numerous discussions have arisen concerning the action of these waters. Some maintain that certain of these waters have anti-syphilitic properties; others that they only make known the fact whether the patient is cured or not of the syphilis; others claim that these waters have only a tonic and stimulant effect. The latter view counts the most adherents, and is undoubtedly the correct view. The favorite resorts for syphilitic patients are the spas of Aulas, Bareges, Luchon, Cauterets, Amelie les-Bains; in a word, the various sulphur springs which abound in the Pyrenees.

I have finished the general treatment of syphilis, but I desire to say a few words about other venereal diseases, viz., the soft chancre and gonorrhœa. Soft chancre requires the same treatment as the infecting chancre. At the same time, under some circumstances, the soft chancre becomes phagedænic, and then it is necessary to employ a very energetic treatment to arrest the spread of the ulceration. Therefore, after failure with perchloride of iron, iodoform, and tincture of iodine, you may have to resort to cauterizations with the hot iron in order to modify the surface of the sore. To all these measures we must add partial baths of 40° C., which, according to Aubert, constitute the most powerful curative agent in simple chancre and its complications. You well know that the mercurial treatment is contraindicated in phagedæna, and that it is necessary to employ tonics under all their forms.

The treatment of gonorrhœa comprises the treatment of blenorrhagic urethritis, and that of blenorrhagic vaginitis. In the former, several forms are to be distinguished. Either it is a case of acute blenorrhagia, or the disease has become subacute, or has passed on to the chronic stage. In acute blenorrhagia, the most rapidly curative medicine is copaiba. You know that this balsam, which is in reality one of the turpentines, is composed of an essential oil, which is eliminated by the lungs, and a resinous copahivic acid, which is eliminated by the urinary passages, and it is this elimination which is the curative agent in gonorrhœa.[1] But in order to obtain from the copaiba treatment all the benefits which you expect, you must follow certain rules here laid down.

[1] [The following gonorrhœal mixtures are from the work of Keyes on Venereal Diseases.—TRANS.

℞	Ol. santali	℥ ss–i.
	Liquor potassæ	ʒ ij–iv.
	Syr. acaciæ	℥ i.
	Aquæ fœniculi	q. s. ad ℥ iij.

M. S. Teaspoonful well diluted, in the third hour after eating.

Never give copaiba in the first periods of gonorrhœa, when the inflammation is invading the entire urethral mucous membrane, for at this stage it is worse than useless. Rather wait eight, ten, or twelve days, till this general inflammation has subsided, before giving copaiba. During this period you can give the diuretic infusions, or alkaline solutions, which have a sedative action. Then you can begin with copaiba, which may be given in capsules. dragées, or in some of the numerous anti-blenorrhagic compounds, like the famous potion of Choppart, which contains copaiba with syrup of tolu and essence of peppermint. But in whatever form it may be administered, it is necessary to give it in frequently repeated doses, so that the urine may be always charged with copahivic acid at the time of emission; so when you make use of the capsules, you should order the patient to take six of them a day—one every two hours. You should increase them by one capsule a day till he takes twelve during the twenty-four hours—one capsule every hour during the daytime. This dose should be continued for two days; then you can diminish them by one capsule a day, till the patient comes to take only one in twenty-four hours, at which time the cure ought to be complete.

In subacute urethral blenorrhagia, you can accompany treatment by copaiba with the use of alterative or astringent injections.[2] I assign due weight,

℞ Bals. copaibæ ..... ℥ ss–i.
Liq. potassæ..... ʒ ij–iv.
Syr. tolu ..... ℥ iss.
Extr. glycyrrhizæ..... ʒ ij.
Aquæ menth. pip..... ..... q. s. ad ℥ iij.

M. Shake.

S. One or two teaspoonfuls at a dose.

℞ Bals. copaibæ ..... ʒ iv.
Syr. tolu .....
Syr. acaciæ ....
Aquæ menth. pip. .... ää ʒ viss.

M. Shake.

S. Teaspoonful.

[2] The astringent injections have for basis sugar of lead or sulphate of zinc or tannin. Here are several of them:

Ricord's injection:

℞ Zinci sulphatis..... .....
Plumbi acetatis..... ää gr. xv.
Tincture catechu..... .....
Tincture opii..... ää ʒ j.
Aquæ Rosarum..... ℥ vi.

M. Injection.

℞ Plumbi acetatis..... gr. ij ad iij.
Decoction papavaris..... ℥ iij.

M.

The above is to be used at night and allowed to penetrate without restraint, as far as

gentlemen, to all the discussions which have arisen relative to the medicinal action of urethral injections, some authorities considering them as beneficial, others as dangerous. I believe that they are both, according to the time when they are employed, dangerous in the inflammatory periods, beneficial in the sub-acute and chronic stages. You are aware of the multiplicity of these anti-blenorrhagic injections, which may be divided into three groups: first, those that have a modifying action, the type of which are injections containing nitrate of silver; second, astringent injections, such as those of tannin and sulphate of zinc; and, lastly, the parasiticide injections, which are to-day very much in

the ordinary impulsion of the syringe will convey it. In four or five days it may be used more frequently. Used at the London Lock Hospital.—H. J. Johnson.

℞ Vini rubri..... ℥ vi.
Acidi tannici..... gr. xviii.
M.

For the male urethra. For the vagina the quantity of tannin may be doubled, or still further increased.—L. Parker.

℞ Zinci sulphatis.....
Acidi tannici ..... ää gr. ij.
Aquæ..... ℥ ij.

M. Injection. To be used repeatedly through the day.—Acton.

[A highly successful and rational mode of treatment has been lately proposed by Dr. Z. T. Dellenbaugh, of Cleveland, Ohio. It is as follows:

"In cases of acute gonorrhœa I have, for eight or ten years, used carbonate of lithia to alkalinize the urine, and find the five-grain compressed tablets, one taken three times daily, very convenient, fulfilling every indication better than any other salt. I now rarely find it necessary to give any other remedy internally.

Should the case fail to respond to the following injections, and not show marked improvement in two or three days, two sandalwood oil capsules may be given, three times daily, for three or four days. The injection I have used in cases of acute and subacute gonorrhœa for more than a year with the most gratifying results, especially to the patients, who have recovered in from two to seven days, and paid me from one to three visits, is the following:

℞ Rescorcin..... ʒ j.
Acid boracic..... gr. xx.
Zinci acetatis..... gr. ¼–½.
Aqua destillat..... ℥ iv.
M.

Of this solution two teaspoonfuls are injected three times daily. The germicides, resorcin and boracic acid, are so slightly astringent, that it requires the additional zinc salt to restore capillary tonicity. This injection is quite or nearly painless.

In the treatment of the later stage of sub-acute and chronic gonorrhœa, without stricture or granuloma as a complicating factor, I have had the happiest results follow the use of the following injection:

℞ Hydrarg. chlor. corrosivi..... gr. ¼–ss.
Zinci chloridi..... gr. ss–j.
Aqua distillat..... ℥ viij.

M. Sig.—A tablespoonful to be injected well down into the urethra, three times daily."]

vogue, and although the microbe of blenorrhagia has not been found, it is not the less true that these injections, and in particular those of permanganate of potash, are employed with success in urethritis.[1] I shall only mention the one which I use oftenest myself, of which the formula is as follows:

℞ Tannin..... 3 parts.
Glycerine..... 100 "
M.

In the treatment by urethral injections it is well to insist upon the directions laid down by Keyes.[2] The patient should first be required to urinate; the injection should be retained for several minutes in the urethral canal, and it is necessary that the syringe be in good working order. In my practice, I prefer the syringe of Langlebert. As for chronic gonorrhœa, so-called gleet, it often presents an invincible resistance to every kind of treatment, and nothing is more obstinate than the *goutte militaire*. You must bear in mind that, as pertaining to this incurability, the patient, by his imprudences, plays a more important part even than the disease itself. It is also a noteworthy fact that deep-

[1] The anti-parasitic injections have for their type solutions of permanganate of potash. Bourgeois proposes the following formula:

℞ Potas. permanganatis..... gr. i.
Water..... ℥ v.
M.

Ziessl would use a much more dilute solution, viz., ⅓ of a grain of the permanganate in about ℥ iij of water, while Weiss would employ as much as two grains of the salt in the same quantity of water.

Chloral injections have been recommended by Pasqua; his formula is:

℞ Chloral..... ..... 1 scruple.
Water..... 4 ounces.
M.

℞ Tannin..... 3 parts.
Glycerine ..... 100 "
M.

[2] Keyes gives the following directions as to the method of using injections in urethritis: The hard rubber urethral syringe knows as No. 1 A, is probably the best. The bulb should be short, the tip only should be introduced into the urethra. It is a mistake to crowd the conical tip deeply into the meatus. This bruises the canal perhaps as positively as does the long nozzle of the old-fashioned syringe. In using an injection, the latter should be slightly warmed; with this warm injection the syringe should be filled and all air carefully expelled. The patient now urinates, washing the pus in this way from the inflamed surfaces. After the canal is free from urine, the nozzle of the syringe is to be gently introduced, just beyond the bulbous tip into the inferior angle of the meatus and the two lips of the orifice are to be pressed against each other with the thumb and finger of the disengaged hand. The lips of the meatus are not to be pressed upon or against the instrument, but against each other. Now the canal of the urethra must be very gently distended by pushing the piston slowly home; the syringe may be at once removed and the injection retained about thirty seconds and then allowed to escape. These motions constitute the whole act in most cases. The quantity of fluid held by the syringe is not enough to penetrate into the canal farther than the bulb, and in a capacious urethra not so far. There is little chance

seated ulcerations or even strictures often keep up this urethral running, and in these cases the use of the sound or medicated bougies may have a remedial effect.

After the tonic regimen, ferruginous preparations, bromide of potassium, sea-baths, or sulphur waters, will give you more certain curative results than the urethral injections and balsamic preparations, which are here absolutely useless.

I have not spoken to you of the abortive treatment of this disease, and for this reason—I consider it as useless and dangerous. I have been for many years, and am still, physician to a certain association of commercial employés, and I have observed very many cases of gonorrhœa among them, and I have never once witnessed a cure by the injection of strong solutions of nitrate of silver during the first few days of the attack. On the contrary, I have always observed that whenever this treatment was followed, there was an aggravation of the malady. I discard, then, altogether these abortive measures.

The treatment of blenorrhagic vaginitis ought to fulfil the two following conditions: it should modify the surface of the mucous membrane and prevent agglutination of the opposing surfaces. Here vaginal tampons and suppositories are of great utility. Besides the *sachets* and suppositories so generally employed, ointments introduced by special *pomade-depositors*, devised by Terrillon and Auvard, are much in fashion.[3]

Tripier has recommended the employ of clay mixed with glycerine. I myself am in the habit of using a conical wad of finely-carded cotton wound rather tightly, having the form of a speculum, which is introduced into the vagina, after being smeared with a suitable pomade.

of doing harm, therefore, by throwing the injection too deeply down the canal. After injections have been used for a time it is allowable to manipulate the fluid in the canal by holding the meatus shut with the finger and thumb of one hand while with the fingers of the other hand the fluid is pressed forward in the urethra so as to distend it and backward so as to make it penetrate more deeply. In so pressing back a fluid the finger should never be carried beyond the peno-scrotal angle, or the fluid may be drawn back into the prostatic sinus and light up cystitis or occasion epididymitis. A light injection used twice a day does more good than a strong injection used only once. The time to use injections with most success is when the discharge is on the decline, after the height of the inflammatory stage is passed. In cases which commence deep in the urethra, when the meatus does not pout, injections may be used from the very beginning of the attack; in other cases it is better to wait and not use them at all until the flow has begun to yield to internal medication. A good injection to begin with is simple dilute lead water; when a more powerful astringent is needed, resort must be had to sulphate of zinc. (*a*)

[3] The pomade of Terrillon and Auvard is made as follows:

℞ Tannin..... 1 part.
Vaselin.....
Starch.....ää 3 parts.
M.

These substances are incorporated into a paste, which is introduced into the vagina by the *pomade-depositor*. This treatment has proved very efficacious.

(*a*) Keyes, On Venereal Diseases. Wm. Wood & Co. New York. 1880.

Apropos of these ointments, there are numerous formulæ all having for basis substances more or less astringent and antiseptic. Of all these preparations that which seems to me the best, is the mixture proposed by Vidal of Gurgun balsam and lime-water, in the proportion of one part of the former to two of the latter.[1] When this quantity of lime-water is exceeded, the pomade becomes too thick, and its application on the cone of wadding is rendered more difficult. Using then the preparation above formulated, I smear my tampon with it, and leave it in place in the vagina for twenty-four hours, and I renew this dressing every morning; when removed, the patient should wash out the vagina with a cleansing injection.

Vaginal injections, like urethral injections, require to be taken with certain precautions. The syringe with rubber ball and tubing, called in America the Davidson syringe, is preferable to the hard rubber or glass tubes in common use; or, what is better still in many cases, the fountain syringe with its appurtenances. The terminal canula should give issue to the fluid by lateral orifices.

The formulæ for vaginal injections are too numerous to be mentioned here, and you will find in your special treatises a sufficient number from which to select for any occasion. I shall only refer to chloral injections, which I was the first to recommend. These are now very much in use, and have often a very happy local effect. My usual way of ordering these injections is as follows:

℞ Hydrate of chloral, 1 part.
Water, 10 parts.

M. Signa.—Add a tablespoonful of this solution to a quart of cold water for an injection.

Next to these chloral injections, and almost on the same level, I place injections with resorcin. In my study with Callias, of this medicament, I have insisted on the energetic modifying action of this substance on bad ulcerations of the genital organs. Leblond and Fissiaux have just repeated these therapeutical experiments, and with equally good results. I know of but one inconvenience attending these applications of resorcin, it is the high price of the medi-

[1] Gurgun balsam (gurgun oil or wood oil) was first employed in 1838, in the treatment of gonorrhœa. Vidal employs the following formulæ:

℞ Gurgun oil.....
Gum arabic.....āā 4 grammes.
Infus. anisi..... 40 grammes.
M.
Sig. To be taken in two doses.

Mauriac recommends as a useful potion in gonorrhœa, the following mixture:

℞ Gurgun oil..... 16 grammes.
Gum arabic..... 10 "
Syrup. acaciæ..... 30 "
Peppermint water..... 50 "
M.
Sig. To be taken in three doses. (*a*)

(*a*) Leon Duval, on Gurgun Oil, Thèse de Paris, 1877.)

cament. The injection is made by adding ʒ ijss of resorcin to a quart of water. Next in importance come the astringent injections, containing tannin, rhatany, oak bark, etc.

I have much more to say respecting the treatment of blennorrhagia, but it is time to bring this long lecture to a close; the indications which I have given will probably meet the greater part of the cases which will occur in your practice.

PART THIRD.

ON THE TREATMENT OF FEVERS.

FEVER FROM A THERAPEUTIC STAND-POINT.

SUMMARY.—Fever—Characteristics of Fever—Animal Heat—Clinical Thermometry—Its Importance from the Stand-point of Prognosis, Diagnosis, and Therapeutics—Anti-Thermic Medication—Pathological Physiology of Fever—Combustions in Fever—Products of Elimination—Phenomena of Combustion—Calorimetry—Theories of Fever—Vaso-Motor Theories—Theories of Traube, of Senator, of Marey—Theory of the Augmentation of Combustions—Nervous Theories—Calorific Centres—Thermic Nerves—Humeral Theories—Pyretogenous Substances—Therapeutical Deductions—Anti-thermic Medications—Physical Means—Subtraction of Heat—Cold Baths and Warm Baths—Subtraction of Blood—Bloodletting—Medicaments Acting on the Circulation—Digitalis—Ergot—Aconite—Veratrine—Antiseptic Medicaments—Quinine—The Aromatic Series—Phenic Acid—Salicylic Acid—Resorcin—Kairine.

GENTLEMEN: In this last part of my course of clinical therapeutics, I propose to consider the treatment of fevers, and the present lecture will be devoted to fever from a therapeutic stand-point. Such general considerations will be an excellent introduction to the study of specific fevers, which is to follow, and the utility of the subject will be a sufficient apology for the dryness and difficulty of many of the details into which I shall be obliged to enter.

Fever is characterized principally by two symptoms, elevation of the bodily temperature and increase of the pulse, the former symptom being regarded of preponderating importance as an essential element of fever, especially since the clinical thermometer came into use. The very etymology of the word (*febris*, *fever*, from *fervere* "to be hot"),[1] and the common consent of the medical profession from Hippocrates and Galen downward, sustain this view, and clinical thermometry constitutes, with auscultation and percussion, as Jaccoud very properly remarks, the foundation stones of the clinician's arsenal.

This study of morbid heat plays a preponderant part in diagnosis, prognosis and even in therapeutics, and physicians everywhere to-day, when they would judge of the intensity of a fever, and the effects of their remedies depend almost entirely on the examination of the temperature. You know how much we consult our clinical charts for daily information as to the fluctuations of the temperature, and the care which we take to have them absolutely correct, as constituting the basis of our treatment. The series of curved lines which I here pass before your eyes, shows you the march of the temperature in typhoid fever, in pneumonia, in small-pox, in intermittent fever, etc., and familiarity with this manner of registering the progress of the fever will

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[1] Fever (febris) comes from the word *fervere*, to be hot, to boil, ferment, glow; the Greeks employed the word *Πῦρ*, *Πυρετός*, whence the name *Πυρέξις*, pyrexia, applied to the febrile state.

Some authorities have thought that this word feber, *febris*, comes from *februrer*, to purge or to purify, but as Littré has remarked, this derivation is inadmissible.

enable you to a certain extent, by a sight of these curves, to tell what fever the patient has, and what are the chances of recovery.

Have we not gone too far in this direction and neglected the attentive study of the pulse? For my part I am convinced that it is generally best to make the study of the pulse and temperature march side by side. If the one furnishes us precise information concerning the state of the fever, the other enables us to determine the condition of the heart and the resistance of the patient. In many febrile maladies the heart undergoes profound alterations, which seriously modify its function and make our prognosis doubtful if not unfavorable.

Examine then the temperature, but do not neglect the pulse; study its frequency, its force, its form. Attempts have been made to establish a relationship between the pulse and the temperature, and Liebermeister and Lorain[1]

[1] Liebermeister's table, establishing the relationship between the pulse and fever, is as follows:

TEMPERATURE.		PULSE.		
		MINIMUM.	MAXIMUM.	MEDIUM.
98.6 F.	37. C.	45	124	78.6
99.5 F.	37.5 C.	44	130	74.
101.4 F.	38. C.	52	148	91.2
101.3 F.	38.5 C.	52	160	94.7
102.0 F.	39. C.	64	160	99.8
103.1 F.	39.5 C.	64	144	102.5
104.2 F.	40. C.	72	158	108.5
104.9 F.	40.5 C.	76	152	109.4
105.8 F.	41. C.	66	160	110.
106.7 F.	41.5 C.	88	160	118.5
107.6 F.	42. C.	114	168	137.5

LORAIN'S AVERAGES ARE AS FOLLOWS:

TEMPERATURE.	PULSE.
99.5 F.	70
101.3 F.	95
103.1 F.	120
104.9 F.	145
106.7 F.	160

have given us precious indications in this regard; but these indications apply only to the number of pulsations, and tell us nothing about the volume or force of the pulse, which can only be made apparent by the touch and the sphygmograph.

I need not insist further on clinical thermometry, it is a subject which belongs to the domain of general pathology and clinical medicine, and I hasten to the study of fever, properly so called.

We have seen that fever is characterized by elevation of temperature; numerous theories have been proposed to explain this excessive heat, and in the last twenty years more especially works have multiplied on this subject. Notwithstanding the patient researches of many experimenters, this great question of physiological pathology is not yet completely elucidated, and we are in reality reduced to an acceptance of the hypotheses of our predecessors concerning the febrile process.[2] Without going very far into the history of the doctrine of animal heat and fever, and referring you to the remarkable study of Lorain on the "Temperature of the Human Body" for more exhaustive information, I may say that the ancients regarded fever as the result of modifications effected in the blood, or of some trouble in the innervation of the circulatory system. We find both this humoral and this nervous theory maintained at the present day, supported, it is true, on other bases, and by arguments drawn from modern physiological experimentation, and it is at the same time difficult to say which one of these theories is the more probable. But in order to approach this discussion profitably it seems to me necessary to enter here into certain details which will enable us to explain the different definitions which have been

According to Lorain, if the rectal temperature at 37.5 C. (99.5 F.), corresponds to 70, each rise of one degree will be accompanied by an increase of 25 pulsations. (*a*)

[2] According to Hippocrates, and more especially Galen, fever depends on augmentation of the heat of the body; the heat is formed in the heart and the blood is the vehicle of it. Against this febrile state Galen counsels refrigerant medications, such as ptisans, and in particular barley tea, and the usage of cold lotions; these views prevailed without disputation till the sixteenth and seventeenth centuries.

Bellini considers fever as dependent on an alteration of the blood. Sydenham sees in it only a movement of nature to expel peccant matters. Stahl partakes of the same view. Bœrhaave makes particular account of the pulse, which for him characterizes the fever.

Cullen places the seat of the fever in spasm of the extremities of the small blood-vessels. Nietski developes this idea and considers fever as peripheral spasm of the vascular system. Frederic Hoffmann has expressed the same notion in saying that fever is a spasmodic affection of the whole nervous and vascular system. Todd says that fever is an irritation of the nervous system.

At an epoch nearer our own, Broussais expunged fever from pathology. Fever was to him a miraculous product of the imagination of physicians. Boullaud makes of fever an *angeiotenia*, and Piorry, an angeio hæmitis, that is to say an inflammation of the walls of the blood-vessels.

(*a*) Lorain, Temperature du Corps Humain, t. 1, p. 30, Paris, 1877. Liebermeister, Deutsch. Arch. f. Klin., Band 1, 1866, p. 466.)

given of fever.[1] Does the increase of heat, which is the characteristic of fever, result from an augmentation in the combustions of the economy? This is the point to be settled. The solution of this problem of physiology has been sought in the examination of the urine, of the expired gases, in the state of the blood itself, and finally in calorimetry. Let us examine each of these points.

Till the last few years, there seems to have been general unanimity in the affirmation that the ultimate product of organic combustions, urea, augments with the temperature in fever patients, and that this augmentation is, so to speak, in the ratio of the hyper-pyrexia. The experiments of Moss, Murchison, Brattler, Claude Bernard, Hirtz, Catel and Unruh, were regarded as absolutely demonstrative.[2] Nevertheless, a more attentive examination of the question has shown that this augmentation is only relative, and its reality has been so far denied that Charvot has even maintained that there is no relation between the

[1] Numerous definitions of fever have been given, "Fever is a morbid state constituted by a variety of functional disturbances, and especially by exaggerated bodily temperature and acceleration of the pulse." (Compendium of Medicine.)

"The words fever, pyrexia designate a morbid state of a certain duration, characterized especially by increase of bodily heat and increased quickness of the pulse," by malaisé and divers other functional troubles. (Grisolle.)

"Fever is a pathological state constituted by increase of the organic combustions and temperature. This elevation is constant, and invariable to this degree that it serves to define and specify the fever. * * * Conversely, every individual whose temperature undergoes persistent augmentation, has fever." (Jaccoud.)

"The best definition of fever," says Prof. (Sée), "is that which is founded on he primordial phenomenon which dominates the entire situation. It is that of Galen: *Calor præter naturum.*"

The most complete definition of fever, and the one most conformable to the results of experimental physiology is that of Lereboullet—"Fever is characterized by a notable elevation of the temperature of the body, regulated under the influence of the nervous system, and is due to an exaggeration of the interstitial combustions, being determined most generally by an alteration of the blood." (Lereboullet, Dict. Encyclop., article Fever.)

[2] At the beginning of the researches concerning the elimination of urea in fevers, everybody seemed agreed in regarding the elevation of temperature as coincident with increased elimination of urea; thus Moss claimed that the curve of urea excretion is parallel with that of the temperature. Murchison declared that the temperature rose in the ratio of the quantity of urea in excess of the normal. Brattler, going still farther, maintained that one might calculate the temperature by the quantity of urea eliminated and that a temperature of 40° C. (104° F.) corresponds to an elimination of 40 grammes of urea (about 600 grains). Desnos, in his *thèse d'agrégation* of 1866, admits the complete parallelism between the secretion of urea and the elevation of the temperature.

But since this time, by dint of a more careful examination of the subject, and thorough study of the influence of alimentation and the function of certain organs on urea, it has appeared to observers that this augmentation does not follow the hyperthermia. Charcot and Robin maintained even that this secretion is below the normal during the fever. Liebermiester has shown that the augmentation of urea does not exist except in the first periods of febrile affections; afterwards this augmentation gives place to diminution.

However, despite these reserves, and especially as a result of making proper account of alimentation, the majority of observers are of the opinion that there is augmentation of urea. Claude Bernard acknowledges this augmentation, and asserts that febricitants eliminate on an average one and a half times as much urea as persons in the state of health. Senator

production of urea and febrile thermogenesis, and that the theory which explains the excessive febrile heat by exaggeration of organic combustion is not admissible. On the other hand, Charvot has affirmed that the quantity of extractive matters [3] follows with great exactness the thermal curve.

The views of Charvot have found few partisans, and despite the strong facts which he alleges in their support, the majority of physiologists and clinicians admit an exaggeration of urea production during the febrile process; not by any means, be it understood, by comparing the figures with those which are observed in the case of the healthy and well-fed individual, but with those which indicate the quantity of urea voided by persons who are fasting.

The same discussions which arose with reference to the quantity of urea excreted by fever patients have been revived when it has been a question of determining by the study of the gases of respiration the modifications which are effected in the combustions of the economy, and while Leyden, Silujanoff, and Frænkel affirm that there is an augmentation of carbonic acid, Wertheim

admits that the combustion of albuminoid matters is augmented during the entire duration of fever. Hirtz has found this augmentation in cases of traumatic fever. Catel has arrived at the same results.

In fine, Unruh claims that the total excretion of nitrogen is one and a half times as much in the febrile process as in the normal state when the individual is fasting.

Anstie affirms that the augmentation in the production of urea, does not always necessarily accompany febrile phenomena, and he cites a certain number of cases where the quantity of urea has been below the normal. According to Zuelzer the sum total of azotized excretions is augmented during the fever and diminished during fasting and convalescence. The relative proportions of nitric acid and phosphorus during fasting remain in the urine in the normal limits of the quantity existing in the muscular substance and in the cerebral tissue. According to this experimenter, in the febrile state it is especially the denutrition of the muscles which is at stake, and in the state of fasting and of convalescence, that of the nervous tissue predominates. (*a*)

[3] The extractive matters in the urine of febricitants have been especially studied by Charvot. According to him, the quantity of extractive matters diminishes in inverse ratio to the abundance of urea, so that the curve follows precisely that of the temperature, since, according to him, the quantity of urea undergoes a notable diminution in fever. He admits, also, a diminution of the solid matters, and in particular, of chloride of sodium. Hœpffner arrives at similar conclusions, for, according to him, the curves of urea and of extractive matters take altogether different directions. (*b*)

(*a*) Anstie, On tissue destruction in the febrile state and its relations to treatment (the Practitioner, March-May, 1874).—Moss, Americ. Journ., p. 384-388, 1861.—Murchison, the Continued Fevers of Great Britain, London, 1873.—Brattler, Contributions à l'urologie, Munich, 1858.—Desnos, thèse agrég., 1866, p. 48.—Charvot, Température, pouls, urine dans la crise et dans la convalescence de la pneumonie.—A. Robin, Essai d'urologie clinique.—Senator, Untersuchungen über den Freberhaften process und seine Behandlung, Berlin, 1878.—Cl. Bernard, Leçons sur la chaleur animale, p. 422.—Hirtz, article Fievre, Dict. Jaccoud.—Catel, De l'urine dans quelques affections fébriles chirurgicales (thèse de Paris, 1874).—Unruh, Rétention des matériaux de combustion incomplète dans la fièvre (Arch. f. path. anat., p. 48, 1869).—Zuelzer, Bemerkungen über einige Verhaltnisse des Stofftreohesels in Fieber und Hungersten (Berl. Klin. Wochens., No. 27, page 381, 1837).

(*b*) Charvot, Température, pouls, urine dans la crise et la convalescence de quelques pyrexies (thèse de Paris, 1871, No. 180).—Hœpffner, De l'urine dans quelques maladies fébriles (thèse de Parfs, 1872).

and Senator maintain that there is not this increase,[1] and the later engaged a few years ago in a vehement dispute with Pfluger *apropos* of the experiments of Colasanti on this subject. The experiments of Liebermeister seem to me to decide this question, and to-day it can hardly be disputed that there exists during fever an augmentation in the exhalation of carbonic acid. Only this augmentation does not show itself except at the commencement of the pyrexia, and does not appear to last as long as the elevation of the temperature.

The examinations of the gases of the blood which have been made by Mathieu and Maljean, while showing us a notable diminution in the respiratory power of the blood in febrile animals, would have furnished a powerful argument to the opponents of the doctrine of exaggeration of combustions in the febrile process, if one did not remember how much the respiratory and circulatory movements are increased in individuals affected with fever.[2] I pass rapidly by the other alterations of the blood, alterations concerning which little is known,[3] only mentioning in this connection the interesting researches of Prof.

[1] Leyden was the first to remark the increased excretion of CO_2 in fever, which increase may attain five per cent. Silujanoff remarked the same increase in animals in which he produced septic fever; but we are indebted to Liebermeister for the most precise observations in the human subject, from which it is demonstrated that the exaggeration of CO_2 corresponds to the rise of the temperature, but does not continue with it, for while the temperature keeps elevated, the production of CO_2 decreases.

Fraenkel and Leyden in their experiments on animals, in which they had determined fever artificially, always observed an augmentation in the production of CO_2; Wertheim, however, claims directly contrary results from his personal observations.

In his experiments on febrile guinea pigs, Colasanti had noted a large increase in the consumption of O, and in the production of CO_2, but in tabulating his results he made allowance for the difference between the temperature of his animals at the time of the experiment and the surrounding atmosphere; admitting, as he properly did, that the temperature of the room exercises a considerable influence on the consumption of O and the excretion of CO_2. *Apropos* of these experiments a long discussion arose between Senator and Pfluger, the first claiming that the correction by Colasanti was inapplicable to the case, the other resolutely maintaining that always in fever there is augmentation of oxidizing processes.

[2] Mathieu and Maljean have always noted in fever patients a remarkable diminution in the respiratory power of the blood. In animals there is the same diminution. Mathieu and Urbian have shown that the proportion of O and CO_2 decreases as the temperature rises. Geppert has examined the gases of arterial blood in animals in which he had produced fever. According to his experiments, the oxygen is not lowered, but CO_2 diminishes proportionally to the elevation of the temperature. He regards this lowering of CO_2 as not the cause, but the effect of the fever.

[3] Legerot affirms that the hæmoglobin of the globules does not possess the property of fixing oxygen during the febrile process. These globules are rendered incapable of administering to the internal combustions.

Richardson also thinks that the septic poisons prevent the absorption of oxygen by the hæmoglobin.

Manassein has observed in the blood of persons affected with fever a diminution of the

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(*a*) Geppert, Die Gaze des arteriellen Blute in Fieber (Zeitsch. f. Klin. Med., t. ii, p. 355).—Mathieu et Maljean, Etude clinique et expérimentale sur les altérations du sang dans la fièvre traumatique et dans les fièvres en général (Bull. et Mém. de la soc. de chirurgie de Paris, t. ii, 1876).—Mathieu et Urbain, Des gaz du sang (Arch. de phys., 1872).—Du Castel, Physiologie pathologique de la fièvre (thèse agrég., 1878).

Hayem on what he has described under the name of the "hæmatic crisis in fevers," a crisis characterized essentially by an exaggerated production of hæmatoblasts, coincident with the defervescence of acute diseases, and I come to the physical demonstration, the most clear in my own mind, of the augmentation of combustion in fever. I refer to the application of calorimetry to this study. Liebermeister, and his pupil, Kernig, have thus shown us by precise experiments, that the febrile individual gives forth more heat than the healthy individual.[4]

All these things concur then, as you see, gentlemen, in clearly establishing this first point, that in individuals affected with fever, there is increase of organic combustions. But this does not suffice of itself to explain the febrile process; there must be some disturbance in the regulation and distribution of heat in the economy.

Vulpian has devoted one of the most interesting chapters of his splendid work on the Vaso-Motors, to the study of the distribution of heat in the healthy individual, and in the febrile individual. He has put in clear light, the capital role of the capillary net-work, and the influence of the vaso-motor apparatus in the calorification of different parts of the body, showing us that whenever the capillary vessels of the skin become contracted, there is an augmentation of the central heat with lowering of the temperature, of the skin, and superficial subjacent tissues; when, however, there is dilatation of the cutaneous and subcutaneous vessels, we have elevation of the temperature of the skin and subjacent tissues, and a lowering of the central heat.[5]

It is by virtue of the harmonious reciprocal play of the vaso-motors of the central organs, and of the periphery, that man maintains in the normal state, and under the influence of divers external influences, his temperature at a figure almost unvarying.

These points being once established, we may now approach the critical study of the different theories invoked to explain fever.

volume of the red globules, while on the contrary, Laptschinsky and Kelsch have found an augmentation in their volume. (*a*)

[4] There are two processes of calorimetry—that by cold baths and by warm baths. In the process by cold baths, the water of the bath serves as calorimeter; in the other process, the patient becomes his own calorimeter. The experiments of Liebermeister and Kernig have shown that in the human organism heat production is in the ratio of the loss of heat. The more the loss, the greater the production, and vice versa. It is also proved that a healthy man, placed in a cold bath, evolves the more heat the lower the temperature of the bath, and that a feverish person radiates more heat than a healthy person. (*b*)

[5] Vulpian, Lecons sur. l. appareil Vaso-Motor, Paris, 1875, t. II, p. 188.

(*a*) Legerot, Etude d'hématologie (thèse de Paris, 1874).—Richardson, Some new researches on the causes and origin of fever from the action of the septic poisons.—Manassein, De la diminution des dimensions des globules, Tubingen, 1872.—Kelsch, Contributions à l'analyse pathologique (Arch. de phys., 1875).—Laptschinstky, Centralbl., 1874, No. 50.

(*b*) Liebermeister, Die Regulirung der Warmebeldung bei den theiren von constanter temperatur (Deutsch. Klin., 1875, No. 40).—Kernig, Experimentelle, Beitrage zur Kenntniss der Warmeregulirung beim Menschen (thèse inaug., Dorpat, 1864).

When we take a general survey of all these theories, we see that they may be grouped in three principal classes.

In the first class we have the theory of Traube and Hueter; a theory which, while denying all augmentation in the combustions of the economy, explains the febrile process by modifications effected in the capillary net-work.

In the second class, the increase of combustions is admitted, but as an element absolutely secondary, the principal rôle being assigned to the vaso-motors; this is the theory of Senator and Marey.

In the third class the augmentation in the combustions constitutes the dominant principal fact, and according as this increase is explained by a trouble in the regulation of heat production, whether by the influence of certain parts of the nervous system, or by the modification in the vaso-motors, we have the respective theories of Liebermeister, Claude Bernard, and Vulpian. Let us examine each one of these theories.

Traube rejects absolutely the notion of augmentation of combustions, as explanatory of the thermal elevation, which results, he thinks, from the fact that in the period of rigor or chill, the capillaries of the periphery contract under the influence of the vaso-constrictor nerves, and the afflux of blood to the central organs becomes the sufficient and sole cause of the febrile manifestation.

Hueter has gone still further in this direction. Taking his stand on the experiments of Albert, which go to show that the mechanical arrest of the circulation in a vascular tract produces thermal elevation and fever, he maintains that the first cause of the febrile process is a mechanical arrest, by embolic infarctions, of the capillary circulation of the lungs and skin.[1]

These theories raise so many criticisms and objections that they have been virtually abandoned. In fact, they can give no explanation of the rise of temperature which precedes the chill in intermittent fever, and they have no sufficient application to continued febrile processes.

The theories of Senator and Marey are much more seductive; in that of

[1] Albert claims for his experiments a demonstration that arrest of the circulation in a vascular district causes elevation of temperature and fever; the arrest being the result of emboli, which may be purely mechanical, producing fever of an intermittent type, or septic, with fever of a continued type.

According to Hueter, fever is due, not to over-production of heat, but to lessened distribution. The body has two surfaces of refrigeration, the cutaneous surface and the pulmonary surface. The less the quantity of blood flowing through the vessels of a refrigerating surface, the less the loss of heat, and the greater the general temperature. In fever there is arrest of the circulation in these two refrigerating surfaces, and fever ensues, with tumefaction of the spleen, kidneys, and liver. All of Hueter's experiments were made on frogs.

Senator has examined the auricular vessels of albino hares in health and in fever, and has shown that during febrile heat there is no permanent paralysis or tetanus of the vessels. He thinks that the theory of Hueter is not well founded. (*a*)

(*a*) Albert, Untersuchungen über das Fieber (Ber. der natvrwiss. Med. Veruns zu Innsbruck, 1873).—Hueter, Ueber den Kreislaufund die Krieslauffstœrungen in der Froschlunge versuche zur Behandlung einer mecanischen Fieberlehre (Centralb., No. 5, 1873).—Senator, Weitere Beitrage zur Fieberlehre (Centralb., No. 6, 1873, p. 84).

Senator we find the same explanation as that given by Traube of the mechanism of the chills and the totality of the febrile phenomena, but he admits the augmentation in the combustions of the economy resulting from the enhanced destruction of albuminoid matters.[1]

The theory of Marey is very much like that of Senator, but to the initial constriction of the capillaries of the periphery, cause of the central thermal elevation, there succeeds, according to him, a paralytic dilatation of this capillary net-work, which brings the heat to the surface, "leveling down the temperature." In the theory of Marey, as in that of Senator, there is augmentation in the combustions, but this is a secondary matter, the primordial phenomenon and the most important is the trouble brought upon the vaso-motor circulation of the periphery, whether by spasm, as Senator thinks, or by alternations of spasm and paralysis, as Marey thinks.[2]

These theories which are much nearer the reality, do not at the same time give us a sufficient explanation of the elevation of temperature which precedes the chill, and the only theory which is in harmony with all the facts, is in my opinion that of Liebermeister. According to Liebermeister, the augmentation in the combustions plays the principal part; it is admitted without dispute, and you have just seen upon what solid proofs it rests. But it is not enough to admit the fact of increase of combustions; the original cause demands explanation, and here certain opinions come in which we must discuss.

Just here Liebermeister, to whom we owe such important works on this part of general pathology, has furnished us precious data. After having shown us by the examination of the urine, of the expired gases, and especially by the application of calorimetry, that there is augmentation of heat-production in fever, he has well brought to light this other fact that this elevation of itself does not constitute fever, and there is needed besides a modification in the regulation of heat. Let me explain.

In the healthy and normal state of man, you may by artificial processes raise the internal temperature, but as soon as those means cease to act, the

[1] According to Senator the febrile elevation is due (1) to exaggeration of heat-production, arising from increase of interstitial combustions; (2) to retention of heat, by contraction and shrinkage of the cutaneous arterioles. Buss adopts the theory of Senator in explanation of fever, which he considers as essentially constituted by a disorder in the deperdition of heat. This disorder is attributed to the presence of irritant agents in the blood which determine the contraction of the peripheral vessels, and hence, augmentation of heat in the ratio of the lessened deperdition. (*a*)

[2] Marey. Medical Physiology of the Circulation of the Blood. Paris, 1883.

The important part of Marey's theory is the leveling of the temperature, which depends on a paralytic dilatation of the peripheral capillaries. At the commencement of the attack and during the first period, there is constriction of the capillaries of the periphery; the blood is forced into the viscera, and the central temperature rises. Then the cutaneous capillaries dilate, and the blood, at a high temperature, flows to the peripheral parts and distributes its heat.

(*a*) Senator, Untersuchungen über den Fieberhaften process und seine Behandlung (Berlin, 1873) — Buss, Ueber wesen und Behandlung des Fiebers (Stuttgard, 1878).

temperature invariably falls back to 98½° F. In the fever patient, on the contrary, the loss as well as the production of heat is regulated at an abnormal standard, varying according to the malady and the individual, insomuch that, according to Liebermeister, the very essence of fever consists in a regulation of thermogenesis for a temperature more elevated than normal.[1]

But to maintain that heat production in fever depends essentially on heat-regulation is not to solve the problem, but simply to remove it farther back. It becomes us now to ascertain what causes this modification in the mechanism of regulation. Here comes in the influence of the nervous system, and we have to consider what may be called the nervous theories of fever. Claude Bernard[2] in analyzing the phenomena which occur after section of the great sympathetic, was persuaded that there exist thermic nerve fibres possessing a special physiological function with reference to calorification, and placed under the dependence of the sympathetic ganglia. The great sympathetic becomes thus the moderating mechanism of the chemical combustions of the economy. So whenever the functions of this system are enfeebled, the inhibitory check ceasing to operate, the temperature rises; in a word, fever is only one of the manifestations of paralysis of the great sympathetic.

Since Tscheschichin as a result of his curious experiments on the mesocephalon of rabbits, claimed this part of the nervous system as the regulator of

[1] Liebermeister begins by establishing that the temperature of a fever patient is higher than that in a healthy person, and that a great part of the symptoms of fever are the consequence of elevation of temperature; then he shows that in fever there is augmented heat-production. Both thermometric elevation and increased thermogenesis are present. In the well man every artificial elevation of temperature disappears rapidly, for in the normal condition the production of heat is regulated for a temperature of 98½° F. In fever, on the contrary, the regulation is adjusted to a certain degree of temperature, which varies according to the intensity of the fever, and its nature, so that the essential difference between a fever patient and a well person is this, that in the fever patient the loss as well as the production of heat is regulated by the standard of a high temperature, while in the healthy man it is regulated at 98½° F. (*a*)

[2] Claude Bernard was the first to put forth the hypothesis of the existence of nerve fibres, influencing physico-chemical operations and heat production. He showed first that section of the sympathetic augments calorification, without increasing the organic combustions. There is, according to him, a physiological function of calorification, and this function is under the control of nerves belonging for the most part to the sympathetic. Independently of its vaso-motor action, the sympathetic has a thermic action. "Its excitation produces a frigorific effect; its section or paralysis, a calorific effect. It is not only a vaso-constrictor nerve, it is a frigorific nerve." The sympathetic acts then on the physico-chemical phenomena, which engender heat, as a sort of moderator, as a check, or an agent of inhibition. "It cools the parts which it innervates," he says, "hence the name we give it of frigorific nerve. It constricts the vessels, and thus renders the organs pale and exsanguinated, whence its name, vaso-constrictor. It moderates and slows nutritive movements; it merits the name of check, or inhibitory nerve (*nerf refrenateur*).

Fever then, according to Bernard, is a result of paralysis of the great sympathetic. (*b*)

(*a*) Liebermeister, Uebor Warmeregulirung und Fieber (Somml. Klin. Vortr. von Richard Walkmann, no 19, 1871).

(*b*) Claude Bernard, Leçons sur la Chaleur Animale, Paris, 1884.

the combustions of the economy, making the pons Varolii the heat centre, there has been a tendency to consider the thermic elevation of fever as depending, not so much on a disturbance in the function of the great sympathetic, as in that of the annular protuberance. Vulpian rejects both the theory of Claude Bernard, and that of the Russian physiologist. In his opinion, it is not proved that thermic nerve fibres exist, or even moderating centres of thermogenesis; no matter in what part of the cerebro-spinal axis you may locate those centres.[1] According to Vulpian, disturbances occasioned in the vaso-dilators and vaso-constrictors, whether by direct irritation of these nerves, or by irritation of the spinal cord and of the medulla oblongata, or whether by reflex action, suffice to explain the thermal elevation. It is then by modifications effected in the action of the vaso-motor nerves that he would explain the febrile process. At the same time he recognizes that in many cases the starting point of these troubles is in the blood, and this leads us to study the action of alterations of the blood on the production of fever; and to the nervous theories of Claude Bernard, of Tscheschichin,[2] and of Vulpian, we will now oppose the theories called humoral.

[1] Schiff has made experiments to determine the influence of the vaso-motor system on the activity of thermogenesis. He cuts the principal nerves of an animal on one side; then he lets the wound cicatrize. Then he determines septic fever in the animal, by injecting putrid substances in the blood. On examining the temperature of the members, he finds that it is higher in the side where the nerves were not cut. Vulpian repeats the experiments, but with contrary results. At the same time he believes in the influence of the vaso-motors, though not claiming to give a very complete explanation of the mechanism of heat regulation. "We must admit," he says, "that the nerve centres, irritated by the morbific cause, act upon the vessels to provoke a constriction or dilatation; they determine a constriction of the cutaneous vessels in the period of chill. They produce without doubt a dilatation of the deeper vessels, especially of the viscera, even during the chill and thus contribute to energize the physico-chemical acts, which give rise to heat. But it appears to me incontestable that all is not limited to a direct influence on those operations, by the medium of the vaso-motor apparatus. The nervous centres must act more directly on those physico-chemical phenomena by the fibres of the nerves of animal or organic life which are in more or less immediate relation with the anatomical elements, the organized, living, protoplasmic substances of the different tissues. We must, in fine, admit that morbid causes (pyretogenous agents) may act also on this organized substance, modifying the nutritive, calorifacient processes in a manner quite direct, and consequently without the necessary intermediation of the nervous system. (*a*)

[2] Tscheschichin cut the pons, in hares, just before the point where the medulla oblongata terminates; the rectal temperature rose several degrees, and the respirations were markedly quickened. If, on the contrary, the bulb or the cervical cord were sectioned, the temperature fell. Hence he considers the pons as acting on the rachidian bulb and spinal cord as a centre which regulates and moderates the organic combustions. If you take away the curb by cutting the connections between the pons and the medulla, the combustions acquire a greater intensity.

Experimenters who have repeated these experiments have not all arrived at the same results; some, as Pochoy, obtaining just the opposite results. Moreover, Naunyn and Quincke in sectioning the cervical cord in dogs, have obtained elevation of temperature, and clinical observations in contusions of the cervical cord by fractures, etc., have often demonstrated the existence of hyperpyrexia. In a case of fracture of the 6th cervical vertebra,

(*a*) Vulpian Leçons l, Appareil Vaso-Moteur, 1875, t II, p. 265.

There is no doubt that the blood plays an important part in the production of the febrile process, and here physiological experiments as well as clinical researches show us the reality of this action. It suffices, in fact, as you well know, to inject into the blood of animals a very small quantity of septic matter, to determine in them a febrile state, more or less intense, and it is this very process which we employ in our laboratories to obtain experimental fever. It is the same with man, and the chill, often so violent, which supervenes in patients after surgical operations or confinement, is a proof that the blood has been contaminated by putrid matters. I showed you when speaking of transfusion, that in many cases this operation has been followed by rigors and veritable attacks of fever. It is to the same cause, that is, to the presence of particles foreign to the blood, that we must attribute these symptoms. Does the trouble consist in modifications of the fibrine of the blood, which, analogous to processes of fermentation, induce changes in the constitution of that fluid, or does the trouble consist, as Verneuil thinks, in the presence of a definite morbid principle, *sepsine?* Or does it consist in the introduction of organized microbes, microbes, which, since the discoveries of Davaine and Pasteur, have so considerable a part in our infectious diseases? These are questions which are not completely solved, but there none the less exists this fact which we should keep in mind, that there are substances which, introduced into the blood, are capable of determining the febrile process and to which we may give the name of *pyretogeneous.*

Have these pyretogeneous substances a direct action on heat production, or is this action only indirect and secondary, and brought about through the intermediation of the nervous system? Without being able to solve this question by precise experiments, I believe that in many cases this action must be secondary, and that it is by modifying the function of the vaso-motor centres that in all probability, alterations of the blood determine the elevation of temperature of fever.

As you see, gentlemen, of all the theories which I have made to pass before you, that which seems to me most comfortable to the facts of clinical medicine and experimental pathology is the theory which makes febrile thermo-

Frerichs noted a rectal temperature of 43.8° C. Bruck and Gunther in the mechanical irritation of the medulla oblongata or pons, determined an elevation of temperature, instead of a lowering, which they should have obtained if the hypothesis of Tscheschichin had been correct. Electric irritation of these parts by Heidenhain, also gave elevation of temperature. Hence Heidenhain rejects the hypothesis of a heat-moderating centre, and Vulpian and Riegel share the same opinion. Murri rejects also the nervous theory of fever, claiming that the excessive thermogenesis results from a trouble in the physico-chemical process of the living elements of the tissues, and not from any special influence of some nervous centre which regulates heat production in the economy. (*a*)

(*a*) Tschechichin, Zur Lehre von der Thicrischen Warme (Reichert's und die Bois-Reymond's Arch..1866) —Pochoy, Recherches expérimentales sur les centres de température (thèse de Paris, 1870, no 120, p. 24).—B. Naunyn et Quincke Rechert's und du Bois-Raymond's Aach., 1869.—Riegel, Uber den Einfluss des centralsservensystems auf die Thierische Warme (Pflüger's Arch., 1871-1872, p· 629-672).—L. Bruck et A. Günter, Versuche über den Enfluss der Verletzung gewisser Klirntheile auf die temperature des Thierköpers (Pfläger's Arch., 1870, d. 578-585).—J. Schreiber, Uber den Einfluss dec Gehirns auf die Kurpertemperatur (Pflüger's Arch., 1874, t. VIII, p. 576),—Vulpian, Leçons sur l'appareil vaso-motor, t. II, p. 250, 1885.—Murri, Salla teoria della febbre, Florence, 1874.

genesis depend on a trouble in the functionating of the vaso-motor system, whether that trouble be primitive or secondary.

These details being once clearly understood (and you will pardon me for having given so much space to their exposition), we can now approach the study of the action of medicaments which combat the febrile process and its principal characteristic, excessive heat-production; in a word, we will examine the bases of the antipyretic treatment. But I must first of all show you the necessity of this antithermic medication, in pointing out the dangers which hyperpyrexia causes.

Here, moreover, we were indebted to Leibermeister for valuable data.[1] Establishing himself on experimental facts and clinical observations, he has assigned to excess of temperature a series of alterations having especially to do with granulo-fatty degenerations of the different viscera, the most important of which, surely is that which affects the cardiac muscle.

I fear that we have gone a little too far in this direction. Remark, first of all, that from an experimental point of view it is difficult, even grounding ourselves on the experiments of Liebermeister, to compare an animal in which the temperature has been made to rise by artificial means, with a person in whom the heat excess is the fact of a febrile process. Moreover, as Hayem has well

[1] The disorders determined by hyperthermia have been studied experimentally and clinically. Claude Bernard has shown that in pigeons death ensues whenever the central temperature attains 48° C. (118° F.). In mammals death takes place when the temperature is 44° or 45° C. (111° or 113° F.); it seems then demonstrated that death always happens to an animal whenever the temperature of the blood exceeds the normal by from 12° to 15°.

In some experiments on dogs Vallin divides into three periods the accidents which supervene in animals whose temperature has been abnormally raised.

In the first period there is acceleration in the respiratory movements. In the second respiration becomes sighing and prostration is marked. In the third convulsions supervene, and death ensues when the temperature attains 44.4° C. (112° F.)

The lesions determined by hyper-thermia, according to Liebermeister, are characterized essentially by a granulo-fatty degeneration of the different viscera; the liver presents the lesions of acute yellow atrophy; the kidneys, especially the cortical substance, are degenerated. The heart presents notable disorders; it becomes soft and friable, and the fibres are affected with granulo-fatty degeneration.

The lesions observed by Stokes and Hayem in typhus and typhoid fever, by Desnos and Huchard in small-pox, and by Vallin in marsh fevers, are all the consequences of this hyper-thermia; it is the same with the lesions of the muscles described by Zenker and the symptomatic myosites observed by Hayem.

At the same time the latter considers these myosites, not as the result of hyper-thermia, but as the consequence of the infectious diseases which modify profoundly the nutrition of the muscular fibres, and this view seems confirmed by a curious observation of Vallin, who in a typhus patient, whose temperature never exceeded 100° F., observed fatty degeneration with rupture and hemorrhage of the muscles of the abdomen and thigh.(*a*)

(*a*) Claude Bernard, Influence de la chaleur sur les animaux (Rev. des cours scient., 1871, p. 134).—Vallin, Recherches expérimentales sur l'insolation et les accidents produits par la chaleur (Arch. gén. de méd.., 1870, p. 138).—Liebermeister, Uber die Werkungen der febrilen temperatur (Deutsch. Archiv, Bd. 1, 1866).—Stokes, Traité des maladies du cœur et de l'aorte, Paris, 1864.—Hayem, Etudes sur les myosites symptomatiques (Arch. phys., 1870).—Desnos et Huchard, Des complications cardiaques dans la variole, Paris, 1871.—Vallin, De la myocardite et de la myostite symptomatique dans les fièvres palustres graves (Un. méd., 1874).—Du Castel, Des températures élevés dans les maladies (thèse d'agrégation, Paris, 1875).

remarked, and as the interesting researches of Vallin show, this alteration of the viscera, and especially these symptomatic *myosites* may depend, not on the thermogenesis, but (with more likelihood) on the infectious or septic agent, which, in altering the blood, has profoundly modified the nutrition of the muscular fibre.

But while combating the exclusive view of those who ascribe to the hyperpyrexia alone the dangers resulting from divers malign febrile processes, I recognize the fact that we ought as far as possible to endeavor to bring back to the normal the temperature of fever patients. To accomplish this we should put in operation the various agencies which constitute the anti-febrile medication.

These medicinal agents may be divided into two principal groups. You will see that this division is based entirely on the physiological deductions, to which we have given development while discussing the pathogeny of fever, and you will at once comprehend how important it was to dwell minutely on this part of our subject.

In the first group we place all remedial measures calculated to remove from the economy the excessive heat; we do not attack the causes of febrile thermogenesis. This group comprehends refrigerants.

The second group comprises methods and medicaments which combat the cause of hyperpyrexia. Since the cause of the exaggeration of physico-chemical phenomena depends, as we have seen, on the two following factors—modifications of the nervous system and modifications of the blood, we may range in two sub-divisions the medicaments which constitute the second group; in the first are those which modify thermogenesis by action on the nervous system, in the second those which are antipyretic by direct action on the blood. There may even be a mixed third group consisting of medicines which, like quinine, belong to both divisions.

This classification being admitted, we may rapidly go over each of these groups, taking only a cursory view, and reserving the more complete details which belong to the application of the different therapeutical agents for the study of specific fevers which is to follow.

I. The anti-thermic methods by abstraction of heat have acquired in these late years a great importance, especially since the promulgation of Brand's experimental researches. Although Hippocrates and Galen[1] have in many

[1] Hippocrates and Galen applied baths and affusions to the treatment of febrile diseases; one may judge of the estimate in which they held them by the following aphorisms: "A fever which does not come from bile gets well under abundant affusions of warm water upon the head," (Aphorisms, sec. 7, § 42). "If the patient is delirious make affusions upon his head," (Epidemics, book III. Sec. 5, page 49). Galen is quite as affirmative; he treats fever by warm or cold baths and by cold drinks internally.

Rhazés advised to combat the fever of small-pox by baths and cold drinks. All these facts had, however, been forgotten and abandoned by the followers of Hippocrates and of Galen; and we have to come down to the end of the eighteenth century to see James Currie, a Scotch physician, practising at Liverpool, establish, on new bases, the treatment of fever by cold water. It is thus that James Currie combated what was then described under the name of grave contagious fever or "typhus," what we now call

places insisted on the employment of cold, internally and externally, in the treatment of fevers; although Rhazes called attention to cold baths as beneficial in small-pox, it is certain that these precepts had fallen into desuetude and oblivion, and we have to come down to the end of the eighteenth century to find the remedial value of cold water in fevers recognized, and James Currie proclaiming a new method of treatment of pyrexias, namely by cold baths. Currie aimed to obtain, it is true, by his cold applications, not so much a lowering of heat as a tonic and reconstituent effect. Despite the great efforts of the Scotch physician, his mode of treatment was little followed, if at all, and despite attempts renewed since in France, by Jacquez, Wanner, Leroy, to treat fever by external cold, this practice was virtually abandoned. It is then in reality to Brand that we are indebted for the revival and formulization of this ancient method.

I do not mean here to decide concerning this therapeutic measure, or estimate its results; such actual examination I shall make in another lecture,

typhoid fever, and even intermittent fevers. Currie examined the results of his medications by means of a thermometer which he placed in the mouth and armpit of the patient.

He employed cold affusions, *i. e.*, with water at 15° C. (59° F.) and affusions of warm water, whose temperature varied from 30° to 35° C. (86° to 95° F). He believes these latter affusions to produce as satisfactory a lowering of the temperature of the body as cold affusions; he joined to them also the internal usage of cold drinks.

When one reads attentively the work of Currie it is plainly evident that he employed cold or tepid lotions not so much to abstract heat as to tonify the organism, and it was rather the reaction which he sought than the thermic depression.

The doctrine of Currie fell into oblivion. Forty-nine years elapsed before attention was again called to this practice, and this time in France. Jacques, of Lure, revived Currie's method in 1846; a method which he had adopted since 1839 in the treatment of typhoid fever, and which consisted in applying over the forehead and abdomen and different parts of the body compresses of cold water ; these he ordered to be renewed every ten minutes; he also administered cold lavements and cold drinks. Out of 143 patients affected with typhoid fever and treated after this manner he had but nine fatal cases, while out of 349 typhoid patients treated by the other methods he had had 91 deaths.

In 1849, Wanner set forth a treatment of typhoid fever which consisted in giving cold water for the only drink, and applying lotions over the whole body of ice-cold water; and from this time onward, in successive memoirs Wanner affirms that with his method persistently carried out of lotions and ice water, which he calls "passes," he has the experimental certainty of triumphing over every case of typhoid fever whose date of invasion does not exceed one week.

In 1852 Leroy, of Bethune, maintained that by cold water internally and externally one could almost certainly cure typhoid fever.

In 1851, Brand, a physician in Stetin, published his first treatise on the employ of cold water in the treatment of typhoid fever. His first affirmations are a little hesitating, and he expresses himself thus: "If typhoid fever is treated from the commencement by cold water, there is in general nothing to fear, and even in cases the most grave one may yet many times obtain cure by cold water." In 1863 Brand becomes still more positive, and he now says: "Every case of typhoid fever treated regularly, according to my method, takes on a light character and almost never terminates by death, so that in fact we may say that Clinical Medicine is in condition to preserve with certainty the lives of all patients entrusted to its care." In 1868 he assures us an absolute cure by his method, in the following terms: "The treatment by cold baths, methodically employed from the commencement, gives a success positively ensured, and always enables one to ward off death." Glenard, of

and shall limit myself in this place to a consideration of the method of Brand, from the stand-point of the physiological pathology of the febrile process.

The refrigerant method comprehends several modes of application. You may use baths, lotions, compresses wet in cold water, bladders of ice, or you may use the ingenious apparatus of Dumontpallier, or even rectal injections of cold water.[2] In all these forms the water may have a variable temperature which is always less than that of the fever patient. But whether you resort to cold affusions, ice bags, or cold lavements, these frigorific means abstract heat

Lyons has deduced from the sum total of Brand's works, this aphorism: "Every case of typhoid fever, treated regularly from the commencement by cold water will be exempt from complications, and will get well."

Huchard, basing himself on the works of French physicians, anterior to those of Brand, maintains that we ought to substitute the term French method, for that of German method (method of Brand) when we speak of the application of refrigeration to typhoid fever.(*a*)

[2] Riegel in studying the action of cold applications on the temperature of fever patients has observed that on applying to the thorax compresses dipped in ice water, the axillary temperature at the end of an hour falls from 0°.2 to 0°.27, and the rectal temperature from 0°.1 to 0°.05. At the same time, Liebermeister observes that in the local applications it is necessary that the refrigeration should be very pronounced, and its application very prolonged.

Riegel has also made some quite interesting experiments in comparing in a typhoid fever patient the effect of baths at 18° C. and renewed every two hours, whenever the axillary temperature exceeded 39.5° C., with the effect obtained by two bladders of ice applied permanently to the thorax. The following are the results which he obtained:

BATHS AT 18°.75 C. EVERY TWO HOURS WHENEVER THE AXILLARY TEMPERATURE EXCEEDS 39.5° C.

	Average of Rectal Temperature.	Average of Axillary Temperature.
1st Experiment.....	39.69	39.18
2d "	39.71	39.69
3d "	39.93	39.55
4th "	40.01	40.03
5th "	39.65	39.51
6th "	39.08	39.84
7th "	40.21	40.09
9th "	39.28	39.34

(*a*) James Currie, Medical Reports of the effects of water, cold and warm, as a remedy in fever and other diseases, whether applied to the surface of the body or used internally, including an inquiry into the circumstances that render cold drinks, or the cold baths, dangerous in health; to which are added observations on the nature of fever, and on the effects of opium, alcohol, and inanition, 5th édit., 2 vol., London, 1814.—Jacquez (de Lure), Bull. de la Soc. méd. de Besançon, No. 2.—Wanner, De l'emploi de la glace comme agent thérapeutique et des lois à observer dans son mode d'administration soit dans les cas de médecine, soit dans les cas de chirurgie (Compt. rend. de l'Acad. des sc., t. XXIX, p. 581, 1849. De la guérison constante, quinze jours au plus tard après l'application du traitment etcela sans nulle convalescence, de toute fièvre typhoïde dont la période d'invasion ne dépasse pas sept jours (Acad. de méd., 1866).

and lower the thermometric curve, on condition, always, that there exist between the temperature of the patient and that of the bath a notable difference.

Liebermeister, in his remarkable researches on calorimetry, has shown us that in a well man the production of heat is in direct relation with the loss of heat. If we apply these data to the refrigerant methods, the result will be that thermogenesis, instead of being diminished, will be increased proportionately to the withdrawal of heat; and reasoning *a priori*, it is not easy to see what good you are accomplishing by this means. Liebermeister, I am well aware, while recognizing that the regulation of heat is the same in the well person as in the febrile individual, has endeavored to prove that in pyrexia cold baths produce much more rapidly a diminution in thermogenesis than in the normal state; but it is none the less certain from the stand point of the physical laws of calorimetry, that as fast as you abstract heat from the fever patient, the same amount of heat is produced anew. So true is this, that to obtain an enduring effect, one is obliged in practice to renew continually the refrigerant applications. Whether the fever patient raise the temperature of the bath, or his own temperature, the effect is the same, and the lesions which you seek to avoid by this means, and which result, not from the elevation of temperature merely, but from the exaggeration of the calorific functions of the economy, will be produced in both cases, and from the strict point of observation of physical laws we should say that the refrigerant method can confer no

TWO BLADDERS OF ICE APPLIED OVER THE THROAX AND ABDOMEN DURING THE ENTIRE DURATION OF THE EXPERIMENT.

	Average of Rectal Temperature.	Average of Axillary Temperature.
1st Experiment.....	37.34	37.49
2d "	37.81	37.65
3d "	37.97	37.62
4th "	39.27	38.83
5th "	39.27	38.97
6th "	37.75	37.47
7th "	40.05	39.95
9th "	38.40	38.12

Foltz, of Lyons, has studied the influence of cold lavements on the heat-fall. According to him, a lavement of one litre of water produces the following thermic depressions:

A lavement of one litre of water at	+ 5°	Diminishes the heat of the body	0°.52
" " " "	+ 10	" " "	0 .52
" " " "	+ 14	" " "	0 .35
" " " "	+ 20	" " "	0 .29
" " " "	+ 32	" " "	0 .14
" " " "	+ 38	" " "	0 .06 (*a*)

(*a*) Riegel, Ueber Warmeregulation und hydrotherapie (Deutsch. Arch. of Klin. Med., t. IX, p. 591, 1872.) Foltz, Du lavement froid (Lyon Médical, janvier 1875).

therapeutic benefit whatever; nevertheless, a real benefit is derived, and you will see when we come to study the therapeutic applications of cold baths, that they produce a marked relief in many cases.

How are we to explain this difference between the result in theory and the result in practice? Simply in this way; the refrigerant applications in fever do not act merely mechanically in removing heat, but they modify profoundly, and often durably, the functions of the nervous system, and particularly of the vaso-motors, all of which, as you know, play so considerable a part in the production of the febrile process, and in this respect Currie seems to me to have rendered a better judgment concerning the action of the refrigerant medication in fever, than even Brand and his pupils.

The action of blood-letting as an antipyretic agent seems to me to belong to that of refrigerants generally, and this, because in withdrawing at a given moment a certain quantity of blood you withdraw also a certain quantity of caloric. Moreover, this antipyretic action produced by sanguineous losses, is one of the most real known, and it suffices to examine what takes place in patients who have had during the course of typhoid fever an intestinal hemorrhage of moderate intensity, to observe the manifest and durable effect of hemorrhages on thermogenesis.

The influence of hemorrhage on pyrexia is complex. The loss of blood has abstracted heat, it is true, but it has also modified the physico-chemical processes which take place in the interior of the tissues, and the functions of the nervous system have also been affected by it. These multiple affections manifest themselves on the elevation of the temperature in pyrexia by effects more enduring than those of cold baths, and we always observe this immediate fall in the febrile heat unless the patient dies in the hemorrhage.

Quite different is the action of the medicaments which constitute the second group of anti-febrile remedies, and their influence is explicable either by a direct action on the nervous system or by morbid changes effected in the blood.

Digitalis is a fair type of anti-febrile agents acting on the nervous system. I have before told you how digitalis acts in diseases of the heart, and the principles there established apply to its antipyretic influence. Hirtz is one of the most earnest partisans of the treatment of fevers by digitalis, and his followers have shown us the benefits which we may derive from this medicine in the divers febrile processes. You obtain from digitalis not only a lowering of the pulse, but also a very evident thermic depression. Nevertheless the precepts of the ancient school of Strasbourg have not been admitted by all, and it is only exceptionally that we see digitalis prescribed in fever; and this results from the fact that this remedy has a powerful emeto-cathartic action on the one hand, and on the other, it is not quite safe to prolong to any extent the action of such a drug in septic and infectious diseases where the heart is prone to undergo fatty degeneration.

It is this same action on the spinal cord and medulla oblongata which explains the anti-febrile effects of colchicine, aconitine, etc., but as in the case of digitalis this influence on thermogenesis is not obtained without serious incon-

veniences, by reason of the large doses which it is necessary to give and which are not without danger in the case of alkaloids as powerful as those which I have mentioned.

Quinine, whose physiological action I propose to explain more completely when I come to speak of the treatment of intermittent fever—quinine, which is one of the most powerful agents of the antipyretic medication, acts, as you know, not only on the nervous system, but also on the blood; in both modes influencing thermogenesis. This class of medicaments has lately assumed a preponderant importance, since the labors of Pasteur have shown us the important part which the proto-organisms have in the production of infectious and virulent diseases. Chemistry furnishes us under the name of the *aromatic series*, a group of bodies, phenols, or oxy-phenols, which all possess the property of arresting more or less completely the development of micro-organisms. These bodies, such as phenic acid, salicylic acid, kairine, resorcine, etc., were all first employed in the treatment of wounds, as a result of the radical change which Lister had just introduced into the dressing and manipulations of operative surgery; then the idea occurred to give these same *bactericide* medicines internally when there seems to be an indication to destroy the septic agents of disease, these being supposed to be bacilli

But the results were really unexpected, for if there were no direct proofs of the destruction of the micrococcus in the interior of the organism, a most marked antipyretic effect was obtained, and these bodies of the phenol series, became the most energetic agents of the anti-febrile medication.

It is, in fact, by employing the derivatives of this series, carbolic acid, salicylic acid, resorcin, kairine,* and especially with this latter, that we obtain the

* [Karine, thalline and antipyrine are three new antipyretics for which we are indebted to the industry of continental chemists in the application of the synthetical methods to the formation of new compounds. As for Karine, readers of the Therapeutic Gazette will find this antipyretic discussed in the volume for 1884, in the following pages: 46, 105, 95, 129, 142, 153, 164, 254, 313, 285, 335, 378. From Dr. Tangeman's article (Ther. Gaz. 1884, p. 105) we extract the following particulars:

Karine was discovered in 1883 by Fisher, of Munich; (its chemical formula is $C_{10}H_{13}NO$). Fisher has experimented quite largely on animals with thls drug, but Filhene has employed it very extensively on the human subject both in health and disease. Since then the subject has been thorougly studied by Seifert, Drasche and others. If it can be shown that this new antipyretic is equally as good as quinine much has been gained. That it is an efficient drug under certain circumstances nobody will doubt who has ever observed its effects. Two preparations are at present in the market: the sulphate and hydrochlorate of karine; the former is a crystalline substauce of a yellowish-white color, its taste is very unpleasant, and is not much of an improvement on some of the older remedies.

The study of the physiological action of this drug on animals has not produced very satisfactory results. On man in health it does not have any tendency to depress the temperature below normal; the hearts action is somewhat slowed, as is also the respiratory act. In disease its action is more marked. There is no condition in which karine does not manifest its antithermic action if given in sufficiently large doses. This does not say that it is indicated in all febrile conditions, or that its administration can safely be recommended in all cases.

There seems to be a great variance of opinion as to the proper dose of this drug by the different experimenters, but this may be only apparent. I think we can explain this differ-

most considerable depressions of temperature; you will often see the mercury fall two, three, and even five degrees in the course of a febrile state, and I propose in the next lecture to state more particularly the therapeutic effects of each of these substances. But I must tell you once for all that such depressions of temperature are not without danger, and that at the same time that we observe this thermal fall we observe also a general depression of the organism and multiple congestions in the different viscera.

Is it solely by their action on the blood that the medicaments of the aromatic series produce such powerful effects on thermogenesis? Is it only by opposing the progress and development of fermentations, the original cause of the febrile processes, that their antipyretic action is exercised? It is difficult

ence by carefully studying the physiological action of the drug. While its tendency is to reduce the temperature, in every febrile condition the state of the patient physically as well pathologically must be taken in consideration. Its main field of efficiency will undoubtedly be found in diseases where neither the heart nor the lungs are primarily affected; but where the fever is a long-continued pyrexia we may expect more, since its action does not in the least influence or abort the natural course of the disease. The safest method to administer this drug is to begin with a small dose and watch the effect with the thermometer until we have arrived at the correct and safe dose for that individual case—a dose that will keep the temperature at a point almost normal. In this manner we are able to better guard against collapse, and at the same time avoid the objectionable symptom of chilliness that is experienced by patients when the temperature rises again after a large dose of karine. Unpleasant after-effects are met with occasionally, but they are not dangerous to the patient; the remedy is one of the safest powerful antipyretics in our possession, if carefully watched. The adult dose generally varies from 0.3 to 1 and 2 grm. repeated every hour. The effect of a large dose is very rapid sometimes, 20 to 25 minutes being sufficient to cause a decline in temperature; but the effect passes off just as quickly. Therefore, the frequent repetition of the dose becomes necessary. It may range from 12 to 15 grm. per day given in 18 to 20 doses.

The drug is best administered in capsules on account of its bitter taste. My experience with karine has been limited, and in some respects differs from the results of other observers. Altogether I have used it in five cases.

"In many instances the patients absolutely refuse to take the medicine any longer, on account of the bad taste and nausea that it produces. The drug seems to be largely eliminated by the kidneys; it can be found in the urine 30 to 35 minutes after administration. Whenever there is a marked decline of temperature there is profuse perspiration. The drug may become quite valuable in diseases of the kidney, or in cases where a reduction of temperature and an elimination of poisonous material from the blood is desirable.

In rheumatism it has been given with excellent results. The action of karine subsides very rapidly, therefore frequent doses are necessary to maintain a permanent effect; the thermometer is our guide, which must be used frequently; upon the slightest chilliness a half dose should be administered. Absolute laws governing the dose and action of karine in all cases cannot be laid down. In feeble and decrepid individuals it must be given with considerable care, since it may, when given in large doses, suddenly produce collapse."

In the Therapeutic Gazette for February, 1885, is an able aditorial on the subject, from which we cite the concluding portion:

"Guttmann has given karine in cases of pneumonia, measles, phthisis, typhoid fever, scarlatina, pleurisy, peritonitis, erysipelas, ague, septicæmia, and apparently always with advantage. On the other hand, Dr. H. Menche's (of Rheydt) experience with it in the pyrexial stages of pneumonia, pleurisy, and pernicious anæmia was unfavorable, which has been attributed by others to the use of large doses. In rheumatism, he found that its use

to respond categorically to these questions, and without denying the action of these substances on the intimate processes which take place in the blood, I venture to affirm that we must attribute a part of their effect in lowering pyrexial heat, to their action on the nervous system, and particularly the vaso-motors.

In a recent communication to the academy of sciences, Prof. Gosselin has well set forth this action of phenic acid on the capillary net work, and he has shown us that when you apply locally to wounds lotions of carbolic acid, the antiseptic actions of these dressings result much more from the obliteration of

was followed by diminution of the pain, but not by any reduction in the swelling of the joints."

"The cases just reported demonstrate that karine possesses the power of reducing the temperature of the body in fever to an unusual degree, and that it does this with certainty and promptitude, and, it may be added, when moderate doses are used, with safety. One care, however, it is necessary to exercise in its administration, and that is to use fresh specimens of the drug only, as it undergoes change if kept for any length of time. It reduces the temperature much more rapidly than quinine, although the apyrexia produced by it is of much shorter duration than that caused by the latter. It is also capable of depressing the temperature during the evening exacerbations of fever, while the most marked results are obtained, on the other hand, from quinine just before the morning's remission. Its use is also free from some of the objections usually urged against the latter, as it does not give rise to unpleasant effects, such as headache, ringing in the ears, and the like. Although less rapid in its action than the cold bath, it is obvious that it may be administered in many cases in which resort to the latter would be impossible. The excitement and terror which are often occasioned by the use of the bath, even when it is brought to the bedside of the patient, constitute a positive objection to it, which, in the author's opinion, becomes insuperable in cases in which it is necessary to carry him some distance to a bath room. It is said to exert a marked and favorable influence over the brain-symptoms which occur in fevers, possessing, in this respect, an undeniable advantage over several of the other antipyretics."

Thallin has lately been successfully used in a large number of cases in the clinic of Professor Nothnagel. It has the constitution of a secondary quinoline base, being one of a number of quinoline derivatives prepared by Prof. Skraup, and is represented by the systemic name *tetrahydroparachinanisol*. The salts of this base, which have an acid reaction, are freely soluble in water and have the property of forming green compounds when treated with solution of ferric chloride, and oxidizing agents. On account of this peculiarity, the cumbrous systemic name has been dropped, in favor of the shorter designation, "thallin." The hydrochlorate tartrate and sulphate of thallin, and the hydrochlorate of ethyl thallin are the salts which have been employed, and these are said to show great antipyretic activity in doses of half and three-quarters of a gramme, a point in which thallin would seem to compare favorably with its competitors. It can be given in wafers, each containing a quarter or half a gramme. It causes a speedy and marked fall in the temperature which lasts several hours. (London Lancet, Dec. 6th, 1884, p. 1018.)

"In the fourth edition of my work" writes Dr. Dujardin-Beaumetz to me, under date, June 10th, 1885, "I have given special attention to antipyrine, karine and thallin. We now divide antithermics into three groups; those which mechanically abstract heat, and of which the cold bath is the type; those which act in the thermogenetic centres, of which the types are quinine, resorcin, salicylic acid, antipyrine, lastly those which act in destroying the respiratory power of the blood, of which karine and thallin are the types. There exists an intermediate class, constituted by phenic acid, which acts at once on the thermogenetic nervous centres and on the respiratory power of the blood."

I have appended to the lecture on Typhoid Fever a note pertaining to *antipyrine* in which the latest researches on this new medicament are detailed. This is the only one of the series of new antipyretics which is likely to come into favor.—TRANSLATOR.]

of all the capillary openings in the wound, than from the special destructive influence of carbolic acid on the virulent principles. Laborde has completed these researches in showing us that this capillary obliteration is due to an action of carbolic acid on the vaso-constrictors.

It is probable that like effects are produced in fever, and that phenic acid once introduced into the blood acts on the vaso-motor centres either directly or indirectly, and thus modifies the conditions of febrile thermogenesis. As you see, gentlemen, therapeutics confirms in a certain measure, the data furnished us by physiological pathology, and shows us the unbounded and preponderant influence of the nervous system on the febrile processes.

In the next lectures we shall make numerous and practical applications of the deductions which flow from this general survey, and you will see the importance of all these developments into which I have entered.

ON THE TREATMENT OF TYPHOID FEVER.

SUMMARY.—Typhoid Fever—Etiology—Spontaneity—Contagiousness—Theory of Typhoid Contagion—The Microbe of Typhoid Fever—The Virus of Typhoid Fever—Theories of the Contagion—Fecal Matters—Fecal Theories—Sewerage—Aliments—Overcrowding—Experimental Physiology of Typhoid Fever—Public Hygiene—Private Hygiene—Hygienic Treatment of Typhoid Fever—Alimentation—Æration—Cleanliness—Treatments of Typhoid Fever—Divisions—Antithermic Medication—Method of Refrigeration—Cold Baths—Brand's Method—Its Application—Its Results—Its Advantages—Its Disadvantages—Warm Baths—Refrigerant Apparatus—Cold Lotions—Cold Lavements—Antiphlogistic Method—Local Bloodletting—General Bloodletting—Antipyretic Medication—Digitalis—Quinine—Antiparasitic Method—The Aromatic Series—Phenic Acid — Salicylic Acid — Resorcin — Kairine — Evacuant Medication — Purgatives—Calomel — Mercurials — Tonic Medication — Alcohols — Cinchona — Exclusive Medications — Their Dangers — Expectancy — Treatment of Indications — Armed Expectancy—Bases of this Medication—State of the Forces—Intensity of the Fever—Treatment of the Complications—Nervous Complications—Pulmonary Complications—Abdominal Complications—Conclusions.

GENTLEMEN—There is, perhaps, no question in therapeutics which has caused so much discussion as the treatment of typhoid fever, and, if I were to follow out all the lines of inquiry which this subject has opened, I should require, not one lecture, but the entire course. I shall, then, be as brief as possible on points of theory, and dwell rather on practical conclusions. Whether you practise in the country or in the city, you will continually meet with cases of abdominal typhus. Last year (1882) you saw our wards filled with the victims of one of the most severe epidemics that have ever afflicted the population of Paris, and the hall of the Academy of Medicine stills rings with the passionate discussions which were raised by the various questions pertaining to this great problem of hygiene and therapeutics.[1]

Etiology, as I have often told you, has an important bearing on the treatment of disease; you recognize, then, the propriety of considering first the causes of typhoid fever; for, if they were absolutely known to us, we should be able henceforth to establish on a scientific basis the prophylactic treatment of this disease. This particular point in the study of dothinenteritis has been especially investigated during the last few years, and we shall have here to dis-

[1] Read the discussion which was held in 1882 and 1883 at the Academy of Medicine on typhoid fever ; a discussion in which the following gentlemen took part : Marjolin, Proust, Fauvel, Rochard, Lagneau, Léon Colin, Bouchardat, Gueneau de Mussy, on the part of hygiene ; Herard, Germain Sée, Dujardin Beaumetz, Peter, Jaccoud, Vulpian, Bouley, Glenard, on the part of therapeutics. (Bull. de l'Acad. de Méd., 1883.) Read also the discussion which took place at the same Academy in 1876 and 1877, and in which H. Gueneau de Mussy, Bouillaud, Brouley, Bouchardat, Jaccoud, Jules Guérin, Chauffard took part. (Bull. de l'Acad. de Med., 1876, 1877.) Read finally the discussion which was held at the Academy of Medicine *apropos* of the epidemic which broke out in Brussels in 1869, and where Martin, Coussot, Crocq, and Boens had the floor. (Bull. de l'Acad. de Méd. de Belgique, 1875, 1876.)

cuss the contagiousness and spontaneity of this affection. According to some authorities, typhoid fever is always the result of a particular contagion ; according to others, it comes from a miasmatic poison. You cannot be ignorant, gentlemen, of the difference which separates *contagium* from *miasm*, a distinction well established by Liebermeister ; *contagium*, coming from specific, morbific agents, which always take their origin and undergo development in a diseased organism ; *miasm*, on the contrary, being generated outside of, and independent of, an infected organism. To make more orderly and clear the exposition of this difficult subject, I shall commence with points which are best established and least open to dispute ; then I shall take up those which are most amenable to discussion.

To-day, everybody is agreed in admitting the contagiousness of typhoid fever. It is especially in our rural districts that this contagion is observed in its worst form, and every year the reports made to the Academy of Medicine on the prevalent epidemics contain facts establishing the contagiousness of this disease. We can go even further, and declare that to-day the active principle of this contagium has been determined. The principle is found exclusively in the stools of typhoid patients, and it needs but a very minute quantity of this pernicious element in potable water to communicate ileo-typhus to all who drink it. We possess, to-day, a considerable number of observations which establish this fact on an undisputable basis. The latest and most accurate is, assuredly, the observation published by Dionis des Carrieres, concerning the epidemic which lately devastated the city of Auxerre, where one of the springs which supply the city was proved to have been polluted by the dejections of a woman sick with typhoid fever.[1] The entire population which derived its drinking water from this source was infected, and there were few that did not suffer more or less; those parts of the city, however, which did not make use of this water, had entire immunity from the epidemic.

The attempt has been made by experiments on animals to elucidate this subject, but these have given uncertain results, and to the positive experiments of Birch-Hirschfeld, of Letzerich, and of Tizzoni, we must oppose the negative results of Robert Bahrd and Motschutkoffsky; moreover, the basic premise of these researches is under dispute, for it is not proved that the lower animals can contract typhoid fever.[2]

[1] Dionis des Carrieres, on an epidemic of typhoid fever which ravaged the city of Auxerre in 1882. (Bul. et Mem. de la Soc. des hôp., 1883, et Un. méd., 1883). [A similar epidemic prevailed this year (1885) in Plymouth, Pennsylvania, among those portions of the population that used water from a reservoir that was polluted by the dejections of a typhoid patient ; these fecal excreta having been consigned to the stream that fed the reservoir.—Tr.].

[2] In experiments made on animals, the hare is generally selected in preference to other animals, this animal being subject, according to Kuchenmeister, to an affection very similar to ileo-typhus; an affection characterized by augmentation (yet without ulceration) of Peyer's patches.

Birch-Hirschfeld, of Dresden, has experimented on animals with typhoid dejections, giving these to hares to eat. They succumbed at the end of from three to thirty days, and

But it is not enough to know that it is by the dejections that typhoid fever is communicated. Pathologists, guided by the theories of Pasteur, have sought in the dejections, and even in the tissues of victims of the disease, the microbe which contains the contagious principle. Unfortunately, we have not here any positive information; not because micro-organisms are not exceedingly abundant in the stools of typhoid patients, but because amid this abundance it is difficult to tell exactly which one of these microbes is the essential element of dothinenteritis.[3] It is generally known that Recklinghausen has found micrococci, Eberth, rod-like forms, and Klebs has described, under the name of *bacillus typhosus*, certain elongated filaments; but despite these researches, and those of Koch, of Meyer, of Friedlander, of Maragliano, of Almquist, we are

presented, at the autopsy, the characteristic lesions of Peyer's patches. Ordinary diarrhœal matters, administered to hares, did not produce any of these symptoms.

Jules Guérin in also experimenting on the same animals, and in injecting, under their skin, from one to two drachms of fecal matters, of urine, or of the blood of typhoid patients, has caused the death of the hares with symptoms similar to those of abdominal typhus.

Letzerich injected, in the subcutaneous cellular tissue of hares, distilled water, holding in suspension certain inferior organisms obtained by subjecting to repeated washings the stools of individuals dead from typhoid fever, and always determined a disease identical with typhoid fever. This affection commences always by the intestine, and induces ulceration of Peyer's patches. The same organisms develop also in the spleen, kidneys, and mesenteric glands.

Tizzoni, in an epidemic at Catana, injected in animals the organic insoluble matters extracted from drinking-water by filtration, and determined in them symptoms analogous to typhoid fever. The anatomical lesions of this experimental typhus are the result of the presence of numerous micrococci in the parenchyma of the spleen, and mesenteric glands.

But by the side of these favorable results we must note the contradictory experiments of Robert Bahrd, and of Motschutkoffsky.

Robert Bahrd, after injecting into the abdomen of hares from ½ gramme to 50 grammes of the fecal matters of typhoid patients, and causing them to live on a soil impregnated with these matters, obtained no results.

Motschutkoffsky, of Odessa, has made experiments with the blood and excrementitious matters of patients affected with typhoid fever, of syphilis, of rheumatism, and of recurrent fever, employing as his subjects, monkeys, goats, and even men. The results were negative as far as the first two diseases were concerned, positive only in the case of recurrent fever. (*a*)

[3] Recklinghausen was the first to find micrococci in the intestinal ulcers of typhoid patients.

Klein discovered the same micro-organisms in the intestinal mucosa, Sokoloff in the spleen, and Fischel in the lymphatic glands. In 1877 Feltz found figured ferments susceptible of culture in the blood of typhoid patients.

Eberth, in 1880, endeavored to isolate the micro-organisms of typhoid fever, but he found that this separation is very difficult. The same year, Klebs and his pupil, Epinger,

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(*a*) Birch-Hirschfeld, Untersuchungen zur pathologie des Abdominaltyphus (Klin. Wochens., No. 52, 29 décembre).—Jules Guérin, Expériences sur l'origine et la nature de la fiévre typholde (Compt. rend. acad. des sc., 26 février 1877).—Letzerich, Experimentelle Untersuchungen über typhus abdominalis (Arch. f. experiment. Path. und Pharm., Bd. XX, heft 3 et 4, p. 312, 1878).—Tizzoni, Studii di Pathologia Sperimentale sulla genesi e sulla natura del tifo abdominale (Ann. univ. di Med. e Chir., février 1880).—Robert Bahrd, Experimentelle Untersuchungen über die Uebertragbarkeit der Typhus abdominalis auf thiere (Arch. der Heilk., XVII, p. 156).—Motschutkoffsky, Experimentale studien über die im barkeit typhœses fieber (Centr. f. d. Med. Woss., 1876, No. 11).—Homolle, Revue générale sur la fièvre typoïde (Rev. des sc. méd., t. X, p. 681).

still ignorant of the real microbe of typhus abdominalis. In a word, the parasitic theory of typhoid fever is almost certain, but it has not yet been scientifically demonstrated in a rigorous manner.

As opposed to this doctrine of contagiousness, we must allude to that of spontaneity. Struck by the fact that typhoid fever exists endemically in all places where are accumulated a great number of individuals—as in our great city; moved also by the appearance of certain epidemics apart from all known contagion; comparing, moreover, the typhus of armies with the abdominal typhus of great cities, certain authorities have maintained that typhoid fever may be produced spontaneously under the influence of bad hygienic conditions; and the cause has been by turns assigned to fecal matters, overcrowding, spoiled alimentary substances, and even to certain bad geological conditions of the soil. Let us rapidly examine each of these points.

Murchison has been the chief defender of the first of these causes, and he has labored to show that fecal matters may spontaneously develop a miasmatic principle which, entering the human system, may engender there ileo-typhus. Between him and Budd quite a lively discussion arose; Budd maintaining that fecal matters were dangerous only when they were fouled by the dejections of a typhoid patient.[4]

These are the two so-called fecal theories of typhoid fever. It was, however, a mistake to confound these theories under one name, for if Budd's view

claimed that they had discovered the parasite of typhoid fever. The bacillus typhosus, according to them, when it is completely developed, is constituted by certain entire filaments $O\mu$ 50 in length, by $O\mu$ 2 in breadth. Experiments made on hares have demonstrated that the inoculation of these microbes determines symptoms similar to those of typhoid fever. Nevertheless, the attentive study of these observations does not prove that the animals really had typhoid fever.

Brautlecht has also found a microbe in typhoid fever, but which is quite different from the one described by Klebs.

According to Koch, micro-organisms of three different species have been found: micrococci, large and short rods (Eberth), and elongated filaments (Klebs). It is difficult, according to him, to determine the veritable infectious agents in typhoid fever. At the same time, the presence of these groups of rods in the internal organs has a real importance. W. Meyer, Friedlaender, Maraglano, Almquist, have also noticed the presence of the *bacillus typhosus*. (*a*)

[4] Budd has affirmed the following propositions:

1. Typhoid fever is a disease essentially contagious.

2. The irritant substance which produces the contagion comes almost exclusively from the intestine of the typhoid patient.

3. The cess-pools and the sewer-pipes, which are the direct continuation of the dis-

(*a*) Recklinghausen, Ueber den Abdominaltyphus (Wurtzburger Zeitung, 10 juin 1871).—Eberth, Die organismen in den Organen der Typhus abdominalis (Arch. f. Path. Anat. und Phys., LXXXI, p. 58). Neue Untersuchungen über den Bacillus des Abdominaltyphus (ibid., LXXXIII, p. 486)—Klein, On the enteric fever (Reports of the med. office of the Privy Coun. and local Government Board, 1875).—Sokoloff, Zur Pathologie der Acuten Miltztumors (Arch. für Path. Anat. und Phys., t. LXVI, 1876, p. 171).—Klebs, Der Typhus abdominales eine Schistomikose (Arch. f. sper. Path., 1880). Der Bacillus der Abdominaltyphus und der typhose Procets (ibid., XII, 1881, p. 381 et 399).—Koch, Mittheilungen aus dem k. Gesundheistamte, p. 45.—V. Meyer, Untersuchungen über den Bacillus des Abdominaltyphus (thèse de Berlin, 1881).—Friedlaender, Notiz ueber typhus bacillen (Dubois Reymond's Arch., 1881).—E. Maragliano, Pathogenese des Abdominaltyphus (Cent für Med. Wiss., 1882, No. 11).—Almquist, Typhoïds feberus. Bacterie, Stockholm, 1883.

be correct, Murchison's cannot be; for it is not yet rigorously demonstrated that fecal matters may spontaneously generate the typhoid poison. This fecal theory has served as an argument to the adversaries and to the partisans of the exclusive sewerage doctrine,[5] which condemns the fixed privy-vaults and the separate systems of removal, and insists that all night-soil shall be consigned to the public sewers, which shall be constantly flushed with running water—the latter, with its excrementitious products, being finally subjected to the filtering and purifying action of the soil. This whole matter of sewerage is not yet settled; yet despite the opposition in certain quarters, the majority of hygienists and civil engineers are of opinion that those cities which have the best system of sewerage are the best protected from typhoid epidemics.

I do not wish to enter into the details of this discussion, which would draw

eased intestine, are the constant source of the propagation of typhoid fever, by diffusing their noxious principles into the atmosphere, and the potable water sources.

4. But the contents of sewers, and the putrefactions there taking place, do not produce typhoid fever until there is mixed with them, at some period or other, real typhoid stools.

Murchison has, on the other hand, pretended that typhoid fever, an endemic disease, may arise independently of any previous case or contagion, from the fermentation of fecal matters, and perhaps from the fermentation of other forms of organic matters.

Biermer has studied the typhic poison. This poison, according to him, is of animal nature; it may be transported by the patient and by his clothing. The poison exists only in the dejections, and it is these latter which render the disease contagious whenever they are placed in favorable conditions. The air does not seem to waft the contagion, but it is surely and rapidly transported by the water of springs and streams.

Cousot has given especial attention to the typhogenous miasm. According to him, the contagia are living, and the theory of animated virus explains the anatomical and functional lesions of dothinenteritis. In his opinion, the virus does not develop in the blood, but in the lymphatic system, and especially in the ganglia, which are the principal, if not the only seat of the evolution of the contagion.

Bouchard rejects both the doctrine of contagion and infection; he considers the theory of fecal origin and that of spontaneous development as not proven. According to him, typhoid fever is a specific and miasmatic disease. (*a*)

[5] As for this question of sewers and cess-pools, it is worth the while to refer to the discussion which was held at the meetings of the Society of Public Hygiene, during the year 1883, and in particular to the discourses of Durand-Claye and Emile Trélat, advocates of the "*all for sewers*" system, and of Brouardel, Vidal, Duverdy, opponents of this system.

One may also appropriately consult the proceedings of the International Congress of Hygiene, which was held at Geneva in 1883, where this question was discussed in the sessions of the 5th, 6th, and 7th of September.

Warrant of Frankfort-on-the-Main, reporter, Smith of London, Hauser of Leipsig, Soyka of Munich, Bourrit of Geneva, have defended the advantages of the "*all for sewerage*" method. Van Overbeck de Meyer of Utrech, and Williem of Mons, have declared themselves partisans of the system of Liernur, which is characterized by the delivery of fecal matters in a system of closed pipes separate from the sewers.

The Technical Commission for promotion of the salubrity of Paris, adopted conclusions

(*a*) Biermer, Ueber entstehung und Verbrettung des abdominaltyphus (Samml. Klin. Vort., No. 53, 1873.—Cousot, Etude sur la nature, l'etiologie et le traitement de la fiévre typhoïde, Bruxelles, 1874.— W. Budd, Typhoide Fever, London, 1873.—Bouchard, Etiologie de la fiévre typhoïde, Congrès médical international de Genève, 1877.—Van den Schrieck (de Hal), Du virus typhoïde et de son rôle dons les épidémies, Bruxelles, 1875.—Pages, Etude clinique sur l'étiologie de la fièvre typhoïde, Paris, 1878.

us away from our subject. I shall only call your attention to the action of oxygen on all putrescent materials floating in sewers—an action which Fauvel has clearly shown in making it plain that this oxidation is a veritable combustion, which rapidly destroys the infectious element in night-soil; and we see in this an explanation of the fact that the South and East, despite their deplorable hygienic conditions, manage (by free exposure of their filth to atmospheric air) to keep tolerably free from epidemics. Although Rochard has affirmed that it would be easy to develop typhoid fever by the simple fact of massing people together in close quarters and under bad hygienic conditions, I believe that this overcrowding is a more powerful factor of typhus exanthematicus than of abdominal typhus. I make the same reserves in reference to the subject of alimentation as the determining cause of ileo-typhus. Wernich,[6] comparing the bacillus of typhoid fever with that of putrefaction, has ably maintained that the

rejecting both fixed and movable fossæ, and the "separative" or "diluent" apparatuses, and sanctioned the following resolution:

"The flow *in toto* of excrementitious matters by sewers may be authorized in sewers largely and constantly fed by running water, which does not allow an accumulation of sand and dirt, and in which these effete matters shall be carried without obstruction or delay to the terminal distributing depot."

The sewer waters carrying excrementitious matters, ought to be submitted to the process of purification by the soil. This purification may take place without danger to the public health. (*a*)

[6] The bacillus of typhoid fever being, according to Wernich, very similar to the bacillus of putrefaction, may be only a variety of the latter under peculiar circumstances of culture. Starting from this principle, he proposes the following distinctions between the typhoid fevers:

1. The typhoid fevers by contagion which are due to the introduction of the bacillus and of spores from typhoid subjects.

2. The typhoid fevers occasioned by aliments in the processes of decomposition. These fevers are determined by the bacteria of putrefaction which are found in unhealthy or spoiled meat.

3. The endemic typhoid fevers due to putrid emanations of sewers, marshes, in a word, to the products of organic decompositions set free from the soil.

4. Idiopathic typhoid fevers: an alimentation exclusively animal in too great abundance and especially the bad digestion of such food, determine in the stomach the putrefaction of the latter, and from this cause the presence of the bacillus of typhoid fever.

With respect to treatment, there are two indications to fulfill, the causal indication and the symptomatic indication. With respect to the causal indication, it varies with the symptomatic indication. The typhoid fevers due to spoiled food, or to too abundant alimentation, demand the employ of purgatives, of calomel, and the internal use of antiseptic substances. The fevers due to contagion and endemic influence are tributary to treatment by quinine and salicylic acid. Idiopathic typhus claims purgatives and a strict dietary regimen.

The symptomatic indications ought to be fulfilled by an alimentation from which should be excluded albuminoid or azotized substances, such as meat, eggs, milk, substances in which the bacillus develops with greatest facility; for drinks, pure water, or spirits and water, are recommended. (*b*)

(*a*) Société d'hygiene publique et professionnelle, 1882.—Congrés international d'hygiène, Genève, 1882.—Travaux de Paris, commission technique de l'assainissement de Paris, 1883.

(*b*) Wernich, Studies and Observations of Typhoid Fever (Zeitsch. f. Klin. Med., IV and V).

use of spoiled meats is a cause of typhoid fever. It has also been asserted that the use of water polluted by organic detritus, and that even milk contaminated by water of bad quality, might also be a cause.[1] I consider all these circumstances as adjuvants; but no one of them alone seems to be sufficient as a determining cause of this disease. It is the same with geological conditions. The doctrine which is supported by Pettenkoffer and Buhl, attributes epidemics of typhoid fever to a lowering of the stratum of subterranean water. Observations have in fact demonstrated that if this theory is conformable to what has been observed at Munich, it is not applicable to epidemics in other parts of Europe.[2]

As you see, gentlemen, it is not yet proved that any of the causes just alleged may spontaneously give rise to typhoid fever; and I am ready, for my part, to give my adhesion to the parasitic theory of this affection. It is true that this doctrine of *contagium vivum* denies all spontaneity, but it enables us to explain—thanks to the theory of vaccination (or, if you prefer so to put it, of

[1] It is in England that attention has been especially called to milk as an agent of contagion in typhoid fever. Hart, Russel, Cameron, Button, Murchison, have observed epidemics developed by the use of milk brought from a farm or habitation where were dwelling patients affected with typhoid fever. (*a*)

[2] In 1865, Buhl remarked that at Munich a large mortality from typhoid fever coincided constantly with the lowering of subterranean water level. On examining, by the aid of statistics, the mortality of typhoid fever, Pettenkoffer found there complete confirmation of the opinion put forth by Buhl, and declared that "these mountains (meaning typhoid fevers) coincided with the valleys" (meaning lowering of the stratum of subterranean water)—a somewhat picturesque expression. Thus it is, for example, that in 1872 there were observed at Munich, in January, 60 deaths from typhoid fever, the level of the waters of the wells being $4\frac{1}{3}$ metres below the surface, while only 18 deaths were observed during the month of July, when the level of the well water was only $3\frac{7}{10}$ metres.

Different explanations of this fact have been given. According to some, when the level of the water-bed is lowered, the fermenting detritus which impregnates the upper strata of the soil soaks, as by a natural drainage, into the wells and reservoirs of drinking water, carrying with it germs from the stools of typhoid patients, issuing from sewers badly calked, and fouling the water destined for alimentation. When the level of the underground water, on the other hand, is higher, as, for instance, after rains, the organic detritus of the soil is diluted and bathed with water constantly renewed, which stops further fermentation. This theory is still defended by Liebermeister, Buchanan, de Renzy, Hoegler, and Geissler.

Buhl and Pettenkoffer do not take this view. According to them, when the waters are low, miasms are disengaged from the soil, and gain the atmosphere. The air of the miasms being generally warmer than the exterior air, acts in rising the part of a cupping apparatus, and aspirates, as it were, the germ-laden water from the soil, and this takes place the more readily since the barometric fall, which almost always coincides with the lowering of the subterranean water-bed, facilitates this gaseous liberation. Pettenkoffer adds that it is, in his estimation, probable that since the respiratory surface is larger than the digestive surface, the typhic poison behaves after the fashion of some other infectious poisons, and is absorbed by the respiratory rather than by the digestive passages. The dispute is far from being terminated between the partisans of the first of these theories (infection by water) and those of the second (infection by the air of the soil). Moreover, the basis of

(*a*) Hart and Corfield, Medical Times and Gaz., april 1873.—Russell, Glasgow Med. Journ., april, 1872.—Cameron, Dubl. Journ. of Med. Sc., november 1873.—Bütton, Lancet, september 1873.

preservation by attenuated virus), it enables us, I say, to explain the immunity of typhoid patients from all future attacks of the disease. It enables us, also, to understand the comparative immunity of individuals who have long lived in Paris as contrasted with those who have lived there but a short time; the first having acquired, by long exposure to the virus, constitutional modifications which prove a relative protection.

It enables us, moreover, to hypothesize atmospheric or telluric conditions, favoring in some degree the culture of germs of the typhoid contagion, without being compelled quite to indorse the explanation which Ernest Besnier has given of the march in accordance with seasons of the dothinenteric epidemic.[3]

But, on the other hand, this theory of living contagium leaves in obscurity many points in this interesting part of etiology, and in particular the epidemic character of this affection, and the special features which distinguish each epidemic—circumstances which render so difficult the application of statistics to the study of the therapeutics of typhoid fever. Nevertheless, despite these reserves, I adopt the theory of contagium rather than that of miasm.

From the facts which I have just set forth, flow very important hygienic applications, some concerning public hygiene, into the consideration of which I shall not enter, others concerning private hygiene, and which in their totality constitute the hygienic and the prophylactic treatment of typhoid fever. As it seems to be absolutely proved that the typhoid virus is found in the fecal matters of persons suffering from the disease, and that water polluted by these dejections is the most powerful factor of the contagion, it follows that it is a duty thoroughly to disinfect these alvine dejections, and the objects which they have polluted. It follows, also, that one should have a careful surveillance of potable water, and, if not certain of its purity, such water should be boiled before

the discussion is far from being indisputable, and Dr. Albin has well said that the exceptions to the aphorism of Munich (Münchener aphorism) are so many that one may almost maintain the contrary aphorism, *i. e., to a rise in the subterranean water-level, corresponds an elevation in the number of typhoid cases.* Similar cases have also been noted by Liebermeister, Ruitmeyer, and Louis. (*a*)

[3] Ernest Besnier has formulated the following laws, basing himself upon the march of typhoid fever these last two years in the hospitals of Paris :

Typhoid fever prevails according to seasons. It finds a habitat in every soil where man dwells, but France is its favorite seat.

In Paris typhoid fever reigns permanently. It carries off every year 1200 of the Parisian population, a mortality which supposes from 7000 to 10,000 typhoid cases in Paris each year.

Of 100 deaths, there are 17 in the spring and 37 in the fall. In July and August the mortality rises suddenly to descend in November and December, and reach its minimum in June.

Such is the law ; there are few exceptions, and these do not materially change it (*b*).

(*a*) Buhl, Eine Beitrag zur Œtiologie des Typhus (Zeitsch. für Biol., 1865, B. I, p. 1).—Pettenkofer, Ueber die Schwankungen der Typhussterblichkeit in München von 1850, bis 1857 (Zeits. für Biol., 1868, et Ueber die Œtiologie des Typhus, München, 1875. — Liebermeister, Deutsch. Klin., 1866. — Buchanan, Lancet, janvier 1873.—De Renzy, Lancet, juin, 1873.—Hoegler, Deutsch. Arch., 1873, t. XI, 257.—Geissler, Bericht über den typhus.—Liebermeister, Handb. von Ziemss., 1854, p. 73.—Albin, Zeitsch. f. Epid., 1874, p. 270.

(*b*) E. Besnier, Comptes rendus de la Société des hôpitaux, from 1865 to 1883.

being used, or some of the table waters should be employed, such as Apollinaris. Moreover, I refer you in this connection to the instructions issued by the Council of Hygiene, of which I am a member, concerning the measures to be taken to stay the progress of the epidemic of typhoid which raged over this city in 1882.[1]

So much for the prophylactic treatment. The hygienic treatment is of capital importance, and the more you see of this disease the more you will appreciate its importance. Under this head I shall examine, successively, the dietary regimen, the measures to promote cleanliness, and the care of the sick-room.

For the severe and cruel regimen of Broussais, who opposed feeding fever patients, we now substitute the administration of nourishment as a necessary part of the treatment, and no disease so markedly shows the advantages of generous alimentation. You must, then, feed your typhoid patients; but, remembering the disease of which the digestive tube is the seat, you should exercise great care in the choice of nourishment, which should be chiefly liquid; and every substance should be prohibited which might become a source of

[1] These are the rules adopted October 19, 1882, by the Council of Hygiene and of Salubrity of the city of Paris, concerning the precautions to be taken in the event of the occurrence of typhoid fever:

When a patient is found to be affected with typhoid fever, it is well to adopt the following hygienic measures:

1. *Isolation.*—The patient must be isolated as much as possible from the other inmates of the house.

If the situation does not permit sufficient isolation, it is better to remove the patient to the hospital.

If the patient remains at home only those persons should be allowed to enter his room who are necessary to give him the requisite care; and all children and youths should be rigorously excluded.

All nurses and attendants should be required to bathe themselves with carbolic water (2½ drachms to a quart of water).

2. *Aeration of the Sick Room.*—The sick room ought to be well ventilated. All tapestry, window curtains, and carpets should be removed. The bed should as far as possible be placed in the middle of the room. All the dejections of the patient before being carried out of the chamber to the privy should be completely disinfected by a solution of chloride of zinc (50 grammes—about 1¾ oz.—to the quart of water). This solution should also be employed in thoroughly cleansing the cloaca every time that the dejections are thrown into it.

3. *Disinfection of the Clothing*—All the body clothing, all the bed clothes, that have been used about the patient, ought before being taken from the sick room to be soaked in a solution of phenic acid (5 drachms to the quart of water); they should then be immediately given to the washerwoman.

4. *Purification of the Room.*—After the recovery or death of the patient there should be placed in the sick room, on a bed of sand, an iron kettle containing red hot coals, upon which should be thrown a quantity of sulphur proportional to the capacity of the rooms—5 drachms to every cubic metre. The room should be thus thoroughly fumigated, and should remain closed for 24 hours.

This having been attended to, the bedding and clothing in this room should be cleansed with the greatest care.

The room should be thoroughly washed with carbolized water (5 drachms to the quart), and it should not be occupied till after having been aerated for at least one week.

irritation in the alimentary canal. Give your patients, then, milk, broths, well-strained gruels, and stimulating drinks, such as wines and vinous lemonades. These beverages constitute the only drinks permissible. I make exception of plain lemonade, which, without possessing any marked anti-febrile properties, is always refreshing to fever patients.[1] When there exist gastric disturbances, and you wish to support the patient, you may give iced champagne. It is generally a good thing to add ice to the ordinary drinks of the patient.

But the time when you should redouble your watchfulness is when you come to the convalescing period of the disease. During convalescence, the patient either has a ravenous appetite or he has no appetite at all. Where appetite exists and is imperious, you will have to exercise rigorous care in prohibiting too free indulgence in all kinds of food. For my part, I have three or four times in my life seen convalescent patients die from excessive eating. I remember well a patient in the Hôtel Dieu, where I was attending, who was convalescing from a very severe attack. He went out of the hospital, and the first thing he did was to help himself to a hearty meal. The next day he came back to the hospital with all the symptoms of peritonitis, from which he died. The autopsy revealed an intestinal perforation. You should have such facts always in mind when you direct the dietary of fever patients during their convalescence, and although the instinct for food at such times is a natural one, the utmost judgment is required in its gratification.

In other cases, there are anorexia, vomiting, and dyspepsia; symptoms which, as our colleague, Anatol Chauffert,[2] has well shown in his thesis on the

[1] The lemon (citrus limonum) is of popular use among the Arabs in intermittent fever. The therapeutic properties of the lemon were especially vaunted by Mohammed, and the Arab physicians have added but little to what he has said. Moreover, Ishac-Ibn-Amraw says that the decoction of the pulp of the lemon is especially advantageous in fever. In Greece the lemon is, likewise, employed as a febrifuge ; and in Guadeloupe they make use of the powder of the bark of the citrus root in fevers.

Maglieri, in Italy, has made trials of this fruit in malarial fevers, and has found a decoction of the lemon to be beneficial. He thinks it even superior to preparations of cinchona. This is the way that Maglieri prepares the decoction : The fresh lemon is cut into small slices, and infused in three teacupfuls of hot water down to one cupful, strained, and expressed through a linen strainer, and cooled in the open air.(*a*)

[2] Cruveilhier has called attention to congestions and hæmorrhages of the gastric mucosa in patients affected with typhoid fever. Others have noted erosions of the stomach, and such instances will be found mentioned in the works of Louis, of Jenner, Rilliet and Barthez. Hamerinsk has observed fibrinous exudation in the pyloric region. Millard, Josias, Collingwood have noted similar cases.

Chauffert has united all these facts under the name of "gastric degenerations of typhoid fever." The gastric alterations are characterized especially by lymphatic lesions of the stomach, constituting veritable confluent abscesses, by vascular stases and by degenerations of the gastric glands. All these lesions manifest themselves by vomiting and by pain in the region of the stomach. (*b*)

(*a*) Bertheran, *Du citron dans les fièvres intermittentes* (*Journ. de méd. de l'Algérie*, août 1883, p. 177). —Maglieri, *Giorn. di clinica e terapia*, mars 1883.—Cazin, *Traité des plantes médicales indigènes.*

(*b*) Studies on the gastric determinations of typhoid fever. Thèse de Paris, 1832.

gastric complications of typhoid fever, depend on the alterations which the gastric mucous membrane has undergone from the typhoid process. Here we must apply all the measures which are addressed to the treatment of ulcerous gastritis—a diet of pure milk, which gives rest to the enfeebled stomach, milk punch with meat powder; this is an excellent way of giving this highly nutritive preparation.[1] It may, finally be necessary to resort to lavage of the stomach and to forced feeding.

It is not enough to support your patients; there must be the most scrupulous care about cleanliness, and it will not do to allow them to be defiled by their urine or alvine dejections. In the curious and interesting narrative which Dr. Stewart has given of his personal experience in an attack of typhoid fever, he alludes to the disagreeable sensations which the delirious patient suffers from the wet, soiled underclothing in contact with his body, as well as from intense light and loud noise. You can promote this cleanliness of the person and the healthy action of the skin by frequently bathing the entire surface with cold or tepid water containing a little thymol or antiseptic vinegar. These lotions not only keep the patient clean, but they also lower the temperature and diminish that sensation of heat and dryness so painful to fever patients. These antiseptic spongings should be repeated two or three times a day.

As for eschars and ulcerations of the skin, they may be prevented by frequently changing the position of the patient, who must not be allowed to lie all the time on his back; and it is always a good plan, where the patient can afford it, to have the bedclothes upon which he lies made of silk instead of cotton, or else to provide him with a water bed.

Your attention ought to be called to the condition of the mouth and throat of these patients—a matter of considerable importance.[2] You should urge the attendents several times a day to cleanse the teeth and gums of the sordes which collect upon them, and you must insist that they keep the tongue moist; there is nothing better for this purpose than the alkaline waters of Vichy and Vals. This dryness of the tongue is one reason why it is so hard for the typhoid patient to talk, and you can only rid him of this inconvenience by cleansing applications and gargles.

You have seen the great importance which is placed on disinfecting the stools of typhoid patients. These dejections, besides the contagious principle

[1] Meat grog is made in this way: Into an ordinary bowl you place two teaspoonfuls of meat powder and add two tablespoonfuls of old rum, which may be sweetened to the liking. Mix thoroughly together and pour on sufficient cold milk to make a thin liquid mixture.

When the patient cannot bear the alcohols, you dissolve the meat powder simply in milk, sweeten the whole with sugar, and flavor with vanilla.

These mixtures may be varied to an indefinite extent, but the essential condition is to administer them cold.

[2] Nelter, of Nancy, has supposed that the typhogenous miasm penetrates by the mouth and nasal fossæ, and that by its progressive march it determines successively bronchitis and diarrhœa. One may, according to him, by constant cleansing of the buccal and pharyngeal cavities, destroy the miasm and arrest on the spot the typhoid fever. (*a*)

(*a*) Nelter, Gaz. des hôp., 1873.

which they contain, have a marked gangrenous odor, which poisons the room of the patient; there is, then, a double necessity for prompt disinfection. You can accomplish this by allowing the fecal matters to be passed in a vessel containing a certain quantity of a two-per-cent. solution of the sulphate of zinc, copper, or iron, and in taking care also to cleanse with the same solutions all water-closets receiving these dejections. Lavements—and I speak here only of disinfectant lavements—have also the same object. One of the best and most inoffensive is that recommended by Bouchard, and which consists of a mixture of powdered charcoal in water, in the proportion of two or three spoonfuls to the pint. These lavements cause no trouble, and have the advantage of destroying the nauseous smell of the fecal matters.

You should also examine with great care the urinary functions of your patients. You know, in fact, how frequent is retention of urine in typhoid patients, and that, in consequence of the delirious condition in which they are plunged, they are frequently unable to express their natural wants. You should, then, frequently examine the abdomen, and resort to catherization when you find that the bladder is not thoroughly emptied.

It is not everything to have directed the alimentation of your patient, to have minutely indicated all the pains that should be taken for cleanliness and disinfection; you must also furnish indications no less precise concerning the ventilation of the sick-room. You should choose a room which is well aired and ventilated, and place the bed of the patient in the middle of this room; the bed should be narrow, moderately elevated, and divested of curtains and all canopy, so that the attendants can readily and rapidly wait on the patient. If in your power to do so, you should choose two rooms adjoining each other, so that the patient may alternately be transported from one to the other. You should allow but a modicum of light to enter this room, and no lamp should be kept burning in the night-time. Strong light is painful to the typhoid patient and favors the delirium. But few persons ought to remain in the room; one commonly suffices. Urge on the attendants the importance of keeping silence, and if they must converse, let them do so in an undertone. Stewart, in the narrative of which I have just spoken, dwells much on the painful sensations which he experienced when loud conversation was going on in his room.

Generally, the delirious manifestations do not acquire a high intensity; nevertheless, there are cases in which there exists a veritable delirium of action, and which necessitates forcibly keeping the patient in his bed. It is best in these cases, as far as possible, to accomplish this by the aid of the persons who attend the patient, and not resort to rigorous measures of restraint, such as the strait-jacket, unless other means fail. By the strangulation which it imposes, by the absolute and continuous dorsal position which it necessitates, by the pressure which it exerts on the thorax—the strait-jacket favors the visceral congestions so frequent in this fever, and may even be a cause of death, as I have several times witnessed in my hospital service.

Apropos of this typhoid delirium, and without departing from the hygienic ground which we now occupy, I cannot too much recommend you to cut the hair of your patients, especially in the case of young females, who are apt to

have long, thick hair. This is the more needful where there is much mental disturbance. I have often observed considerable improvement in the delirious manifestations by cutting the hair; and this cannot be much of a sacrifice to patients who reflect that their hair will all fall out in the course of convalescence.

You will, perhaps, think, gentlemen, that I have gone into too many little details about the hygienic management; but all these points have their importance, and I can affirm that typhoid fever well nursed is half cured. The necessity of careful attention to hygiene is exemplified in the difference in mortality which obtains between hospital and private practice; for in our hospitals we are not able, by reason of the peculiar conditions in which we are placed, and especially from want of sufficient nurses, to apply these hygienic rules as thoroughly as we would like. Therefore, I earnestly recommend you in your private practice to attend scrupulously to the minor as well as the major details of hygiene. How many severe typhoid cases have I seen which owed their recovery to these hygienic means alone, and to the faithful services of some friendly attendant—rendered with that devotion and that self-sacrifice which are only to be found in the bosom of the family!

I pass now to the proper medical treatment of the disease. I shall commence by reviewing the different kinds of treatment which have been in vogue; then we shall examine the approved medicinal measures, and the indications for their employment during the regular course of the fever and during the complications.

The different kinds of treatment of typhoid fever may be arranged in three principal groups. In the first, it is the fever alone which demands attention; in the second, it is the typhoid poison or miasm which is to be combated; in the third, it is empiricism which has directed the treatment. Hence we will examine successively the antipyretic treatment, the parasiticide treatment, and the empirical treatment.

We find in the antipyretic medication the same divisions as in the previous chapter, viz., we shall have to examine successively refrigerants and antipyretics. Refrigerant medication has found in the treatment of typhoid fever one of its principal applications, and we shall have to study here, cold baths, tepid baths, refrigerant apparatus, cold affusions, and lavements.

There is no question in therapeutics which has of late years provoked more vehement discussion than that of the application of cold baths to the treatment of typhoid fever; and this method to which Brand has justly given his name, for he it is who has furnished it with a rigorous and mathematical formulation, has been attacked and defended by resolute adversaries and determined partisans. I myself have taken part in this debate, and I am going to set forth as impartially as possible the advantages and disadvantages of this method.

Brand has thus formulated the treatment by cold baths: "You must administer baths of 64° to 68° F. of fifteen minutes' duration, from the fifth day of the fever; these must be repeated day and night every three hours, as long as the temperature of the rectum exceeds 102° F." In applying rigorously this method, so simple in appearance, Brand considered himself warranted in af-

firming, *that every case of typhoid fever treated regularly from the beginning by cold water, will be exempt from complications, and will get well.*

I shall not here enter into the details of Brand's method, details which pertain to the manner in which the patient should take the bath; and I refer you in this regard to the minute directions which Dr. Chapuis has given in his thesis (Paris, 1883), and which are founded on the technics in usage in the hospitals of Lyons.[1] Lyons is, in fact, the only city in France where Brand's method is used in all its rigor, under the persevering efforts of Dr. Glenard, who, during his captivity at Stettin, had an opportunity to witness the results which Brand was obtaining. Dr. Glenard must congratulate himself on the success which has attended his persevering efforts, for we see almost complete unanimity in the hospitals of Lyons in reference to the refrigerant medication.[2]

[1] This is how, at Lyons, Brand's cold bath treatment is carried out: The baths are not given at the bedside of the patients, but they are carried into a special bath room. The transportation is made on arm-chairs provided with wheels and well padded with rubber cushions. The windows of the bath room are closed at all times, even in the summer. The door is also kept tightly shut during the period of immersion in the water.

As soon as the patient enters the bath, the nurse gives him a cold affusion on the head with water from 43° to 46° F. This water has been cooled with ice; the temperature of the water in the bath varies from 64° to 68° F. If the delirium is intense, the affusion is of longer duration, and the water is projected from some height; during the whole duration of the bath the attendant looks out that the patient is kept immersed up to his neck in the water of the bath tub; not even the shoulders are to be allowed to remain out of the water. Frictions are made up and down the upper limbs and over the chest; this massage is especially useful in the case of patients that are cyanosed. When first the chill becomes imminent (which generally happens at the end of ten or twelve minutes) the patient is vigorously rubbed, and a few mouthfuls of wine are given. The bath lasts ordinarily about fifteen minutes in the case of adults, and six to eight minutes in the case of children. Before leaving the bath, the patient is subjected to another affusion of ice-cold water; this being over, he is wrapped up in a dry sheet and covered with a warm woolen blanket and returned to his bed without being wiped. The patient is then given some soup and several spoonfuls of wine; but Brand's recommendation is not followed out, viz., to give the febricitant a few swallows of cold water every quarter of an hour; it is considered better to let him rest. In cases where the meteorism is very marked, compresses of cold water are applied over the abdomen, and kept there permanently.(*a*)

[2] It was Glenard who first, in 1873, introduced the method of Brand into the service of Faivre, physician of the hospital of La Croix Reusse. This physician having been made prisoner in 1870, had been able personally to observe, during his captivity at Stettin, the results obtained by Brand. From July, 1873, to January, 1874, of 53 typhoid patients treated in the service of Faivre by the method of Brand only one died. The mortality by the other methods for the same year was 26 per cent.

During the epidemic of 1874, an application of this treatment was made on a large scale, and in a series of 228 patients treated by cold water, it gave a mortality of 19 per cent. 229 other typhoid cases treated by the ordinary method gave a lessened mortality of 10 per cent.

A report made by Molliere *apropos* of Brand's method, covering 150 cases of typhoid fever treated at Lyons, furnished a mortality of 9 per cent. for the patients treated by Brand's method, and 5 per cent. for the patients treated in the ordinary way. Although the

(*a*) Chapuis, Typhoid Fever and Cold Baths at Lyons. (Thése de Paris, 1883.)

It is upon statistics that the partisans of this method base their arguments almost exclusively. Jaccoud, from a review of more than eighty thousand cases, arrived at an estimate that the average mortality in typhoid fever was 19.23 per cent.[3] On the other hand, taking as a point of comparison the military hospitals, and in reckoning under a common title the continued fevers and typhoid fever, a mortality of 14 per cent. is obtained. The application of Brand's method has caused a considerable fall in the percentage of deaths, since, out of 30,000 cases treated by cold baths, there was a mortality of only

report was not accepted by the Medical Society of Lyons, it had an unfavorable influence on the adoption of the cold bath system, which was abandoned from 1877 to 1881. In 1881 the method was again taken up, under the influence of Bouverel and Raynaud, and it has since then furnished results so satisfactory that 22 hospital physicians out of 24 have sent to the Academy of Medicine a declaration, stating that they are partisans of Brand's method of treating typhoid fever, with the experimental conviction that this method, regularly applied from the onset of the disease, considerably lowers the rate of mortality. They aver that they employ it in their families, in their hospital service, and in their private practice.

The two physicians of the hospitals of Lyons who have not adopted the cold bath system are Teissier and Bondet. The first has obtained with the ordinary methods a mortality of 7.89 per cent. As for the second, in comparing the mortality of typhoid fever in the civil hospitals where Brand's method is carried out, and in the military hospitals, where recourse is had to other treatments, he has found that with respect to the first, out of 2609 patients the mortality was 15 per cent., while with respect to the second, out of 3471 patients the mortality was only 13.50 per cent.(*a*)

[3] Jaccoud has gathered statistics bearing on a total of 80,149 cases of typhoid fever, and producing a mortality of 19.23 per cent.

In the French army the mortality for the year 1876 was 45 per cent., and for the years 1875 to 1879, 37.41 per cent. If you add to the figures of typhoid fever those entered as continued fever (as Colin urges), the mortality then falls to 14 per cent.

Brand, in his statistics of 335 patients, claims a mortality of only 4.6 per cent. Only, while 211 patients of the civil statistics (private patients) have furnished no deaths, 124 patients treated in the hospital have given a mortality of 12 per cent. In bringing together statistics representing 8,141 cases where his method has been applied, the writer arrives at a mortality of 7.4 per cent. in the hospital wards.

Glenard affirms that the mortality of the cold water treatment, taking as the basis of his calculation 30,000 cases of typhoid fever treated in France and Germany, falls to 9 per cent,; while in certain military Pomeranian hospitals the mortality is not more than from 1 to 2 per cent.

The results obtained at the civil hospital of Munich, from 1868 to 1875, where Brand's method has been applied in all its rigor, in 2,223 cases have given, according to Ziemssen, a mortality of 9.2 per cent., and at Zaubzer a mortality of 8.8 per cent. These figures come very near to those given by Brand himself.

Strube, physician in chief and director of the health department in Prussia, affirms that in the military hospitals of the commandery at Stettin, constituting the second corps of the army, the mortality falls to 8.7 per cent. where the method of Brand is rigorously applied;

(*a*) Glenard, Du traitement de la fièvre typhoïde par les bains froids à Lyon, de juillet 1873 à janvier 1874 (Lyon méd., 1874).—Humbert Mollière, Rapport sur le traitement de la fièvre typhoïde par la méthode de Brand (Lyon méd., no 42 et 43, 1876).—Mayer, Résultats comparés du traitement de la dothienentérie par la méthode de Brand et par les méthodes ordinaires (Un. méd., novembre 1876; Lyon méd., no 51, 1876.)—Bondet, la Fièvre typhoïde el les bains froids à Lyon pendant l'épidémic de 1874 (France méd., juillet 1874).—Edmond Chapuis, la Fièvre typhoïde et les bains froids à Lyon (thése de Paris, 1883).—Bondet et Teissier, Acad. de méd., décembre 1882.

nine per cent., and in the case of the military hospitals, of only seven per cent., or even less; and, if we may rely upon the figures furnished by Abel, physician in chief of the second corps of the Prussian army in Pomerania, the mortality was reduced to nothing.

What is the real value of such captivating figures as these? You know already my opinion concerning statistics as applied to therapeutical results—I expressed them very clearly while on the treatment of pneumonia—I have not

while in the thirteenth corps, where this method is not adopted, the mortality is 31 per cent. He claims that a whole battalion may thus be saved every year to the army, and, in three years, a regiment.

Abel, physician to the second corps of the army in Pomerania, goes still farther. According to the statistics which he has collected, the mortality of 15.9 per cent. before the adoption of Brand's method has fallen to 0 since the adoption.

Schmidt, of Erlangen, at the same time, has presented statistics of treatments by cold baths, which are as follows:

	Mortality.	
From 0 to 15 years.....	0 per cent.	19.6 per cent.
,, 16 to 30 ,, ...	10.1 ,, ,,	
,, 31 to 45 ,, ...	29.1 ,, ,,	

Goltdammer, who rigorously applies Brand's method to the treatment of typhoid fever at the Bethany hospital of Berlin, has furnished the following statistics.

Years.	Cases.	Deaths.	
1868	220	23	10.4 per cent.
1869	182	20	11.9 ,, ,,
1870	126	14	11.1 ,, ,,
1871	186	22	11.8 ,, ,,
1872	350	40	11.4 ,, ,,
1873	239	27	11.3 ,, ,,
1874	245	45	18.3 ,, ,,
1875	333	56	16.3 ,, ,,
1876	205	29	14.1 ,, ,,
1868-1876	2,086	276	13.2 ,, ,,

These statistics continued by his assistant Gesenius, until 1881, give the following results:

Years.	Cases.	Deaths.	
1877	236	35	14.0 per cent.
1878	160	23	14.4 ,, ,,
1879	159	18	11.3 ,, ,,
1880	289	47	16.3 ,, ,,
1881	210	24	11.4 ,, ,,
1877-1881	1,054	147	13.9 ,, ,, (a)

(a) Jaccoud, Traitement de la fièvre typhoïd [Fac. de méd., 28 et 30 novembre, et Acad. de méd., 1883].—Colin, Traité des maladies épidémiques et recueil des mémoires de médecine militaire, janvier, 1882, et Acad. de méd., séance du 23 janvier, 1883.—Brand, Die Hydrotherapie des Typhus, Stettin, 1863; Die Heilung des Typhus, 1868; Die Wasserbehandlung der Typhoesen Feber, Tubingen, 1877, p. 280 et 281.—Frantz Glenard, Sur le traitenent de la fièvre typhoïde par les bains froids [Acad. de méd., séance du 9 janvier, 1883].—Du traitement de la fièvre typhoïde par les bains froids à Lyon, juillet, 1875, janvier, 1874 [Lyon méd., p. 142, 220, 349, 415, etc., etc.].

changed my mind, and I persist in considering statistics as an unreliable criterion of the results of our treatment, because, in order that this method may give positive results, it is essential that the individual cases which are collected and compared together shall be proper subjects for comparison, a thing which does not happen in pathology. Take, for example, typhoid fever. Do you believe that one typhoid patient is exactly like another typhoid patient? The age of the patient, the state of his vital forces, the relative severity of the epidemic, the period of the year, the nature of the locality even, have a great influence on this pathological aggregate, and modify its march and its fatality. It is here, especially, that we see the influence of what I have called the morbid genius of epidemics, where one sees epidemics relatively benign, succeed epidemics that were relatively malignant; and according as you apply the same method of treatment to the first or to the second, you will have multiplied successes or failures.

The arguments, gentlemen, which I adduce against statistics, I can in turn obtain from statistics themselves, and to the figures so convincing of Brand, of Glenard, of Strube, of Abel, etc., I need only oppose those of Schmidt, of Erlangen, of Goltdammer, of Berlin; of Boudet, of Lyons, which show us that by rigorously employing the cold bath medication, the rate of mortality is considerably increased, approaching, as it does, a mean of 19 per cent., and even exceeding this sometimes. I might even compare the other methods of treatment with that of Brand, and show you also by figures that the refrigerant method has nothing to boast of.

I know well the objection which the partisans of the cold bath cure make to these last statistics. They tell us that in these cases Brand's system of treatment was not carried out with mathematical precision, and according to his rules, and, what is of more importance, it was not employed from the very commencement of the disease. My reply to the objection is more formal, and I assert that in the majority of cases, and outside of military practice—for which I make some reservation—the method of Brand is impracticable, both in our hospitals and in private practice. Not that I believe we cannot, in our hospitals and in our ordinary practice, succeed in giving, despite the difficulties which attend them, cold baths day or night to our patients, but because it is necessary, according to Brand, to give these baths before the fifth day of the disease. Never do patients enter our hospitals at this period, and when they do enter, as we cannot be sure of our diagnosis till after the seventh day, it is not till this date that the cold bath treatment can be commenced.

To this objection Brand's partisans have replied categorically, and Bard has given the reply in this concise form: "In order that the method of Brand may have full efficacy, all fever patients should, without distinction, be subjected to the bath; *the bath will know its own.*" I do not know if the bath will "know its own" or not; but what I do know is, that we cannot, without danger, subject all our fever patients to a rigorous and severe method, and when we are ignorant of the cause even of the febrile process. Do you believe that the cold bath may not determine profound congestions? Do you believe that you can thus, without danger, force the circulating blood from the

cutaneous surface to the central parts? My colleague and friend, Dumontpallier, has well argued that the slow and progressive refrigeration does not provoke visceral congestion; but to the clinical and experimental facts to which he appeals, I have opposed experiments and observations absolutely contrary to these views. Brand's method, whatever one may say, is not free from danger, and not a few of the complications which supervene on the part of the lungs or intestines, in patients submitted to this treatment, may be attributed to it. As for the pulmonary liabilities, there is no doubt that as a result of the cold bath medication congestions and inflammations of the lungs have arisen; and during the discussion which took place in 1876 and 1877, in the Society of the Hospitals, this fact greatly impressed the majority of those who took part in these debates.[1]

I must say as much as regards intestinal hemorrhage; I believe that in certain cases the cold baths may favor these hemorrhages in patients who are predisposed.[2] These complications, moreover, on the part of the lungs and intestines, are quite explicable from the very action of the cold baths which are employed.

Where do you suppose the blood goes to which circulates at the periphery

[1] Hagenbach affirms that pneumonia occurs in typhoid fever treated by the ordinary methods in 20 cases out of 100.

Brand, basing himself on the statistics of Jurgensen, of Scholz, and of Stecher, as well as on his own, arrived at a medium of 7.2 per cent. for the cases of pneumonia after the employment of refrigeration.

At the same time the statistics of Liebermeister are even more favorable, as lobar and lobular pneumonia occurred 70 times out of 861 cases of typhoid fever before resort was had to Brand's method, that is to say in 7 per cent., and since the application of cold baths there have been but 50 cases of pneumonia in 559, *i.e.*, 6.4 per cent.

In France these complications have been oftener observed. Potain, Raynaud, Peter, and Féréol have noted pulmonary congestions and pneumonias produced by cold baths.(*a*)

[2] Apropos of the frequency of intestinal hemorrhages in typhoid fever, Brand has observed but 155 cases out of 1,995 where cold baths were employed, *i.e.*, 3.1 per cent. The statistics of Louis, of Ragaine, of Griesinger, bearing on 4,890 cases, give 771 cases of intestinal hemorrhages, *i.e.*, 5.6 per cent. under the ordinary methods.

Lehnert has made the statement, with reference to Brand's statistics, that the latter made no account in those statistics of moderate hemorrhages. If the latter are reckoned, the hemorrhages would attain the figure of 5 per cent. Goltdammer, in comparing 5.636 cases of typhoid fever treated by cold baths, with 13,653 treated by the ordinary method, with reference to the proportion of intestinal hemorrhages, observed these in 4 per cent. of the former cases, and 3.90 per cent. of the latter.

To these statistics should be added those of Wunderlech (son) and Schultz, of Heidelberg. The former observed at Leipzig 253 cases of typhoid fever; 155 were treated with cold water—there were 16 cases of enterorrhagia, 10.3 per cent.; of the other 98 cases, there were 2 of hemorrhage, *i.e.*, about 2 per cent.

Schultz has made a comparative study of the mortality in typhoid fever, as treated by

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(*a*) Brand, Wasserbehandlung der typhösen Fieber abdominal und flecktyphus, Tubingen, 2e édit., 1877.—Féréol, Sur le traitement de la fièvre typhoïde par les bains froids [Un. méd., 18 décembre, 1876, et Soc. des hôp., juillet, 1883].—Raynaud, Du traitement de la fièvre typhoïde par les bains froids à propos de l'épidémie actuelle [Bull. gén. de thér., t. XCI., p. 433].—Robert, Etude sur les complications consécutive des traitements de la fièvre typhoïde par la méthode de Brand [thèse de Paris, no 160, 1877].—Peter, les Bains froids coup sur coup dans la fièvre typhoïde [Un. med., avril et mai, 1877].

when it is driven inwardly by the vaso-motor constrictive action of the cold bath and ice-water lotions? The blood cannot find refuge except in the internal organs, and this reflux cannot but favor congestion of the abdominal viscera. Soulier has made many experiments on animals to show that the vaso-motor constriction is produced almost at the same time at the surface and in the central organs; but I believe that these experiments, however careful they may have been, place the animal in quite different circumstances from those of our typhoid patients.[3]

To sum up, I consider the exclusive method of Brand, and the rigorous and mathematical rules which he has formulated, as deserving to be banished from the treatment of typhoid fever, and for this reason especially—because it requires, in order to derive from it all the results which it promises, to be applied before the diagnosis can be certain; for, employed later, this system only gives—according to the acknowledgment of its most zealous partisans—results comparable with those of other therapeutic methods, and with greater danger to the patients. You will see, in fact, that we have for the treatment of certain manifestations of abdominal typhus, hydro-therapeutic means much less dangerous and quite as powerful—not, perhaps, from the point of view of hyperthermia, but from that of the other symptoms of typhoid fever; for, in my opinion, the advocates of the refrigerant medication have committed an error in vociferating, "The hyperpyrexia! behold the enemy!" The hyperpyrexia, as Peter has well said, does not constitute all the danger of the disease, of which it is only one of the manifestations.

Tepid baths are, in my judgment, much more applicable to ordinary cases of this disease, and I pointed out several years ago the advantages which might be derived from these baths, which, as my hospital experience has shown, have an antipyretic action much less marked than that of cold baths, but are abso-

the cold baths and by the ordinary medication. The method of cold baths gives only 1 per cent. in favor of this treatment. He has, moreover, noticed that intestinal hemorrhages were in the proportion of 9.6 per cent., while with the other methods they occurred in only 3.4 per cent.

In France, Peter, Raynaud, Féréol, etc., have also noticed this greater frequency of hemorrhages.(*a*)

[3] Soulier plunged in water at a temperature of 8° to 14° C. (46° F. to 57°F.) hares and guinea pigs previously shaved in order to permit of refrigeration. After several minutes no elevation of temperature was indicated by a thermometer placed in the rectum. In another hare he dissected out and exposed the mucous membrane of the ileum; the animal was plunged into a bath of 15° C. without allowing the water to come in contact with the intestine. At the moment of immersion the mucous membrane became pale, and its capillaries appeared shrunken and empty, while vermicular movements were produced expelling the intestinal matters.(*b*)

(*a*) Carl Wunderlich, Ueber Darblutungen bei Typnus abdominalis unter der Kaltwasserbehandlung [Diss. inaug., Leipzig, 1872].—Ch Deperet, De l'influence du traitement par l'eau froide sur la production de l'hémorrhage intestinale dans la fièvre typhoïde [thèse de Paris, 1876].—Blachez, Danger des bains froids chez les typhoïdiques [Gaz. méd., 2 février, 1877].—Peter, Raynaud, Féréol, Soc. méd. des hôp, 1876, 1877.—Schultz, Ueber die Resultate der Kaltwasserbehandlung de Typhus abdominalis, in Acad. Krankenhause zu Heidelberg [Abhand. der Heilbeib. nat. Med. Vereins: neue serie I, 1 Heft, 10 et 24 fèvrier, 1884].

(*b*) Soulier, Typhoid Fever and Cold Baths at Lyons, Paris, 1883, p. 45.

lutely safe.[1] They allay the excitement of the nervous system, diminish the sensation of burning heat, and enable us to maintain perfect cleanliness in our patients.

There are two ways of administering tepid baths. Some, as Ziemssen, Schutzenberger, and Laure, of Lyons, employ baths of decreasing temperature, and from 95° F. they lower the temperature of the water, in the course of ten minutes, to 77° F.[2] Others, and I am of their number, keep the warm bath at a constant temperature of five degrees below that of the patient, to wit, varying from 93° F. to 98° F. These baths should be of much longer duration than the cold baths, and without going as far as Reiss, who keeps the patient in them almost all the time, I am of the opinion, relying especially on the experiments of Thery, that it is sufficient to prolong them from twenty to thirty minutes.[3]

[1] Curry was among the first to vaunt the action of tepid baths in the treatment of typhoid fever. These tepid baths were, moreover, anciently employed by Hippocrates and Galen.

Dance, in 1831, recommended the employment of tepid baths in the treatment of typhoid fever. Hervieux in 1848 also devoted a chapter to the utility of these baths in dothinenteritis. Such baths at a constant temperature of 30° to 35° C., (87° to 95° F.) were shown by the experiments of Barthé and Berthornier made on themselves, to have caused lowering of the pulse from 16 to 20 beats and the temperature one degree.

Dujardin Beaumetz has noted the same effect in patients affected with typhoid fever and has seen the temperature fall two degrees and the pulse ten beats.(*a*)

[2] Ziemssen employs baths of decreasing temperature. He makes use of water of 33° C. (91° F.) of temperature at the commencement, then he adds cold water so that at the end of ten minutes the temperature of the bath is not higher than 23° C. (73° F.) These baths are administered four times in twenty-four hours, at six and ten o'clock in the morning, and six and ten o'clock in the evening.

Laure, of Lyons, has employed the same methods. The water was first used at an initial temperature of 30° C. (86° F.) and was cooled to 25° C. (77° F.) The duration of the immersion varies from fifteen to twenty minutes. The patient ought to make some voluntary movements while in the bath, or else be rubbed in front and on the back.

Schutzenberger employs baths of 25° to 30° C. (77° to 87° F.) and lets the temperature of the bath cool down (as it naturally would) from two to three degrees during the immersion, which is from fifteen to twenty minutes in length. (*b*)

[3] Riess employs permanent tepid baths in the treatment of typhoid fever; he places the patient on a hammock and makes him remain for several hours in a bath at a temperature of 88° F.

Afanowjew has employed the same method; he places his patients in a bath of from 75° to 85° F. on a rubber mattrass, the head resting on an air cushion. The maximum duration of the bath is three hours; two baths are given every day.

Hermann, on the contrary, considers these prolonged tepid baths of no advantage.

(*a*) Dance, Sur le traitment de la fièvre typhoide (Arch. Gén. de méd., 1re série, t. PXV, p. 186).—Hervieux, De l'emploi des bains tièdes et de leur utilité dans le traitement de la fièvre typhoide (Areh. gén. de méd., 4e série, t. XVIII, p. 28).—Barthé, Recherches sur l'emploi des bains dans la fièvere typhoide dans le but d'abaisser la temperature (thèses de Montpellier, 1871).—Berthomier, Des bains tièdes et de leur influence sur l'abaissement du pouls et de la temperature (thèse de Paris, 1874).—Dujardin-Beaumetz, Dè l'emploi des bains tièdes comparé à celui des bains froids dans le traitement de la fièvre typhoide (Soc. méd. des hôp., 22 décembre 1876).

(*b*) Ziemssen, Die Kaltwasserbehandlung des Typhus abdominalis, Leipzig, 1870.—Laure, De l'emploi du bain tiède de préférence au bain froid dans le traitment de la fièvre typhoide (Soc. des sc. méd. de Lyon, 1874).

These baths are repeated once or twice a day, the attendant having care to sustain the forces of the patient by giving him, during the bath, wine and meat broths.[4] I have always seen, under the influence of these tepid baths, typhoid patients with hyperpyrexia and delirium manifest a notable amelioration of the symptoms, become calm, and obtain quiet sleep.

I shall say little about the employment of refrigerant apparatus, not because I doubt their value—on the contrary, they are the only means which enable us to apply, systematically and rigorously, the refrigerant method—but because I have had no personal experience with regard to them. They are, in fact, quite complicated and costly, and this is why no one but their inventor, my colleague, Dumontpallier, has applied them in practice.[5] If we refer to the conclusions which he has recently formulated, these apparatuses have given him good results. We find means much more easy of application in cold affusions, lotions, and the wet pack, which can be used by anybody.

Affusions of cold water, or rather of sea-water, which was Currie's treatment of fevers, are no longer in use, and the cold lotions of which I have already spoken are far preferable.[6] These lotions of cold water are decidedly antithermic in their action, as no one who has watched their effect can have

They have no action in typhoid fever, and diminish neither the length nor the gravity of the disease. (*a*)

[4] Théry has studied the influence of prolonged baths on the circulation and calorification. Baths above 97° F. augment the circulation and the temperature; below 97° F. they lower them both. From 90° to 97° F. the fall is from four to six-tenths of a degree. This heat fall is more tardy with baths at 86° and below. Thermometric depression obtained by a bath at 93° F. lasting one hour is equivalent to the fall determined by a bath of thirty minutes at 71° F. (*b*)

[5] These are the conclusions formulated by Dumontpallier :

1. The refrigerant method in typhoid fever cannot be judged, except by experimental and scientific researches.

2. This method carefully conducted, not exclusive of other treatment, may offer great advantages in therapeutics.

3. It cannot make pretentions to the cure of all patients affected with typhoid fever, but in modifying the hyperthermia and its consequences, it may diminish the mortality in a notable proportion. (*c*)

[6] Currie employed affusions of cold or of tepid water. These affusions consisted in throwing over the patient a certain quantity of cold water; then he bathed him with vinegar and water and afterwards with sea-water. He preferred in general for these affusions, sea-water to river-water. He made use also of affusions of tepid water, that is to say, of water from 87° to 95° F.

Wanner employed sponge lotions which he called *passes;* this sponging was repeated several times a day. (*d*)

(*a*) Riess, Ueber den Einfluss des parmanenten Cauwarmen Bades auf die Temperatur des Typhus (Centralbl., No. 30, 1880).—Afanowjew, Ueber die Behanlung von Typhus Krankenmit Langdauernden lauen Bädern (Saint-Petersbourg Med. Woch., No. 26, 1881.)

(*b*) Théry, Physiological study on prolonged baths. These de Paris, 1881.

(*c*) Dumontpallier, contribution to the study of the refrigeration of the human body in febrile diseases and in particular in typhoid fever. [Acad. des sc., Feb. 26, 1883.]

(*d*) Currie, Medical Reports of Cold Water, etc., Edinburgh, 1797.

failed to observe; the temperature falls appreciably under their use, especially if they are repeated several times a day. This heat-reducing power is, I well know, limited, and in certain grave cases of ileo-typhus these lotions do not suffice to bring down the temperature, and we must have recourse to more active means. I believe the refrigerant action of these lotions to be a secondary effect, the principal and dominant action being that which they exert on the vaso-motor functions of the cutaneous capillary network, functions so profoundly disturbed in typhoid fever, and which tend to become restored under the influence of these cold lavations or spongings.

This vaso-motor and revulsive action is much more energetic when the wet pack is used.[1] The method is very simple; the patient, in a state of nudity, is wrapped from head to foot in a sheet or blanket wrung out of ice-cold water. It is well, as a preliminary step, to have a rubber blanket spread upon a mattress; over this you place the wet sheet, in which you wrap your patient. Liebermeister advises that this envelopment should be continued for ten minutes; for my part, I prefer a shorter duration of a minute or so, after which the patient is taken from the wet sheet and removed to his bed. If I prefer wet wrappings of short duration, to the practice of Liebermeister, it is because I do not wish to obtain refrigeration from these envelopments, but only a regulative modification of the nervous system, and this effect will be the more marked, the shorter the duration of the cold application. This is, gentlemen, one of our most powerful modes of treatment in cases of typhoid fever of ataxic and adynamic character, and you will derive great benefit from it. Foltz has recently added cold lavements to the refrigerant medication.[2] These lave-

[1] Priesnitz, Scoutétten, and Liebermeister have studied the action of wet wrappings in fevers. This envelopment is made in two ways; in the one the patient, being naked, is wrapped in a blanket wrung out of cold water; the application does not last longer than a minute, then the patient is rubbed dry and put into bed,

Liebermeister employs another method; it consists in leaving the individual wrapped in a wet sheet and covered with a woolen blanket for ten minutes, and in renewing this wet pack three or four times in succession.

According to Liebermeister, four successive wet wrappings thus practiced produce the same effect as that of a bath at 68° F. lasting ten minutes. Ziemssen and Zimmermann have not obtained from this wet pack so notable a refrigerant action; it is true that they do not prolong the duration of the wrappings so long. (*a*)

[2] Foltz, of Lyons, has treated 27 patients by cold lavements, and has administered to each of them a number of lavements which has varied between 30 and 300. Out of these 27 patients only one has succumbed. The quantity of water varies with the age, from eight ounces to a quart; the temperature of the water was between 50° and 60° F.

Brand has observed that cold lavements lower the temperature from 0°.2 to 0°.5; but this fall does not last long. Prosper Boyer, basing himself on the results obtained by Barrallier, of Toulon, affirms that cold lavements are superior from the point of view of the refrigerant medication, to cold baths. (*b*)

(*a*) Liebermeister, Handbuch der Pathology und Therapie des Fiebers, Leipzig, 1875.—Scoutetten, Rapport sur l'hydrothérapie, adressé à M. le Maréchal ministre de la guerre, après un voyage fait en Allemagne, Strasbourg et paris, 1843; De l'eau sur le rapport hygiénique et médical de l'hydrothérapie, Paris, 1843, in-8°.

(*b*) Boyer, Comparative utility of cold baths and cold lavements in the treatment of typhoid fever. (Thèse de Paris, No. 234, 1875.)—Foltz, on cold lavements in the treatment of typhoid fever. [Lyons Medical Journal, 1875.]

ments of water at 50° F., lower the temperature of patients—in a feeble manner it is true—but still appreciably, and this is a fact worthy of being remembered. So wherever you have occasion to give enemata to typhoid patients, see to it that the water which you use is cold.

Having finished refrigerants, I pass now, in accordance with the order which I adopted in the previous lecture, to bloodletting.[1]

Very much in use in the treatment of fevers at the commencement of this century, and before we had precise notions respecting the nature of typhoid fever, bloodletting was still practiced at a later date in this disease by Louis and Chomel, and especially by Bouillaud, who thought to jugulate the disease by applying to it the formula of "bleeding upon bleeding" (*coup sur coup*). To-day the practice of bloodletting, local or general, is completely abandoned; and, nevertheless, whenever nature herself proceeds to the letting of blood, and when these losses do not exceed certain limits, we see the temperature fall, and symptoms of the greatest gravity abate; so that, in a great many cases, intestinal hemorrhages are an element of prognosis rather favorable than otherwise. The two clinical charts which I here show you, indicate well the antithermic action of these hemorrhages.[2] It is true that you sometimes purchase this amelioration by a long and painful convalescence; however this may be,

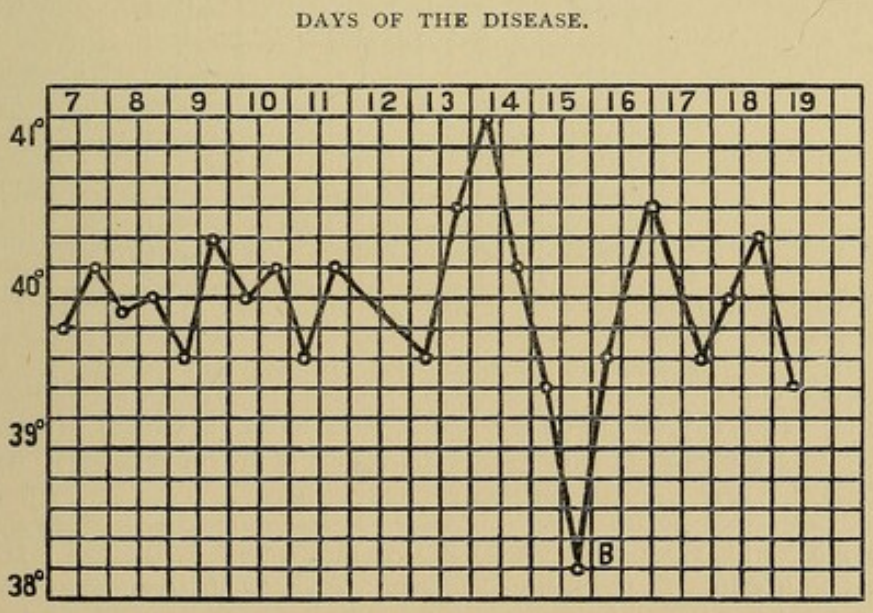


FIG. 15.

[1] Louis and Chomel recommended moderate bloodletting in typhoid fever. Bouillaud practiced bleeding *coup sur coup* (repeated bleeding), from the first week of the disease, thinking to cut short the disease; after the second week he abandoned bloodletting and gave a tonic règime. Forget, although a partisan of bloodletting, only practiced it in certain forms of typhoid fever called inflammatory.

[2] In the first curve (fig. 15) we have represented the pyrexial progress in a patient twenty-three years old, and vigorous, who on the fourteenth day of the disease was taken with a very abundant intestinal hemorrhage (B.) which caused his temperature to fall from 41° to 38° C. The first depression during the eleventh and twelfth days corresponds to the administration of salicylic acid.

we note the fact without venturing to authorize the interference of the physician in order to produce artificially, in typhoid patients, loss of blood.

I now come to the study of medicaments which act on the fever by the intermediation of the nervous system, and we shall examine successively the treatment of typhoid fever by digitalis; aconite, veratrum viride and sulphate of quinine.

It is Hirtz who, in our country, has defended with the most ardor the treatment of this fever with digitalis, a practice already adopted since 1862 by Wunderlich.[1] Digitalis is given in the form of infusion, and fifteen to thirty grains of the powdered leaves are steeped in a gill of water, all of which is administered daily in divided doses. These doses, continued for three days, cause a notable diminution of the pulse and temperature, but despite this

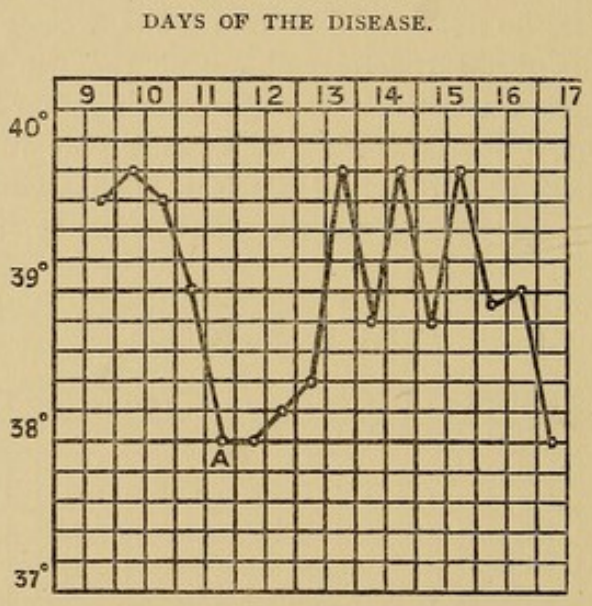


FIG. 16.

The second curve (fig. 16) corresponds to a case of typhoid fever in a young man of nineteen; the tenth day of the disease supervened a very abundant hemorrhage. The next morning (A.) the two patients were better, but their convalescence was long and painful, marked by very pronounced thermic oscillations.

[1] Wunderlick, in 1862, counseled the use of digitalis in typhoid fever; he recommended its administration in the form of infusion, advising to steep from fifteen to thirty grains of the powdered leaves in six ounces of water, and give the whole daily in divided doses. Under its use he asserted that the pulse and temperature went down.

Fritz was one of the most ardent advocates in this country of the treatment of fever by digitalis. In 1869 he reported the results of this medication, which were strongly commendatory. His method was as follows: from ten to fifteen grains of digitalis leaves was infused in four ounces of water, of which a tablespoonful was given every hour; this treatment was continued for three days.

Bernheim has observed during this treatment a lowering of the temperature down to even 96° F. The pulse and temperature fell at the same time.

Grimshaw employs digitalis in typhoid fever; according to him this medicament diminishes neither the duration of the fever nor the temperature; it only diminishes a little the frequency of the pulse and augments the force of the heart's contractions.

German Sée is opposed to the administration of digitalis in typhoid fever; he thinks

powerful antithermic effect, which is not denied by any observer, this kind of treatment is not much in favor. One fears, with reason, the action of digitalis on the heart, which is so often affected, as we have seen, with symptomatic myositis, as well as the emeto-cathartic effects which digitalis determines when given in such large doses.

I shall not take up your time with the treatment by aconite[2] recommended by Lavasseur and Deshayes, of Rouen, nor with that of veratrum viride employed by Hirtz, Vogt, and Liebermeister,[3] their trials not having been since repeated; at the same time remarking, *apropos* of the first of these medicines, that if you wish to experiment with aconite you should use the tincture of the root and not that of the leaves, the latter having no medicinal virtue, and I pass now to the study of a kind of treatment which has numerous partisans at home as well as abroad. I refer to the medication of typhoid fever by quinine.

Broqua, of Mirande, in 1840, communicated to the Academy of Medicine the good results which he had obtained in the treatment of typhoid fever with large doses of sulphate of quinine,[4] and we have seen successively Chappotain,

that to lower the temperature it is necessary to employ daily doses of more than 30 grains, and that these doses may be the cause of grave accidents, especially when the heart is affected with granulo-fatty degeneration.(*a*)

[2] In 1863 Lavasseur, and in 1873 Deshayes employed tincture of aconite in the Hôtel Dieu of Rouen in the treatment of typhoid fever. This is the formula which Deshayes employs:

℞ Alcoholic tinct. of aconite..... gtt. xx.
Distilled water..... ℥ iv.
Tinct. aurant. cort..... q. s.

M. S. A dessert spoonful every two hours.

He feeds his patients with beef tea or veal broth (a cupful every two hours). (*b*)

[3] Vogt has given veratrum in large doses in typhoid fever. Liebermeister prescribes pills of one-twelfth of a grain of veratrine every hour till nausea and vomiting follow. From four to six pills suffice. This treatment produces considerable prostration. (*c*)

[4] Sulphate of quinine was introduced into the therapeutics of typhoid fever by Broqua, of Mirande, in 1840. Chappotain, of St. Laurent, applied the method of Broqua at the Hôtel Dieu, in 1842. Pereira in his théses made known the results of this method. Boucher of the Ville Jossy, in his inaugural théses, insists on the utility of employing large doses, 30 grains at least. Monneret goes farther and proposes to substitute for the miasmatic poisoning of typhoid fever, the toxic action of sulphate of quinine, hence he would give as much as 75 grains a day to a typhoid patient. Blache and Briquet report the good effects of this treatment in the case of children.

These tentatives were repeated in Germany by Vogt in 1858, by Wachsmutt in 1863, particularly by Liebermeister in 1867. The latter has insisted on the doses and the period of administering them. He gives from 30 to 45 grains a day in divided doses of seven or

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(*a*) Wunderlich, Arch. der Heilkunde, 3e Heft, ams. 1869.—Hirtz, Des indications de la digitale dans la fièvre typhoide (Bull. de thér., t. LXXVII, 1869, p. 223).—Grimshaw, On the influence of Digitalis on the weath heart of Typhus fever (the Dubl. Journ. of Med. Sc., juin).—Germain Sée, Clinique de l'Hôtel-Dieu, leçon sur le Traitement de la fièvre typhoide (France méd., 1878 et 1879, et Mouv. méd., 1874).

(*b*) Deshayes, On the treatment of typhoid fever by aconite. (Gaz. hebd., 1875).

(*c*) Liebermeister in Ziemssen's Anthology.—Louis Boiteux, on Typhoid Fever. (Thèses de Paris, 1883, p. 119).

of St. Laurent, Pereira, Boucher, of Ville Jossy, Blache, Briquet, and Monneret boast of the effects of this medication. Monneret went the farthest in this direction, for endeavoring to substitute for poisoning by the typhogenous miasm the toxic effect of quinine, he was in the habit of administering as much as seventy-five grains a day of this medicine. Such bold experiments were sometimes followed by bad results; therefore this medication was abandoned, at

eight grains every ten minutes; he begins the administration of these doses about five o'clock in the afternoon. He obtains thus a reduction in the pulse and temperature, which persists from twelve to eighteen hours; he waits several days before repeating this dose. Liebermeister employs indiscriminately cold baths or quinine, but he prefers the latter medication.

Kaulich and Chapetal, of Vienna, employ Liebermeister's method in the typhoid fever of children, and they apply concurrently the refrigerant method and sulphate of quinine, which they associate in the following way: every day in the first part of the afternoon the child is wrapped in a sheet wrung out of cold water, then is given, in one full dose, seven and one-half to thirty grains of quinine (the child being supposed to be from four to ten years of age). This mode of treatment is repeated every second day in cases of urgency; moreover, a careful alimentation is early commenced.

Lindwurm, of Munich, never exceeds 30 grains a day. Lassau, of Copenhagen, gives the same dose all at once from seven o'clock till nine o'clock in the evening. Hérard also employs sulphate of quinine, and goes as high as 45 grains a day.

Germain Sée uses sulphate of quinine and prefers it to all other antipyretics; basing himself on some experiments made with Bochfontaine; he, in fact considers sulphate of quinine as a heart tonic; he gives it in one large dose about seven o'clock in the morning.

Jaccoud also prefers quinine to salicylic acid. He gives the first day 30 grains of bromhydrate of quinine; the second day 20 grains and the third day 15 grains. The medicament is taken in substance in wafers, each containing 7½ grains; the wafers are swallowed one after the other, with ten minutes of interval. Jaccoud administers them in the morning when he wishes to lower the evening temperature, and in the evening when he wishes to lower the morning temperature, and with respect to this administration he regulates himself according to the examination of the temperature of the patient.

Pawer employes doses much smaller, and never gives more than seven or eight grains a day.

Teisser has shown the danger of sulphate of quinine in large doses. According to him it is an hyposthenic medicament which certainly enfeebles the functions of the nervous system.

Laborde, in basing himself upon his experimentation, has shown that the massive doses of sulphate of quinine may determine in certain cases of infectious myocarditis grave accidents on the part of the heart. Dujardin-Beaumetz has also shown the danger of these large doses of sulphate of quinine. (*a*)

(*a*)Broqua (de Mirande), Acad. de méd., 1840.—Chappotain de Saint Laurent, Arch. de méd., septembre 1842, t. XV, 3e série, p. 5.—Pereira, Recherches cliniques sur l'emploi du sulfate de quinine à haute dose dans le traitement de la fiévre typhoïde (thèse de Paris, 1842).—Boucher de la Ville-Jossy, Quelques réflexions sur l'action physiologique du sulfate de quinine à haute dose en général, et, en particulier, dans le traitement de la fièvre typhoïde (thèse de Paris, No. 22, 1846).—Monneret, article Fièvre Typhoïde, Compendium, t. VIII, p. 258.—Blachez et Briquet, Un méd., 3 novembre 1853.—Liebermeister, Recherches physiologiques du sulfate de quinine sur l'homme sain (Arch. Schm., 5 vol., CXVI, p. 275).—Oeffner, Die Anwendung des chinis bei der Behandlung der Typhus, Munich, 1874.—Germain Sée., Leçons de clinique faites à l'hôpital de la Charité (Mouv. méd., 1874, et Acad. de méd., 1883.)—Oehme, Zur Anwendungsweise des chimins in Typhus abdominalis (Zeitsch. f. Prak. Med., Nos. 42 et 43, 1875).—Jaccoud, Traitement de la fièvre typhoïde, leçons à la Faculté, 28 et 30 novembre 1881, et Acad. de méd., 1883.—Dujardin-Beaumetz, Acad. de méd., 1882 et 1883.—Laborde, voir Jules Simon, Des succédanés en thérapeutique (thèse de Paris, 1882).—Pawer, Large doses of quinine in enteric fever (the Med. Times and Gaz., 1er février 1873).—Kaulish, Therapeutische Beobachtungen heim Typhus abdominalis (Jahrbr. f. Kenderh., Bd. XVII, Heft 1, série 1re, 1881).

least in our country. Vogt, in 1858, and Wachsmuth, in 1863, and, lastly, Liebermeister, in 1867, repeated these first trials, but this time they applied to the study of the effects of the medicament the use of the thermometer, and gave precise indications of the administration of the medicine. This treatment was rapidly adopted in foreign lands and in France, and we see Lindwurm, of Munich, Œffner, Larsen, of Copenhagen, Pawer, Kaulich, Jaccoud, Germain Sée, Herard, Barthez, and others, put in practice this medication.

It is the sulphate of quinine that is most often employed; yet in Germany use is made of the hydrochlorate, and in France Jaccoud prescribes the bibromhydrate of quinine. These salts are administered in solution, or oftener in capsules; the pill form should be discarded, for it not seldom happens that on account of the state of the digestive tube, these pills pass through the intestinal canal unaltered. But the capital point, and it is this on which Liebermeister has insisted, is to give large doses; for example, you should make your patient take eight grains every fifteen minutes till half a drachm has been reached. Liebermeister often exceeds this quantity, and continues giving the small doses every quarter of an hour till from forty to sixty grains are administered, but in this country we generally stop at half a drachm.

The period of administration of these massive doses has also a great importance. Liebermeister counsels to give the quinine between five and seven o'clock in the evening; Germain Sée prefers the morning; Jaccoud, with good reason, says that you should give it in the morning or evening, according to the effect which you desire to obtain. Do you wish, for instance, to procure a lowering of the evening temperature? give your quinine in the morning; Do you wish to obtain a matinal fall? give it in the evening. Liebermeister and Kaulich give one large full dose on one day only, and do not repeat the dose unless the temperature takes on again an ascending march. Jaccoud gives his salt of quinine in decreasing doses for three days. Sée administers it without interruption. I believe that the method by interruption has great advantages over the continuous employ of the medicament, and you ought to be guided in this regard by the thermometric curve.

Employed after this fashion, sulphate of quinine produces in typhoid patients a very pronounced depression of the pulse and temperature, which lasts often for two days, and when the thermal curve rises it does not attain as high a point as before the exhibition of the quinine. But this antipyretic action, obtained with such large doses of quinine, has certain advantages. In giving to the patient thirty, and often forty or more grains of quinine, you are likely to overstep the therapeutic effect, and obtain the toxic action on the brain and on the heart. Gérmain Sée and Bochefontaine affirm that this cardiac action is of a tonic kind, but Laborde, with much reason, maintains that it is dangerous in hearts with degenerated muscular fibre, and you know that the latter is a very common complication in the infectious diseases.[1] More

[1] Germain Sée and Bochefontaine have noticed by experiments on animals and by direct tracings on the healthy man and in the febricitant, that sulphate of quinine supports the heart's force and even augments it; it especially causes disappearance of the dicrotism

over (and this is an argument which I adduced in the last discussion at the Academy), the typhoid patient is a bad subject for treatment, not only because absorption of medicines is difficult in consequence of the unhealthy state of the digestive tube and the lymphatic vessels, which originate there, but also because the functions of the kidney and the liver are notably compromised. In a former course of lectures I showed you the capital importance of the liver and of the kidney from the point of view of the action of medicines, and from all these considerations you see how easy it is, when drugging your typhoid patients, to exceed the therapeutic and obtain the toxic action of your remedial agents.

You ought always, gentlemen, to have these facts in mind when prescribing active medicines in large doses to your patients in this fever. And while recognizing the benefits of quinine medication, I believe that it is best to be very prudent in the administration of this alkaloid, and never to exceed the dose of thirty grains a day, and always to have care not to give this medicament continuously. Therefore, I much prefer, as an antipyretic, salicylic acid to quinine, because one obtains antithermic effects quite as powerful with the former, and in doses which entail less danger.

It was Riess who first, in 1875, applied salicylic acid to the treatment of typhoid fever; and since this first trial, Schroeder, Nathan, Fischer, Ewald, Goldtammer, Bælz, in foreign lands, and in France, Garcin, Noel Gueneau de Mussy, Jaccoud, Oulmont, Hallopeau, Caussidon, and Rabeau, and, especially, Prof. Vulpian, have shown us the advantages which may be derived from salicylic acid in this disease. Salicylate of soda, salicylate of bismuth, and salicylic acid have severally been employed.[2] Salicylate of soda is preferred by the

which results, according to them, from direct diminution of the blood pressure, and moreover from relaxation of the walls of the vessels due to intensity of the fever.

Laborde, on the contrary, while recognizing the action of quinine on the heart shows that in animals massive doses determine ataxia of the heart; an ataxia which leads to the complete exhaustion and cessation of the efficacious contractions of the heart. (*a*)

[2] Buss was the first, in 1874, to employ, at the Cantonal hospital of Saint Gall, salicylic acid in the treatment of typhoid fever. He gave it in powder, in the wafer form, or in emulsion in water. He declares that salicylic acid given in doses double that of quinine, has the same antipyretic efficacy as the latter.

The year following, in 1875, Riess treated 250 cases of typhoid fever by salicylic acid. He gave from 75 to 100 grains of salicylic acid a day, and he administered it in solution with bicarbonate of soda. He observed by this means a notable diminution in the pulse and temperature.

Schroeder has also employed salicylic acid, or rather its solution, in alkaline menstrua, and prefers the salicylate medication to the cold bath treatment. Nathan, of Kiel, in 1875 recommended much larger doses, giving as much as 180 grains of salicylate of soda a day. Fischer prefers salicylic acid, which he administers in substance in wafer form. He gives massive doses of from 30 to 120 grains morning and evening.

Liebermeister has also employed salicylic acid; he prefers the salicylate of soda, and remarks that its antipyretic effect is more noticeable than that of quinine. Ewald also prefers salicylate of soda. According to him the minimum dose necessary to lower the temper-

(*a*) Germain-Sée et Bochefontaine, Comp. rend. de l'Acad. des sc., 1883, et Gaz. méd. de Paris, 3 février 1883, p. 52.—Laborde; voir Jules Simon, Des succédanés en thérapeutique (thèse de Paris, 1883, p. 39).

greater part of German physicians, as producing less irritation of the alimentary canal than salicylic acid, and as being quite as good an antipyretic. I do not hold this opinion, and believe with Prof. Vulpian, supported as is this belief by numerous cases occurring in my hospital practice, that salicylic acid possesses —in equal dose—an antifebrile action far superior to that of salicylate of soda; and I am as much a partisan of salicylic acid in the treatment of this fever as I am of the salicylates when it is a question of rheumatic fever. Salicylate of bismuth, which I was the first, I believe, to employ in therapeutics (not, indeed, in typhoid fever, but to combat the fetid diarrhœa of infancy), has been utilized by Vulpian in the treatment of dothinenteritis. Guided by the idea—very just,

ature should be 75 grains. Riegel, of Cologne, also gives the acid dissolved in water by means of the salts of soda; he pretends thus to avoid the irritation of the digestive tube. Goldtammer vaunts the effects of salicylic acid, he also prefers the salicylate; small doses at intervals, according to him, produce no effect, but a massive dose of 75 grains given in the evening determines a fall in the temperature of more than three degrees.

Bælz gives from 60 to 90 grains of salicylate of soda once or twice a day; he has observed under this treatment a fall of 6°, and even 6°.5 without any concomitant dangerous phenomenon; he has also noted that the temperature when it goes up again, attains a less height than before the administration of the salicylate. He has not noted any degree of excitation till after doses of 60 grains; this excitation is more intense in women than in men. He has also observed an augmentation in the quantity of urine and the appearance in the latter of salicylic acid eight minutes after the administration of this medicament in a patient affected with exstrophy of the bladder. Albert Robin has, on the contrary, noticed a diminution of the quantity of urine, and a very marked augmentation in its density, which may attain 1044 under the influence of 90 to 120 grains of salicylic acid.

In France the employ of salicylic acid in typhoid fever dates from 1875. At this epoch, Garcin, of Marseilles, administered salicylic acid in the dose of seven to 15 grains, this is the same dose that Noel Gueneau de Mussy gives; the latter employs from 15 to 30 grains of salicylic acid, dissolved in one or two ounces of gum arabic water, sweetened with syrup; from one to four teaspoonfuls of brandy are added.

In 1876 Jaccoud also made trial of salicylic acid; he made use of capsules containing eight grains of salicylic acid and gave 30 grains the first day, 20 the second, 15 the third; he now prefers sulphate of quinine to salicylic acid.

Hallopeau employs, in their order, salicylate of soda, sulphate of quinine and calomel; this is how he proceeds in his medication: the first day of their entry the patients take 15 grains, or a scruple of calomel; the days following he gives them either salicylate of soda in one dose only of 30 grains, or sulphate of quinine in the dose of 15 or 20 grains; then he continues alternately these two medicaments, having care not to leave his patients subjected more than three consecutive days to the action of the salicylates. He prescribes simultaneously cold lotions renewed from three to five times a day, cold applications over the abdomen and cold lavements. In the ataxic forms, he has recourse to digitalis simultaneously with cold baths; the visceral congestions are combatted besides by repeated applications of dry cups. He endeavors to sustain, as far as possible, the forces of the patient by making him take every two hours a cup of milk or of broth; the typhic patients thus ingest regularly four or five quarts of milk a day. Apart from the calomel given the first day, M. Hallopeau makes little use of purgatives, which have the inconvenience of hindering the administration of the antipyretics, and whose utility appears problematical in a disease where diarrhœa is almost constant.

Vulpian is a great advocate of the employ of salicylic acid, which he prefers to the salicylate of soda, and the results of his practice have been published in the thesis of Henri Rabeau. He administers the salicylic acid in the quantity of 75 to 100 grains a day, in powders of 7½ grains an hour. The defervescence produced by this medicament follows a con-

indeed—that typhogenous virus develops especially in the last portion of the small intestine, Vulpian thought of this medicament, which seemed to him likely to reach without any alteration the diseased places in the intestine, and there combat, *in situ*, the development of the infectious organisms. But the results have not met his expectations; salicylate of bismuth has, indeed, lowered the temperature, but it has had no influence on the march of the disease. So, despite the more satisfying results which Desplats has obtained, this medication has not found much favor.[3]

Salicylic acid should be administered in capsules, and in a dose not exceeding sixty grains, for more than this determines, especially in females, cerebral excitation, buzzings in the ears, and gastro-intestinal irritation. I, moreover, am always careful to give at the same time a little milk to mitigate the symptoms of the latter, and when I come to speak more particularly of the details of management of this fever, I shall tell you the rules which I follow in giving salicy-

tinued progression and the evening exacerbations are less marked, so that in 24 or 36 hours the temperature falls to 98½ and even lower.

But this medicament has no action on the pulse. With defervescence there is produced an amelioration of all the general symptoms. At the same time the salicylic medication has no influence on the march of the disease; it does not diminish its duration or prevent relapses. Such are the principal results of Vulpian's observations.

Caussidon, of Algiers, considers salicylate of soda as the best antithermic agent to employ in typhoid fever; he gives 15 grains every two hours till the temperature falls to 100° F. (*a*)

[3] Salicylate of bismuth presents itself under the form of a pulverulent body of little solubility. The salicylate which is found in commerce always contains a certain quantity of free salicylic acid, and which varies according to the mode of fabrication. Jaillet has proposed the following process:

After having prepared a quantity of crystallized acid nitrate of bismuth, this salt is precipitated in 500 times its weight of water, rendered feebly alkaline by caustic soda, and containing in solution a proportion of salicylate of soda double that of the nitrate of bismuth employed.

After the deposition of the precipitate, you decant the supernatant liquid, and add a new quantity of pure water, and when the precipitate has been washed three times, to re-

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(*a*) Buss, Ueber die Anwendung der Salicylsaeure als Antipyreticum (Deutsch. Arch. fur Klin. Med., 1875; zur Antipyretischen Bedeutung des Salicylsaeure, Stuttgard, 1876).—Riess, Ueber die innerliche Anwendung des Salicylsaeure (Berl. Klin. Woch., 1875, p. 181 et 194).—Schroeder, Zur Anwendung des Salicylsaeure, resp. des natron Salicylicum (Deutsches Arch. fur Klin. Med., 1876, Bd. XVIII, p. 514).—Nathan, Ueber die Bedeutung des natron Salicylicum als Antipyreticum (Diss. inaug., Kiel, 1875) —Fischer, Zur Antipyretischen Werkung des Salicylsaeure und des Salicylsauren natrons (Deutsch. Zeitsch. fur Prakt. Med., 1875).—Liebermeister, Handbuch der Pathologie and Therapie des Fiebers, p. 644.—Typhus abdominalis (Ziemssen's Handbuch der Specullen Path. und Therapie, Bd. II, 1874).—Antipyretische Medicamente (Ziemssen's Handbuch der Allgemeinen therapie, 1880, Bd. I, p. 69).—Ewald, On Salicylic Acid as an Antipyretic (the Pract., 1876).—Riegel, Ueber die innerliche Anwendung des Salicylsaeure (Berl. Klin. Woch., 1875, p. 673 et 699).—Goltdammer, Zur inneren Anwendung der Salicylsaeure (Berl. Klin. Woch., 1876).—Baelz, Salicylsaeure, Salicylsaeures Natron und thymol in irhem Einflus auf Krankheiten (Arch. der Heilk., 1877).—Alb. Robin, Note sur l'acide salicylique dans la fièvre typeoïde (Gaz. Méd. de Paris, 1877).—Garcin, Onze cas de fièvre typhoïde traités par l'acide salicylique (Journ. de thér., 1876).—Jaccoud, Traitement de la fièvre typhoïde (Mouv. méd., 1877, p. 164 et 181, et leçons sur le Traitement de la fievre typhoïde, 28 et 30 novembre 1882),—Hallopeau, Traitement de la fièvre typhoïde par le calomel, le salicylate de soude et le sulfate de quinine (Un. méd., 1881, et Soc. méd des hôp., 13 août 1880).—Vulpian, Traitement de la fièvre typhoïde par l'acide salicylique (Bull. Acad. de méd., 22 août 1882).—Caussidon, Traitement de la fièvre typhoïde par le salicylate de soude (Gaz. hebd., 1881, p. 283).—H. Rabeau, Etude sur la médication salicylée dans la fièvre typhoïde (thèse de Paris, 1883).

lic acid. In doses of from half a drachm to a drachm it lowers the temperature two or three degrees without much influencing the pulse. By not exceeding this quantity of the medicament, I have never observed any cardiac or nervous symptoms to follow. It is not so with the next antipyretic of which I shall speak, viz: carbolic acid.

Desplats, of Lille,[4] was the first to found the phenic medication of typhoid fever; the trials made previously by Pecholier, Tempesti, and Skinner were not successful, by reason of the small doses given. Desplats gives phenic acid in lavements containing twenty to thirty grains, and gives three or four of these a day; these lavements should be retained so that the medicament may be absorbed. Phenic acid has a considerable antipyretic action, and for my

move every trace of salicylate, the product is collected and dried rapidly in a stove heated to 104° F.

The substance which is thus obtained is quite crystalline, and constitutes the acid salicylate of bismuth, and has the following formula:

$$(Bi^2O^3)\,(C^{14}H^6O^4)^5 + {}^{16}HO.$$

After having prepared, by the method just given, the acid salicylate of bismuth, if you continue washing the precipitate till the decanted water no longer gives a violent reaction with perchloride of iron, you obtain a new salicylate of bismuth, which this time represents by its composition the sub-salicylate or basic salicylate of bismuth, which has for formula:

$$Bi^2\,O^3,\,C^{14}H^6O^4 \times {}_2Bi^2\,O^3,\,C^{14}H^6O^4.$$

It is then a mixture of two basic salts. Ragoucy has disputed the correctness of these formulas.

One of these salicylates, the acid salicylate, contains more than 50 per cent. of oxide of bismuth, and 40 per cent. of salicylic acid. The other, the alkaline, contains more than 76 per cent. of oxide and 23 per cent. of salicylic acid.

The absolutely different proportion of these two compounds ought to give to these two preparations different therapeutic properties.

Vulpian has made use of the commercial salicylate of bismuth containing from 30 to 45 grains of salicylic acid to every three drachms of the salicylate.

Vulpian administers three drachms of the salicylate every 24 hours, dividing this quantity into fractional doses to be given at intervals of an hour or an hour and a half; he has thus obtained a notable lowering of the temperature of from one to three degrees; the stools are disinfected and scanty. In fine, this medicament has had no influence on the march of the disease.

Desplats administers from 75 to 100 grains of salicylate of bismuth in fractional doses of 15 to 30 grains; he has in certain cases observed a veritable abortive action, and the typhoid fever has been arrested in its course. (*a*)

[4] Declat was one of the first to employ phenic acid in typhoid fever; but his observations, having no scientific character, have not been taken into consideration. Stephen Skinner, in 1873; Pecholier, in 1874; and Tempesti, in 1877, have also employed this acid, but in such small doses that its therapeutic effect cannot be appreciated. It was Desplats (de Lille) who first, in 1880, gave the proper rules for the administration of this medicament, and his method has since been adopted by his pupils, Van Oye and Maquart, and by Clodo, at

(*a*) Jaillet, Des salicylates de bismuth (Bull. de thér., t. CV, 15 août 1883, p. 113).—Ragoucy, Sur la composition du salicylate de bismuth (Bull. de thér., t. CV, 15 octobre 1883, p. 328).—Vulpian, Sur des essais de traitement de la fièvre typhoïde au moyen du salicylate de bismuth (Journ. de pharm., 1882).—Rabeau, De la médication salicylée dans la fièvre typhoïde (thèse de Paris, 1882, p. 55).—Henri Desplats, Application du salicylate de bismuth au traitement de la fièvre typhoïde (Soc. de thér., 23 mai 1883, et Journ. des sc. méd. de Lille, 1883).

part I have seen doses of less than half a drachm administered in lavements, produce a fall in the fever of nearly five degrees. Such an antipyretic action is not, however, produced without danger; it is, in fact, accompanied with profuse sweats, pallor of the integument, and often an alarming state of collapse.

Last year (in 1882), I often had recourse to carbolic lavements, and frequently observed pulmonary congestions in patients thus treated; in calling to mind the toxic effects noted in animals poisoned by phenic acid, where these pulmonary congestions are the rule, I attributed to my medication a certain part in the production of these thoracic complications, and discontinued the

Lyons, by Vulpian, Bouchard, Siredey, etc., in Paris. Desplats employs the following method: He makes use of lavements containing from 8 to 15 grains of phenic acid dissolved in a little less than four ounces of water.

These lavements are renewed every three hours, so that from a drachm and a half to two drachms of phenic acid are administered daily; the lavement is given by means of a syringe, and a soft rubber tube carries the liquid high up in the rectum, so that the lavement is sure to be absorbed and retained.

When the patients can take the carbolic acid by mouth, Desplats employs the following lemonade:

Phenic Acid,.....	2 to	4	grammes,
Lemonade [lemon juice and water],.....	100		"
Simple Syrup,..	100 "	150	"

He gives the patient about 100 grammes (about three tablespoonfuls) every three hours, each dose containing about ten grains of phenic acid. This medication is not employed except when the temperature attains or exceeds 104° F.

Claudo employs two lavements a day; one at 8:00 o'clock a. m., and the other at 4:00 o'clock p. m., containing from 15 to 24 grains of phenic acid dissolved in five ounces of water at 68° F. Vulpian made use of phenate of soda, giving as much as 30 grains in lavements.

The dangers of this method were well shown at the time of the discussion which took place before the Société des Hôpitaux, in 1882.

Dreyfus Brissac, Dujardin-Beaumetz and Siredey pointed out the collapse and the pulmonary congestions which accompany the administration of phenic acid, and Siredey has also cited the toxic action of this acid.

Similar facts were given in 1881 at the Biological Society, by Raymond.

In 1881, Glenard considered phenic acid as producing toxic accidents, and that its application to typhoid fever does not lower the rate of mortality. Ramonet also pointed out that among the accidents laid to the charge of the phenic medication, pulmonary congestion is the most frequent and the most formidable.

Desplats has responded to these various objections in replying that phenic acid properly administered does not produce any of these accidents. At the same time he admits that the administration of this acid is not without danger. (*a*)

(*a*) Stephen Skinner, On the Treatment of enteric Fever by use of internal Disinfection (the Pract., september 1873).—Tempesti, Usage de l'acide phénique dans la fièvre typhoïde (lo Sperim., janvier 1877).—Pécholier, Sur les indications du traitment de la fièvre typhoïde par la créosote ou l'acide phénique et les affusions froides (Montpellier méd., juillet 1874, p. 36).—Desplats, Sur l'emploi de l'acide phénique comme agent antipyrétique (Acad. de méd., 1880). De l'acide phénique appliqué au traitement de la fièvre (Journ. des sc. méd. de Lille, 1881). Action comparée de l'acide phénique et du salicylate de soude (Journ. des sc. méd. de Lille, 1882). Traitement de la fièvre typhoïde par l'acide phénique (Bull. de thér., t CIII, 1882, p. 193).—Van Oye, De l'action de l'acide phénique sur les fébricitants (thès de Paris, 1881).—Maquart, Traitement de la fièvre typhoïde par l'acide phénique (thèse de Lille, 1882).—Glénard, Valeur antipyrétique de l'acide phénique dans le traitement de la fièvre typhoïde, acide phénique ou bains froids (Lyon méd., 1881).—Ramonet, De l'action et des règles de la médication phéniquèe dans la fièvre typhoïde (Arch. gén. de méd., 1782).—Siredey, Vulpian et Bouchard; voir Royer, De l'acide phènique et du phénate de soude (thèse de Paris, 1881, et Soc. des hôp., 1882).

employ of these phenic lavements. Since then, at the Medical Society of the Hospitals, at the time of the discussion which followed the report of Ferrand on the method of Desplats, several of our colleagues, and in particular Siredey and Dreyfus Brissac, mentioned similar facts; therefore, gentlemen, while recognizing the powerful antipyretic action of phenic acid, this medication must be considered as dangerous, and when you have recourse to it you cannot exercise too great care and watchfulness. For my part, I think it should be abandoned altogether.

Resorcin has been little used in typhoid fever. You will see, when I come to speak of intermittent fever, that it has been used to advantage in this fever, but although I have made many attempts to introduce this substance into the therapeutics of our country, I have not obtained any very positive effects from it in ileo-typhus. As for kairine, I am not aware of any definite results which have been obtained from it in this disease.

I pass now to the study of germicide medication. You already well know that a great number of antiseptic medicaments have become, by their therapeutic application, antipyretic medicaments; this is what has happened in the case of many substances derived from the aromatic series. It remains for me now to speak of medicaments which, while possessing an evident antiseptic action, have not, at the same time, any effect on the temperature.

It is thus that there have been successively applied to the treatment of typhoid fever, creasote by Pecholier[1] and Morache, iodine and the iodides by Aran, Magonty, and Wilbrand;[2] a combination of iodine and carbolic acid by Roberts Bartholow and James C. Wilson; chlorine and the hypochlorites by

[1] Pecholier, of Montpellier, employs an antizymotic treatment in typhoid fever. This treatment consists in the use of creasote in the dose of 3 to 5 drops, associated with the essence of lemon. He employs also cold affusions, but only to combat the ataxo-adynamic element.

Morache also employed creasote at Val de Grâce, in 1870. He gave from 4 to 8 drops a day. The stools were disinfected, and a thermic depression was noticed. Out of 59 patients affected with typhoid fever, where this method was applied, there were 59 deaths. (*a*)

[2] Sauer proposed, in 1840, to treat typhoid fever with iodide of potassium. Aran, in 1853, employed, in typhoid cases, tincture of iodine, administering daily from 13 to 30 drops.

Magonty, in 1859, and von Wilbrand, in 1866, employed in the treatment of typhoid fever, the iodureted solution of iodine. This solution has the following formula:

Iodide	0g.30—(5 grains).
Iodine of potassium	2.00—(30 grains).
Water	10.00—(150 grains).

Dose, 3 or 4 drops every two hours, in a wine-glass of water.

Liebermeister, who has tried this medication, has observed no result, but the mortality was less in patients where this iodo-iodureted solution was employed. (*b*)

(*a*) Pecholier, on the indications of the treatment of typhoid fever by creasote, or phenic acid, or by cold affusions.—(Montpellier méd., July, 1874, p. 36) Morache, on the employment of creasote in typhoid fever.—Gaz. (des hôp., 1871, p. 394.)

(*b*) Aran, on the employment of iodine in typhoid fever (Bulde thér., 1853). Magonty, new treatment of typhoid fever (Paris, 1859). Liebermeister, in Ziemssen's Cyclop. Art, typhoid fever.

Chomel and Beaufort;[3] the sulphites and hyposulphites by Polli;[4] preparations of copper by Burq and Moricourt;[5] mercurial preparations (the black sulphuret) by Serres; and calomel by Wunderlich[6] and Liebermeister, also by Bartholow and Wilson in America. I shall not dwell further on these antiseptic preparations, this medication not being established on a scientific basis; for, if by the introduction of antiseptic substances it has been possible to disinfect the stools, it has been impossible to arrest the course of the disease, that is, to prevent the development and penetration of the micro-organisms into the entire economy.

Regis also employed iodine, both by respiration and by deglutition. He was in the habit of putting in the mouth of the patient pastilles containing from 1 to 2 grains of iodine. These pastilles were not to be chewed. Every hour he gave the following potion:

Tinct. iodine	0g.20 (4 grains).
Syrup	30.00 (℥ j).
Orange-flower water	20.00 (℥ v).
Peppermint water	60.00 (℥ ij).

[In this country Professor Bartholow has used, apparently with decided success, the following modification of the iodine treatment:

℞ Tinct. iodinii ..... 8.00 c. c. (fl. ℥ ij).
Acid. carbolic ..... 4.00 c. c. (fl. ℥ j.)

M. Sig. 1 to 3 drops three times a day.

He now gives it every three hours, during the day and night. (Boston Med. and Surg. Journ., Feb. 1, 1883.)]

[3] Chomel has employed, since 1831, the dried hypochlorite of soda, dissolving it in the proportion of about 15 grains to a pint of water. He thus gives his patients daily from 30 grains to a drachm of the salt. He employs, also, lavements containing 15 grains of the hypochlorite. He also wets cataplasms with Labarraque's solution and sprinkles the floor and the bed-clothes with the same.

De Beaufort has employed a solution of hydrochloric acid diluted as lemonade, containing from half a drachm to a drachm of the acid to each quart.

Winter (of Giessen) has employed chlorine and obtained excellent results from it.

[4] Polli employs in typhoid fever sulphites and the hyphosulphites; this medication, according to Murchison, has very doubtful results.

Wilks employs sulphurous acid [giving two to three drachms a day, well diluted], and Meklhausen has obtained success by this same treatment.

[5] Burq has shown, by statistics, that workers in bronze are protected from cholera and typhoid fever. Taking a hint from this, Moricourt has prescribed small doses of ammonio-sulphate of copper by mouth and by lavements.

Burq's prophylactic consists in giving binoxide of copper pills (1/6 gr.), and thinks that this preventive treatment is "full of hope." (*a*)

[6] Serres has proposed the treatment of typhoid fever by mercurials. He makes frictions with mercurial ointment over the abdomen, rubbing in 2 to 4 drachms of the ointment per diem, giving also internally a scruple of the black sulphuret of mercury. Grisolle has tried this method, and has found it absolutely inefficacious.

Calomel seems to have given better results than the black sulphide of mercury. Tauff-

(*a*) Burq, on the treatment of cholera by copper (Gaz. des hôp., 1883). Maricourt, treatment of typhoid fever by cupric preparations (Gaz. des hôp., 1882).

Calomel, which terminates this long series of antiseptic medicine, belongs rather to the evacuant than to the parasiticide medication, and will serve as a bond of union between the two. The idea which gave rise to the evacuant medication was perfectly just, especially at the time when this medication was first instituted. In fact, we have seen De Larroque maintain since 1832,[7] that it is in the fecal matters that the septic element of the disease is found, and that it is necessary, in order to prevent the poisoning of the entire organism, to eliminate these septic matters by stool. You have seen that experimental physiology has justified this view of the subject; only, in their haste to eliminate the peccant principle, the founders of the evacuant method have gone a little too far, and have not hesitated to give every day an ounce of castor oil or a bottle of Seidlitz water. Carried to this extreme, the purgative method is rather injurious than useful; it weakens the patient, and, by exaggerating the peristaltic movements of the diseased intestine, it may be the exciting cause of hæmorrhage or of perforation. Utilized in moderation, however, the evacuant method is a serviceable adjuvant to treatment, promoting elimination of putrescent matters.

It remains for me to speak of the tonic and empirical medication. The tonic medication is now universally popular, and in order to repair the incessant losses which the organism undergoes from the exaggerated combustions which the febrile process determines, preparations of quinine have been employed, and, along with suitable alimentation, alcoholic stimulants.[8]

I shall not repeat what I said about alimentation while on the hygienic treatment of typhoid fever, nor shall I dwell further on preparations of bark,

lieb pretends by these medications to have arrested the march of the disease. Wunderlich has also noted a diminution in the duration of the affection under calomel.

Liebermeister has also obtained good results. The latter gives three or four half gramme doses of calomel in the course of 24 hours, at the onset of the disease. He never noticed stomatitis of any gravity. Liebermeister assures us that the mortality is diminished, and the duration abridged by this treatment. (*a*)

[7] Larroque, who in 1839 and 1844, published elaborate treatises on typhoid fever and its treatment, has given the most explicit directions as to the evacuant medication of this disease. His faith in the curative benefit of purgatives was based on this idea that the septic matters contained in the stools, by remaining in the intestine, effect alterations in that viscus and penetrate the organism, poisoning it; and Frémy compared what took place in such cases with what happens in suppurating wounds when in free communication with their septic products. The treatment was as follows:

At the commencement, an emeto-cathartic was given, and every morning the patients took a little Seltzer water, or an ounce of castor oil, or a half drachm dose of calomel. The mortality in these cases was only about ten per cent. Piedagnel (the author of a treatise bearing date of 1835), in employing Larroque's method, had a mortality of 14 per cent., and Andral, of 16 per cent.

[8] It was Graves, Stokes, and especially Todd, who introduced alcohol into the treatment of fevers, and typhoid fever in particular.

Jaccoud administers alcohol in all cases of typhoid fever, prescribing according to the

(*a*) Serres, Du traitement de la fièvre typhoïde par les préparations mercurielles (Acad. des sc., 1847). Wunderlich, De la température dans les maladies, 1872.—Liebermeister, Typhus abdominali in Ziemssen's Handbuch des Allgemeinen therapie, Bd. II, 1874.

only pointing out this fact, that the potions containing the soft extract of cinchona, which are so much administered in these cases, often pass through the alimentary canal without undergoing any modification; and in many instances I have found in the stools of my patients almost the whole of the extract which I had given them. But I must devote a little more time to a consideration of alcohol.

Since the works of Todd in England, and those of my master, Behier, in France, the use of alcohol in this fever has acquired great vogue, and I have already spoken of the advantages and disadvantages of this medication, while on the treatment of pneumonia. In typhoid fever, alcohol does not act as an antipyretic, and if you wish to lower the temperature by this agent, you will have to give such large quantities of it that the treatment will be more dangerous than useful; but, given in proper doses, alcohol acts as a tonic, and, moreover, diminishes that process of denutrition which results from exaggeration of the combustions; this is its great utility.

To those who adopt the opinions of Lallemand, Perrin, and Duroy, it is very difficult to explain this waste-restraining action, because, in their belief, alcohol does not undergo any transformation in the organism. According to the hypothesis which I have defended, and which seems to-day experimentally demonstrated, this kind of effect is quite readily explicable. I maintain, in fact, that alcohol, in presence of oxyhæmoglobin, and by virtue of the feeble

constitution, strength, and habits of the patient, from one to three oz. of rum or of brandy in the form of cordial potion, or of julep, adding 30 to 50 grains of extract of cinchona.

Murchison does not administer alcohol constantly ; he gives with precision the indications and contra indications of this medication, which he formulates in the following way : It is, he says, advantageous to give spirituous liquors to alcoholic subjects early in the disease, and in quantity proportioned to the number of years exceeding forty which the patient may have passed. A quick, soft, compressible, irregular, intermittent, wavy pulse calls for alcohol, whose good effect is seen in slowing and strengthening the pulsations ; if, on the contrary, it accelerates them it does harm.

Alcoholic stimulants should also be given to patients who perspire profusely, and in whom this perspiration does not coincide with amendment of the general symptoms.

In typhoid subjects with dry, brown tongue, it is always indicated, and it may even be given in cases of typhoid fever with delirium, when the delirium is not aggravated under its use. Alcohol is also indicated in the adynamic forms, and in those accompanied with complications.

It should be abstained from in patients below thirty years of age, in patients with dry skin, in cases complicated with delirium, which alcohol is almost sure to augment, especially in noisy, acute delirium, in cases where an intense cephalalgia is observed, with injected eyes and cerebral determinations, lastly, in patients where the urine is scanty, of little density, poor in urea, and rich in albumen.

Fourrier, in a valuable article on typhoid fever in the Bul. gen. de. Ther. for 1873, showed all the advantages to be derived from alcohol in dothinenteritis. According to him, alcohol diminishes the duration of the disease, and acts well in cases where delirium exists. In 1871 Antellet also insisted on the antipyretic action of alcohol in typhoid fever. He maintained that alcohol diminishes the fever and lowers the temperature.(*a*)

(*a*) Jaccoud on the treatment of typhoid fever. Paris, 1873.—Murchison on typhoid fever. London, 1878.—Antellet on the antipyretic action of alcohol in typhoid fever. Paris, 1871.

bond which in this substance unites oxygen to hæmoglobin, appropriates the oxygen, and, transforming this oxyhæmoglobin to reduced hæmoglobin, modifies and arrests in a certain measure the oxidation of the tissues of the economy.

Todd, Murchison, Fourrier, and Autellet have shown us the good effects of the alcoholic medication in typhoid fever. Notwithstanding the advantageous results claimed, I do not believe that we ought, following the example of Jaccoud, to give alcohol to all our typhoid patients indiscriminately; and I believe that it is best to reserve this remedial agent for certain cases which I shall soon have occasion to describe.

By the side of alcohol we should place that triatomic alcohol known under the name of glycerine, which Semmola has administered with good effect in fevers,[1] and which you may utilize advantageously under the form of glycero-tartaric lemonade in your practice.

I shall have finished this long series of medicaments and medications when I have spoken to you of ergot of rye, which is recommended by Duboué.[2] Basing himself on physiological data, very ingenious but rather hypothetical, this authority advances the opinion that the typhoid virus affects particularly the muscular contractility, and especially that of the arterioles, and it is this

[1] Semmola counsels the following formula :

℞	Glycerine	℥ j.
	Citric or tartaric acid	ʒ ss.
	Water	Oi.

M.—Sig. to be used freely as a drink in typhoid fever.

According to Semmola glycerine is a *sparing* medicament (aliment d'épargne), which is very useful in the treatment of severe febrile processes, especially in typhoid fever.(*a*)

[2] Duboué believes that the typhoid poison acts especially as a vaso paralytic ; the poison induces nutritive troubles of the muscular system, but especially of the vascular system, causing diminution of the contractility of the blood vessels. The heart and vessels thus altered cease to functionate, and there results a general stasis, with vascular congestions ; the stasis gives rise to globular alterations, which, in their turn, become toxic agents, and determine other congestions. It is thus that he explains the favorable action of ergot of rye in the treatment of dothinenteritis, ergot being a vaso-constrictor medicament.

This writer recommends always to verify the goodness of the ergot before making use of it ; the grains should be carefully examined, and if eroded or full of holes, or covered with white mould, they should be rejected; the fracture of the grains should be smooth. As for the medium dose, it is from 20 to 50 grains for an adult, and from 8 to 15 grains for children of from 6 to 12 years of age.

You should always commence, unless in very severe cases, with a relatively small dose; the daily quantity should be administered in fractional doses, every three, four, or six hours. The powder may be given in capsules or wafers, each containing from two to six grains; in grave cases it is better to administer this powder in the form of potion.

The effects of ergot medication are very speedy, even in grave cases.

To avoid relapses and sudden death, Duboué recommends the administration of ergot until an advanced period of convalescence, but in feeble doses (eight grains daily in two four-grain doses).

Lardiez, author of a treatise on the use of ergot in typhoid fever, published in 1882, and

(*a*) Semmola on the employment of glycerine in acute fevers. Bul. de Ther., 1883, t. civ., p. 481.

paralysis of the vaso-motors which constitutes the essence of typhoid fever. To this want of contractility, he opposes medicaments which have the property of augmenting the tone of the bloodvessels, and, in particular, ergot of rye. The trials which I have made with this treatment have not given any positive results, and I believe that if the spurred rye and its derivations are ever indicated in this disease, it is to combat the intestinal hemorrhages which so often occur.[3]

In this therapeutic arsenal, the richness of which I have already shown you, physicians have chosen arms of various kinds, sometimes a single weapon, sometimes several, with which to fight abdominal typhus, and have thus constituted single medications and compiex medications, and, according as they have applied them exclusively to all cases of dothinenteritis, or as they have varied them according to circumstances, they have made thereof exclusive medications, or medications according to the indications. Lastly, another group of physicians have thought that by the unaided efforts of nature, typhoid fever ought to end in recovery, and have applied to the treatment of this disease the doctrine of expectancy. Hence we have these three systems of treatment; exclusive medication, expectancy, and medication according to indications. I cannot too much protest against exclusive medication, whether in typhoid fever or in any other disease. One patient is never just like another patient, and it is absurd to suppose that the practice of medicine can be summed up in a simple breviary, containing, on the one hand the description of the disease, and on the other the therapeutic formula that will cure it. Age, sex, state of the vital forces, the symptomatic aggregate, above all the genius of the epidemic, modify the disease in its totality, and at every step in its evolution.

The science of the physician consists in modifying the treatment according to the divers circumstances, and it is from this fact that results that intimate union which I regard as so indispensable, of clinical medicine and therapeutics. Do you believe that typhoid fever is the same in an infant as in an old person? Do you believe that grave cases can be assimilable to

who has employed the method of Duboué, considers ergot of rye as a powerful means of medication, and of which he has personally seen the beneficial effects. Guichard also considers medication by ergot of rye as of marvellous efficacy.(*a*)

[3] Edwards Duffield has employed in typhoid fever the tincture of dyer's weed (baptisia tinctoria), giving it the dose of two or three drops every two hours. This remedial agent, which he recommends for the more grave cases, has not been employed by other observers. (*b*)

(*a*) Duboué, La physiologie pathologique de la fièvre typhoïde, Paris, 1878.—Des effets comparés des divers traitements de la fièvre typhoïde et de ceux produits en particulier par le seigle ergoté de bonne qualité, Paris, 1883.—Du traitement de la fiévre typhoïde par le seigle ergoté [Acad. de méd., 5 et 12 septembre, 1883].—Lardier [de Rambervillers], De l'emploi de l'ergot de seigle et de ses dérivés dans le traitement de la fièvre typhoïde et du contrôle à exercer sur la bonne qualité de ce médicament [Gaz. hebd. de méd. et chir., 22 décembre, 1882, et 5 janvier, 1883].—Guichard, Concours méd., 21 octobre, 1882, p. 520.

(*b*) Edwards Duffield on baptisia tinctoria in typhoid fever. New York Med. Record, Nov. 1, 1872. [The baptisia tinctoria has long been a favorite remedy in typhoid fever, as well as in septic putrid fevers generally, among the Eclectics of the U.S.] (Tr.)

light cases? Do you believe that benign epidemics are suitable for comparison with malignant epidemics? Do you believe, in a word, that one same therapeutic formula, rigorous and uniform, can be made applicable to all cases indiscriminately, and that we can thus reduce to a common level all forms of the disease?

I know well that the partisans of the exclusive treatment, whether single or complex, pretend to reduce all cases of the disease to one and the same type, but this is only an assumption which is not supported by the facts, and as Professor Vulpian says with so much justice, we have not as yet found a kind of treatment which is sure to modify the march of this disease and arrest its course. There are physicians who pretend to have methods which jugulate typhoid fever; but when we come to examine attentively all the so-called jugulating medications, we perceive that to obtain all the benefits which they promise, they must be applied in the first seven days of the disease, that is to say, in a period in which one is almost sure to confound simple gastro-intestinal irritation (*embarras-gastrique*) with typhoid fever. It is these same physicians who have called to the support of their doctrine of jugulation, the mild forms of typhoid fever described by Jules Guerin, and which the Germans have treated under the name of typhus-levissimus, and in which one sees the malady undergo its evolution in from twelve to fifteen days; but these are natural forms of the disease and not the result of modification by therapeutic means.

There is no such thing in existence as expectancy, properly so-called, applied as a medical or therapeutical system, for physicians who boast of employing this method take all due pains, nevertheless, to surround the patient with all the hygienic care which his situation demands, and to attend to the hygiene of your patient is not to deprive him of therapeutic aid, but to render him excellent therapeutic service. But often these hygienic attentions are insufficient, and more active intervention is required, and you must then resort *secundum artem* to the medication according to indications which I have styled armed expectancy. This expression, *armed expectancy*, has given rise to much criticism. Germain Sée has condemned it as "revolutionary." I do not consider that it has this significance, and if our interference is demanded, it is not to effect any violent changes in the economy, but to calm and regulate the disorders there going on; it is then rather as conservators than as radical innovators that we act.

But, you may ask, what are the rules of this "intervention?" On what manifestations do you depend when you decide on the advisability of more active therapeutic endeavors? These three points should guide you, gentlemen: the intensity of the fever, the general state of the patient, the complications which arise; and, to set forth with more method these three points, we will in imagination take a case of typhoid fever, and follow it through the various phases of its evolution.

Your first care will be, as soon as you suspect typhoid fever, to surround your patient with all the hygienic precautions which I have above enumerated; you take the temperature twice a day, at precisely eight o'clock in the morning and five in the afternoon. Although the rectal temperature is always prefer-

able to that of the axilla, the latter generally suffices. You watch carefully the abdominal functions, and you regulate the bowels by giving mild laxatives, such as saline purgatives and the natural mineral waters, which are better than castor oil. It will be well to cover the abdomen of your patient with a layer of cotton batting, which is kept applied by means of a body bandage. This application immobilizes, in a certain measure, the intestinal mass, and prevents the too sudden shocks, which, in the present disordered state of the intestines, may do mischief. This wadding is much superior to poultices, which are inconvenient by reason of the clammy and uncomfortable moisture which attends them. Then I make my patient the subject of serious attention, being ready to act according to the rules I have just mentioned; if the temperature does not exceed 102° F.; if no complication arises, I adhere to the hygienic treatment, and those mild laxatives administered every day, and you have many times seen in my service that these simple means are quite sufficient for benign forms of the disease.

When the temperature exceeds 102° F., I begin the practice of cold lotions (sponging), which I repeat two or three times a day, or even oftener, according to the elevation of the temperature. These means often suffice to keep the temperature in the neighborhood of 102° F. But when it exceeds 103° F., and marches towards 104° F., then is the time for my intervention of salicylic acid. I give at noon, and in the space of an hour, four capsules, each containing seven and a half grains of salicylic acid, and I take care to administer during the day a certain quantity of milk, namely, about a quart.

Under the influence of the salicylic acid there is a depression of temperature; but to render this, in a manner, permanent, I repeat my dose the next day, at the same hour, then I omit the treatment for a day or two, and note the height of the thermal curve. If it attains the previous figure, I again give the acid for two days, in the same dose; and if the temperature still tends to exceed 104° F., I double the dose, and then give sixty grains in two hours—in doses of seven and a half grains every fifteen minutes; and sometimes I go as high as seventy-five grains; but I never prolong beyond two days the action of the medicament. Such are the sole means which I employ against the pyrexia.

In order to judge of the condition of the vital forces, I am guided by the assemblage of symptoms and the stage of the pulse.[1] As long as the pulse re-

[1] Melherbe has studied the modifications of pulse in relation to temperature in typhoid fever; and draws the following conclusions: 1. In typhoid fever the frequency of the pulse is not always proportional to the elevation of the temperature; 2. If the pulse remains of little frequency, and the temperature of but slight elevation at the onset of a febrile affection, typhoid fever is probable; 3. If the pulse remains between 80 and 90 in the course of typhoid fever, although the temperature rises above 104° F., or even 105° F., there is not generally reason to pronounce the prognosis to be bad; 4. If, on the other hand, the frequency of the pulse augments at the same time that the temperature rises above 104° F. or 105° F., the prognosis is very grave; 5. If the temperature suddenly falls, while the pulse increases in frequency, the prognosis is unfavorable; 6. The parallelism between the daily oscillations is subject to numerous modifications. (*a*)

(*a*) Malherbe, on the diagnostic and prognostic value of the relations of the pulse and temperature in typhoid fever [thèse de Paris, 1883].

mains between 80 and 90 a minute, I let the patient alone; when it raises above 90, I give alcohol, either in the form of Todd's mixture, milk punch containing brandy, or Spanish or Sicilian wines.

In the immense majority of cases, when the fever takes on a certain acuteness, there supervenes a nocturnal delirium of mild type; when this delirium becomes more active and boisterous, I resort to chloral, which I much prefer in these cases to opium and its derivations, which, in fact, have for their physiological effect to congest the brain; and you well understand that in ileo-typhus, in which this congestion is the rule, opiates may do harm. I administer, then, hydrate of chloral, in the dose of fifteen to forty-five grains, in a mixture of egg and milk sweetened; and I frequently associate bromide with chloral.

A boisterous delirium often accompanies ataxic phenomena, constituting thus what was formerly described under the name of ataxo-adynamic fever. When this state is not too intense, and the fever is attended with dryness of the skin, I place my patient in a warm bath, which I repeat every day or two. If the ataxo-adynamic condition becomes more intense, I have recourse to envelopment in the wet sheet, which envelopment I repeat two or three times a day, according to the necessity. I add often in these cases to the chloral or the bromide, preparations of musk, of which Trousseau made great account, and I give from seven and a half to fifteen grains of musk, in pills rather than in potion, the latter being very disagreeable to the taste. Such are the therapeutic means which I employ in the adynamic and ataxic forms of typhoid fever, and I come now to other morbid determinations of the disease.

The pulmonary complications are the most frequent. They include bronchitis, pneumonia, broncho-pneumonia, and sometimes, though very rarely, pleurisy. In the treatment of these pulmonary complications, you should avoid the application of blisters; the patient, in fact, being in a state of constant agitation in his bed, and the functions of the skin being altered, these fly-blisters are attended with ulceration, or even gangrene, and may thus become a serious evil. You should use, instead, dry cups, which render us great service in typhoid fever with pulmonary congestion, and with these cups you may cover the whole chest of your patient. You may also give internally a little tincture of aconite, which diminishes, though feebly, this congestive tendency. It will be well also to have your patients well propped up in their beds, so as to prevent those hypostatic congestions which too horizontal a position determines.

I have but little to say about cardiac complications, at least from the point of view of treatment. Here we have, unhappily, one of the causes of sudden death in typhoid fever, not easily explicable always, whether we suppose, as Dieulafoy does, a simple reflex action, whether we attribute the fatality, as does Hayem, to symptomatic myositis, or whether we make it depend, according to Laveran and Bussard, on cerebral anæmia, or whether it results from these last two causes combined, as Huchard maintains.[1] Our therapeutics, in fact,

[1] Four theories have been advanced to explain sudden death in typhoid fever.

1. *Theory of reflex action.*—This theory has Dieulafoy for its advocate. According to him the syncope is due to a reflex action which has its starting place in the diseased intestine.

have very little power to prevent such a termination. I agree, at the same time, with Huchard, that tonics, general stimulants, and perhaps nitrite of amyl, may in these cases render some little service.

On the part of the digestive tube there may supervene several complications. One of these consists in the appearance of gastric troubles, and I have already spoken to you of them while on the subject of diet in this disease; the other is an accident much graver and always mortal, namely, perforation of the bowels; lastly, the third results from the occurrence of intestinal hemorrhages. I have little to say to you from a therapeutic point of view concerning intestinal perforations, yet apart from perforations as a determining cause, peritonitis has been sometimes observed in typhoid patients. In these cases there is a possibility of a recovery by a rigorous treatment, which consists in the application of ice to the abdomen, and immobilization of the intestinal mass. As for intestinal hemorrhages, we have seen that when they are of moderate intensity they are often rather beneficial than otherwise; unhappily it often occurs that they are too abundant, and we are called on to interfere with applications of ice to the abdomen, and the internal administration of perchloride of iron or ergotine. For my part I very much prefer ergotine or ergotinine, which I give in hypodermic injections. I have thus far omitted to say anything about the diarrhœa. While recognizing the fact that a typhoid patient ought to have two or three movements a day, there are cases when the passages are altogether too frequent, and exhaust the patient. I advise you in these cases to make use of the salicylate of bismuth, in from forty to sixty grains a day.

The renal complications present a certain gravity in typhoid fever. Fothergill even thinks that it is the non-elimination of the products of com-

He bases himself on the experiments of Goltz, Bernstein, Jarchanoff, and of Francois Franck, who have demonstrated that a shock affecting the intestinal mass determines sudden arrest of the heart in animals.

2. *Theory of cerebral anæmia.*—This theory has been defended by Laveran, and by Bussard, according to whom death supervenes from anæmia of the bulb and secondary arrest of the heart.

3. *Theory of myocarditis.*—Hayem has called attention to the frequency of granular degeneration of the cardiac muscle in typhoid fever, and it is in this way that he explains the arrest of the heart and sudden death in this disease.

4. *Theory of cerebral anæmia and myocarditis.*—Huchard shows that none of the preceding theories sufficiently explain the pathogeny of sudden death in typhoid fever. According to him, two predisposing causes, the alteration of the heart and the anæmia of the brain, place the typhoid patient in almost continual imminence of syncope.

The granular degeneration of the heart muscle, and the consequent enfeeblement give rise to anæmia of the cerebrum and bulb, and the latter, already pre-existent and persistent in the convalescence of typhoid fever, concurs on its part in promoting syncope and in permanently arresting the heart (*a*)

(*a*) Huchard, Critical Study on the Pathogeny of Sudden Death in Typhoid Fever (Un. Med., 1877). Hayem, Note on the alterations of the muscles in fever, and particularly in variola (Soc. de biol, 1866), also, Relations which exist between sudden death and vascular alterations in typhoid fever (Arch. de phys., 1869, p. 700], also, Studies on the symptomatic myosites, [Arch, de phys., 1870. Dieulafoy, On Sudden death in typhoid fever [thése inaug., 1870], etc.

bustion which is the point of departure of the typhoid state.[1] The kidney, in fact, is congested in typhoid fever, and the urine is albuminous. Whether we are concerned with an infectious nephritis, as Bouchard thinks, or with a congestive nephritis,[2] there none the less results a perturbation in the functions of the renal organ, and I have already spoken to you of the important part which I assign to this perturbation in explaning the toxic action of certain medicaments in typhoid patients. It is necessary, then, to favor the functions of urination, and you can accomplish this by giving abundant drinks to your patient, and one of the best is certainly milk. I share, in this regard, the view of Jaccoud, who thinks it a good thing to give to his fever patients one or two quarts of milk a day.

The skin, as you know, may become the seat of mortifications more or less deep (bed-sores); these eschars are sometimes of great gravity, extending so far as to expose the bones of the pelvis. I have even observed myelitis consecutive to the opening of the vertebral canal in typhoid patients. I have already shown you by what hygienic means you may avert these mortifications of the skin, but when despite your care they appear, you will require a special dressing for them. The best in my opinion is a solution of chloral. It was in a case of gangrenous ulceration of the hip of great extent, in a young typhoid female, that I made the first local application of chloral, and the astonishing results which I obtained from this outward medication encouraged me to study and make known the antiseptic properties of chloral, and this work of mine has served as a basis for the local therapeutic employ of chloral, to-day so much in vogue.

You make, with one-per-cent. solutions of chloral, frequently repeated

[1] Fothergill has studied the typhoid state; according to him this state depends on the retention of materials of combustion which should have been eliminated, and this takes place under two conditions. Either there is an excess of production of these effete organic matters within a given time, and under circumstances unfavorable to their elimination, so that they accumulate in the blood; or else, under conditions of normal combustion, renal degeneration prevents their removal from the organism. He concludes that in typhoid fever we should aid the various excretory emunctories, skin, kidneys, intestines, etc., and promote elimination. (*a*)

[2] A renal form of typhoid fever has been described by Gubler, A. Robin and others. Hardy in 1878 devoted several chapters to this subject. Legreux and Handt and Renault, of Lyons, have also studied the renal lesions of typhoid fever. Bouchard has shown by the presence of bacteria in the urine the parasitic nature of this nephritis.

This nephritis is multiple, parenchymatous and interstitial, and the inflammatory process affects all the elements of the kidney. The symptoms of the renal form are characterized by adynamia, stupor, dryness of the tongue, œdema of the members, lumbar pains and cutaneous disorders; the last are especially ecthyma, furuncles, etc. The urine is sanguinolent, and contains an abundant grayish retractile albumen. (*b*)

(*a*) Fothergill, On the typhoid condition [Edinb. Med. Jour., Dec. 1879, p. 225]

(*b*) Gubler, Leçons faites à l'hôpital Beaujon sur l'albuminurie, et article Albuminurie [Dict. encycl. des sc. méd., Paris].—A. Robin, La fièvre typhoide. Essais d'urologie clinique [thèse de Paris, 1877].—Legroux et Hanot, Observations d'albuminurie dans la fiévre typhoide [Arch. gén. de méd.]—Renaut, Arch. de phys., janvier 1881.—Bouchard, Des néphrites infectieuses [Rev. de méd., 1881, p. 971].—Petit, Des néphrites dothiénentériques [thèse de Lyon, 1881].—Didion, De la fièvre typhoide à forme rénale [thèse de Paris, 1883].

dressings, and you have care especially to introduce into the excavation which results from the mortification of the tissues, wadding or lint soaked in this solution.

Apart from these eschars I ought to mention erysipelas of an infectious kind, and for that very reason of extraordinary gravity; phlegmons, accidents quite common in typhoid fever of a subinflammatory character, deeply hidden in the interstices of the tissues, and the possibility of which ought to make you examine, with the most scrupulous attention, the painful points of which typhoid patients sometimes complain during their convalescence. You well understand that these purulent collections should be thoroughly drained and treated by antiseptic washings and injections.

Such are, gentlemen, the principal complications which you will have to meet; there are still others of which I shall not speak, for they are exceptional; such as gangrene of the limbs, œdema of the glottis resulting from laryngo-typhus, suppurative parotitis, but it is very rarely that you will have occasion to treat these complications.

I shall say but little of the convalescence of typhoid fever; remarking at the same time that relapses are frequent in this disease, and especially that variety of remittent or intermittent fever which accompanies convalescence from typhoid fever; a variety which David Borelli has plausibly explained by the presence of intestinal ulcerations slow to cicatrize.[1] The entire therapeutics of convalescence is summed up in a problem of alimentation, and you should employ all your care and skill in directing aright the diet.

Such is the aggregate of therapeutic means which you ought to employ in typhoid fever; in putting them in practice you will succeed in curing the great majority of your cases, and without admitting with certain physicians that it is possible, by therapeutic means, to cause the mortality of typhoid fever to disappear, I am of the opinion that there is no disease in which the success won by therapeutics are more numerous.

It is in following step by step the disease whose evolution he has mastered, that the physician by his earnest and thoughtful care and his attention to little points, by his energetic intervention when complications appear, may in many cases say that he has saved the life of his patient, and to express briefly my thought, I might conclude with this phrase, which although a solecism, is the truth—"The best treatment of typhoid fever is a good physician."

[1] David Borelli has described, under the name of slow ulcer of typhoid fever, certain intestinal ulcerations developed under the influence of this disease, and which take a long time to undergo reparation. The presence of these ulcerations determines attacks of remittent fever, which resemble much what one observes in pyæmia, and which are rebellious to quinine. Borelli has been able to prove the existence of these ulcerations by post mortem examinations. The treatment consists in the administration of milk or broth, in maintaining immobility of the abdomen; it is useful to add now and then a laxative to maintain freedom of the bowels. (*a*)

(*a*) David Borelli, on slow ulceration of the intestines in typhoid fever [Ann. Clin. degl. Incur, Anno. 1, 1877].

APPENDIX.

THE NEW ANTIPYRETIC—ANTIPYRINE.

Since the foregoing chapter was written a new antipyretic has been brought to the knowledge of the profession. In many respects this new febrifuge medicament, to which the name antipyrine has been given, seems to be superior to all the other agents of the antipyretic medication. Numerous monographs concerning it have appeared in the medical journals of both continents, and the properties of the new medicine have been discussed before numerous medical societies. From the already quite extensive literature of antipyrine we select portions of the recent contribution of Dr. Leon Arduin, in the Bulletin General de Therapeutique, March 30th, 1885 :

"The antipyretic medication has from all time interested practitioners, and if it will not do to accord to fever all the gravity which was attributed to it once, there are nevertheless cases where it becomes not only a complication, but even a veritable danger, against which the physician should direct all his efforts. If we pass in review the principal antipyretics employed down to the present time, such as salicylic acid, salicylate of soda, phenic acid, resorcin, in fine those of quite recent discovery, such as kairine, aspidospermine, and thallin, one does not fail to see that the inconveniences, and sometimes the dangers attending these medicaments, make physicians often hesitate to employ them. Only one remains in the first rank. I refer, of course, to sulphate of quinine, whose marvellous action is incontestable. Now, in typhoid fever, is it not a fact that the action of quinine becomes *nil*, or almost so, after a few days ?

Nevertheless, leaving one side intermittent fever, it is still in dothinenteritis that the action of quinine is the most manifest. Besides, sulphate of quinine has certain inconveniences attending its use, such as buzzing in the ears, cephalalgia, vertigo, nausea, etc. In a word, despite the incontestable action of sulphate of quinine, we are still looking for a good antipyretic medicine, for in a number of febrile diseases it is impossible for us, in the present state of therapeutics, to lower with certainty a too elevated temperature, and, at the same time, to do this with entire safety to the patient.

Antipyrine is a derivative of oxymethylquinizine, which is the product of acetacetic ether reacting on phenyl hydrazine ; if to this oxymethylquinizine you introduce a new methylic group, you have methylated oxymethylquinizine, which Knorr has called dimethyloxyquinizine, and Felehne, antipyrine. This substance is in the form of grayish-white powder, slightly bitter to the taste, and slightly soluble in water.

Our clinical and therapeutical study of this medicine is based on more than fifty cases, most of them occurring in the practice of Dr. Huchard. Several facts of a practical nature result from these observations. The first, which M. Huchard has made known, is the almost elective action of antipyrine in diseases of the lungs, and in the fever of the tuberculous ; for it is seen that with minimum doses of eight grains, and even of four grains, you obtain a sure fall of the temperature, and this sometimes by more than 2°.

Moreover, it suffices to cast a glance over the thermometrical tracings, to see the progressive and almost mathematical fall of the temperature with feeble doses. Generally the first dose makes the temperature fall from 1° to 1½°. If you cease the administration of the medicament the temperature maintains itself at this point for several hours, and even descends several tenths of a degree. If you administer a second dose, the heat falls from ½° to 1°, and keeps at this level for several hours. It is this remarkable action which has caused M. Huchard to say that antipyrine might be considered as a specific, not of tuberculosis, but of tuberculous fever. One cannot too much insist on the effect of small doses, in opposition to the practice of the Germans, who employ exaggerated doses of from four to five grammes (ʒ j to ʒ jss) a day. This point, in fact, is of capital importance, for one of the greatest inconveniences of antipyrine is the production of excessive sweats, which often prostrate phthisical patients. Under the influence of smaller doses, however, of from four to eight grains, this inconvenience is completely obviated ; temperature falls, the dyspnœa is calmed, the insomnia disappears.

Our observations show that antipyrine lowers the temperature in pneumonia in a remarkable manner, and that this effect is noticed when small doses are used, contrarily to what takes place in typhoid fever, where much larger doses are necessary.

What is now the action of antipyrine in typhoid fever? It is always attended with a fall of the temperature. Large doses, however—as much as 15 grains three times a day—are required. Moreover, the temperature falls much less considerably than in diseases of the lungs; 1°, 1½°, and the duration of this action is shorter. The pulse diminishes sensibly in frequency, nevertheless this diminution is not in relation with the fall of the temperature.

In fine the quantity of urine seems to augment at the same time that a slight diminution of the urea is noted.

In fact, we may already formulate the following conclusions: The general march of the disease is not influenced in a notable manner; hence it will not do to give antipyrine in all cases of typhoid fever, but only in those where the temperature is very high; therefore we should not seek to make typhoid fever cases undergo their evolution without fever, but content ourselves with lowering the temperature sufficiently so that the disease may follow the natural course, *i.e.*, pursue its evolution like a relatively benign acute disease.

Antipyrine is well tolerated by infants at the breast. It disturbs neither the appetite nor the digestion, does not provoke vomiting, causes little vertigo, and no buzzing in the ears or headache. It diminishes the frequency of the pulse, has little or no action on the respiration. Although large doses are said to have occasioned vomiting, this evil certainly does not attend fractional doses.

As for the physiological effects of this medicament, it has been found to produce in hares and guinea pigs convulsions, both clonic and tonic, with paraplegia or general paralysis; according to Bouchard, it acts on the medulla oblongata and on the brain. It has also a remarkable hæmostatic action; we have seen hemorrhage arrested much more rapidly with antipyrine than with ergotine, and even perchloride of iron; it needs, in fact, only from two to four minutes for antipyrine to arrest a hemorrhage which takes seven minutes for ergotine to arrest, and thirty minutes for perchloride of iron.

From the point of view of its action on the circulation, we have always noted a slowing in the beatings of the heart. Animals die by paralysis of that organ. As for its effect on the blood, according to Prof. Demme, it is a protoplasmic poison. The prominent indications for the use of this new remedy are hyperthermia and continuity of the fever. What ought we to understand by hyperthermia! Are we to give this name simply to extreme temperatures, without any distinction of diseases? A temperature of 104° F., for instance, does this constitute an hyperthermic temperature? Assuredly not. Hyperthermia is not an abstract formula, which we can measure by an invariable figure, which one can define by the degree of the fever simply, with the thermometer in hand. The hyperthermia changes with each disease. What is hyperthermia for acute articular rheumatism is not hyperthermia for scarlet fever, and if a temperature of 104° F. is hyperthermia for the first it is not for the second.

Now, it is against these hyperthermic temperatures, and it is against them alone, that it is necessary to give antipyretics, and it is not when the fever constitutes simply an element of the disease that we must give the medicine, it is only when it becomes a complication and a danger. But this is not all; there remains an important point to elucidate. What is the end which the therapeutist has in mind in giving antipyretic medicaments? Do you mean always and constantly to bring back a hyperthermic temperature to the normal? If this is the end you have in view, you will find yourself at each moment astray; you will make nothing but failures.

What you are to demand of these medicaments is to bring back the temperature to where it should be in the normal course of the disease, and in doing so you will have sagely acted, since you will have suppressed a complication and a danger.

The second indication is the continuance of the fever. It is useless to insist on the benefit which the patient derives from the natural remissions in the course of fevers, and on those which the antipyretic procures.

Modes of Administration.—These are three in number. 1, By hypodermic injection; 2, by the rectum; 3, by the stomach.

1. The hypodermic method is rejected on account of the pain which these injections determine. If this method be resorted to, 15 grains may be dissolved in a syringeful of warm water and injected.

2. Antipyrine may be given in lavements. Make a solution, one part to fifteen, and add two tablespoonfuls to a small lavement. You obtain thus effects almost as satisfactory as when given by the mouth.

3. In giving antipyrine by mouth, which is the best mode of administration, you dissolve the medicament in a little sweetened water, flavored with a few drops of essence of peppermint or tincture of orange peel. It may conveniently be given in a little wine and water.

The doses are: 7 to 12 grains in phthisis; 15 to 45 grains in typhoid fever and the great pyrexias. It is best never to give more than 15 grains at once, and the doses should be at least an hour apart.

CONCLUSIONS (Dr. Henri Huchard):

1. In all the febrile diseases the fever is not an indication for the employment of antithermics. It is the exaggeration of the fever. It is the complication of hyperthermia, different with each disease, which constitutes the indication.

2. In the great pyrexias, such such as typhoid fever; in the consumptive diseases, such as pulmonary phthisis, the continuity of the fever constitutes a new indication.

3. In fine, it is necessary to give fractional and feeble doses, to avoid the sweats and to avoid plunging the patient into that state of adynamia which may result from abuse of the medicament.

4. In the last place, it will not do to demand of the medication more than it can physiologically perform. I mean to say that it will not do to try to make a grave disease pursue its course with a normal temperature.

TRANSLATOR.

ON THE TREATMENT OF INTERMITTENT FEVER.

SUMMARY:—The Marsh Poison—Its Nature—Atmospheric Influences—Cinchona Fevers—Cinchona Bark—Alkaloids of Cinchona—Quinine—Cinchonine—Cinchonidine—Quinidine—Quinoidine—Quinoleine—Physiological, Toxic, and Therapeutic Action of these Different Alkaloids—Superiority of Quinine—Absorption and Elimination of the Salts of Quinine—Sulphate Chlorhydrate, Tartrate, Bromhydrate, Salicylate, and Tannate of Quinine—Mode of Administration—Pills—Potions—Gastric Method—Intestinal Method—Lavements—Dermic and Hypodermic Methods—Pomades of Quinine—Pulmonary Method—Intra-tracheal Injection of Quinine—Mode of Introduction—Modes of Administration—English Method—Italian Method—French Method—Doses—Massive Doses—Fractional Doses—Duration of Medication by Quinine—Contra Indications of the Employ of Quinine—Influence of Pregnancy—Succedanea of the Salts of Quinine—Alkaloids by way of Synthesis—Quinolein—Aromatic Series—Salicylic Acid—Resorcine—Kairine—Cedron and Valdivine—Picric Acid and the Picrates—Arsenic—Animal Substances—Spider Web—Hygienic Treatment—Hydrotherapy—Thermal Treatment—Treatment of Pernicious Intermittent Fevers—Treatment of Paludal Cachexia—Conclusions:

GENTLEMEN:—You know that in marshy localities there prevails a fever of an epidemic kind, which is described under the name of intermittent fever, fever and ague, marsh fever and malarial fever. It is to the treatment of this fever that I shall call your attention to-day.

What is the *materies morbi* of this paludal intoxication? This is an etiological consideration of considerable importance, and concerning which we have not yet obtained positive knowledge.

We find two opinions which are prevalent: according to one theory there exists a miasm which is in the cause of the disease; according to the other, atmospheric influences alone may engender it. With regard to the first theory, there exist two hypotheses; that of a telluric miasm, and that of a marsh miasm. The first has had for its principal defender, Leon Colin, who holds that all organic substances contained in the soil, may, when they are brought in contact with the air, by upheavals of the soil, determine intermittent fevers, and thus constitute the telluric miasm. Much more numerous are the partisans of the doctrine of marsh miasm.

Relying on experiments on animals, the supporters of this doctrine have maintained that stagnant waters are the origin of the marsh poison. Some have even localized the toxic principle; Salisbury, for instance, considers certain low vegetable organisms of the palmella genus as competent to occasion by their introduction into the economy, the symptoms of intermittent fever, while Klebs and Tommasi-Crudeli have attributed the same effects to micro-organisms of the genus bacillus. Bouchardat, moreover, arraigns the infusoria which abound in stagnant waters, as being the originators of a virus which may thus poison the economy.[1]

[1] Vitruve and Varon claimed that the insalubrity of certain countries depends on the introduction of minute insects into the economy. Lancisi and Rusoki attributed malaria to

To this theory of the toxic action of ferments, or virus, Eisenmann, Burdel, Durand and Munro have opposed another doctrine which, repudiating the idea of telluric or paludal miasm, affirms that all the disorders of

certain febrigenous animalcules, called by the Italians *cerafici*. From this came the usage of filtering the breathing air through certain respiratory apparatuses worn by patients, or modifying this air with garlic from the supposed antiseptic properties of the latter.

J. Lemaire has also studied the influence of the animalcules, and vibriones, which are found in abundance about the marshes. These bodies act, according to Gautier, as a ferment, and are the cause of intermittent fever.

Klebs and Tommasi-Crudeli have studied experimentally the pathogeny of intermittent fevers by injecting under the skin of hares the products of culture of microbes from the water, soil, and air of countries ravaged by malaria. These experiments have shown that the germs of malaria impregnate in great abundance and on a large scale the soil where the malady prevails, and even the air in strata which are in contact with the soil. Stagnant waters do not seem to hold the germs in suspension.

When you introduce under the skin of a hare liquids holding in suspension either particles from the infected soil, or products of culture, you determine in this animal intermittent febrile phenomena; the filtration of the liquids prevents these accidents. In all cases of this kind where artificial malarial fever has been induced, tumefactions of the spleen are found at the autopsy.

The micro-organisms belong to the genus bacillus; they constitute mobile brilliant spores, and when cultivated develop in the form of elongated filaments, which undergo segmentation. They are not aerobic, that is to say, they have no need of oxygen for their development; it is in the spleen and the marrow of bones that their micro-organisms develop most actively.

Salisbury has noted on the surface of the soil of certain marshy regions of Ohio, certain organized cells, resembling an alga, of the genus palmella.

These spores are met with in the atmosphere, but only in the night time, and rise only to a certain altitude above the soil, viz: from 35 to 100 feet. Salisbury has detected these same spores in the expectoration and in the urine of patients affected with intermittent fever.

He has placed earth containing these palmellæ in the night time in the windows of the sleeping rooms of various persons, and has seen these individuals contract malarial fever.

Fever and ague has also been attributed to certain microscopic vegetals found on the surface of the water in the marshes of Dombes and of Pontines; these microphytes are different from palmellæ. Salisbury gave the name of *gemiasma* (miasm of the earth) to the organisms which he discovered, He describes them thus:

"Plants having the appearance of cells, consisting of a thin exterior wall, containing a nucleus full of minute spores, simple or aggregated; the colors of these plants are varied, they are red, green, and yellow."

Bouchardat also believes that the marsh miasm is produced by a vital act of infusoria, which pullulate in the mud of marshes that are in the process of drying; he compares the effects of this miasm to those determined by animal poisons. Therefore, the most probable hypothesis, according to him, as to the nature of the marsh effluvium, is that it is a poison produced by one of the species of microscopic animalcules resulting from fermentation of the marshes. Bouchardat, moreover, does not specify the variety of animalcule which causes the disease in question.

Laveran attributes impaludism to certain organisms which he has found in the blood. Richards has also detected in the blood the same organisms having a pigmented appearance. (*a*)

(*a*) Salisbury, On the cause of intermittent and remittent fevers, with investigations which tend to prove that these affections are caused by certain species of palmellæ (Amer. Journ. of Med. Sc., vol. LI, jan. 1866.

intermittent fever are the product of modifications of the atmosphere, and in particular, of atmospheric electricity.[2] To which of these hypotheses shall we give the preference? Undoubtedly the influence which the labors of Pasteur have had on the study of fermentations, makes the balance incline toward the miasmatic doctrine of paludal fevers. Nevertheless I am ready to adopt, with Arnould, a mixed theory, which, while assigning a preponderant role to miasms, attributes also a certain part to meteorological influences.[3]

Although we cannot determine just what the veritable nature of the marsh miasm is, we know, nevertheless, by clinical experimentation, that all the symptoms which result from it are amenable to one and the same treatment, viz: treatment by cinchona and its derivatives; hence the name of cinchona fever, by which intermittent fever is sometimes designated. But in this application of

[2] Eisenmann puts forth the hypothesis that augmentation and change in the kind of atmospheric electricity is the cause of intermittent fevers; he considers the marshes as presenting circumstances favorable to the production of these electric modifications.

Burdel adopts the theory of electric influence, attributing the fever to sudden abstraction of electricity. He has noted by means of a particular apparatus—the hydro-thermo electric condenser—that the production of ozone and of electricity attains its minimum at the middle of the day, and it is at this moment that persons generally contract the fever. Durand, of Lunel, also admits this electrical influence; according to him the presence of the marsh miasm in the circulatory passages has for its effect to neutralize or depress the electric state of the blood.

Munroe believes that there is no especial poison associated with malarial fevers, and that the action of heat upon fermentations suffices to determine the electrical states which induce a more or less intense paralysis of the ganglionic nervous system, and that this paralysis is the occasion of all the febrile accidents. (*a*)

[3] Arnold has divided into three groups the present views respecting the etiology of marsh miasm: 1. Doctrine of miasm which comprehends that of impaludism and that of telluric miasm; 2. Doctrine of meterological elements in which the idea of miasm is rejected, and in which meterological elements alone are regarded as the cause of the malarial poisoning;

3. Mixed doctrine in which are admitted both the influence of miasmatic elements and that of meterological elements. (*b*)

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p. 51–75).—Lemaire, Acad. des sc., 1864, p. 426–317.—Gautier, Etude sur les fermentations (thèse de Paris, 1869).—Klebs et Tommassi-Crudeli, Einige Saëtze über die Ursachen der Malaria. Studien über die Usache des Wechselfieber und die natur der Malaria (Arch. f. Exper. Path. und Pharm., Bd. XI, Heft 1 et 2, p. 122, et Heft 5 et 6, p. 311, 1877).—Bouchardat, Des poisons et des venins (Ann. de thér., 1856, p. 299, et Bull de thér., 15 déc. 1883.—Laveran, des Parasites de l'impaludisme (Soc. méd. des hôp., 28 avril 1882).—Richard, Acad. des sc., 1883. [Some of the older observers believed the malarial poison to be a gaseous emanation from decomposing vegetable organisms(CO_2, H_2C and CS_2). This view is now abandoned, as refuted by the facts. Others have attributed it to the gaseous effluvia from a volcanic soil, others to a modification of the electricity of the earth or air. None of these views have been established on sufficient proof, and even the supposed microscopic vegetable organisms of low grade, the spores and algæ, with regard to the influence of which in producing malaria, so much has been said, lack as yet all practical confirmation.—TRANS.] See Hertz, in Ziemssen's Cyclopædia, Vol. II. page 585.

(*a*) Eisenmann; voir Hirsch, Recherches sur l'étiologie de la fièvre intermittente (Zeitsch. für die Gesamm. Med., 1849, et Gaz. méd., 1850, p. 821).—Burdel, Recherches sur la fièvre paludéenne, Paris, 1858, p. 88.—Durand (de Lunel), Traitement dogmatique et pratique des fièvres intermittentes, Paris, 1852.—Munro, Remarks upon Malarious Fevers and Cholera, etc. (Arm. Med. Rep., Feb. 1882, p. 263, London, 1874).

(*b*) Arnould, on climatal affections and the climatic element in malarial fevers. Arch. gen de Med., April and May, 1874.

cinchona bark to fever and ague, it is empiricism alone which has guided the physician, and which guides him to-day. Since first the Indians of the village of Malacatos gave cinchona in intermittent fever,[1] (centuries ago); since the time when the wife of the Viceroy of Peru, the Countess del Cinchon brought to Spain this precious medicament, or when, at a later date, the Jesuit fathers spread the knowledge of it all over Europe; and since the time, finally, when Louis XIV bought of Talbot the formula of this anti-febrile remedy, the question of the anti-periodic effects of Peruvian bark has made little progress towards solution. Despite the persevering researches of chemistry which have made known the principal alkaloids of cinchona, and despite much careful phy-

[1] It is only since the middle of the 17th century that cinchona bark has been known as a therapeutical agent. It is probable that for a long time the Peruvian Indians were acquainted with the properties of cinchona. But it was not till about 15 years after the conquest, that the Europeans learned the benefit of this medicament, which Geoffry calls "God's gift," and which Held qualifies with the attribute of "Divine;" which Morton styled as the "Herculean" antidote; and Redi, a miraculous medicine; and which Sydenham called admirable.

According to Jussieu, who was sent to America in 1735 to study the natural history of the country, it was the Indians of the village of Malacatos, several leagues to the south of Loxa, who were the first to discover the properties of cinchona. He is the author of the following note in a work published in Latin in 1739, as cited by Le Maout:

"It is certain that those who were the first to know the virtue and efficacy of this tree were the Indians of the village of Malacatos. These poor people were subject to intermittent fevers, caused by the moist heat of their climate, and by the variability of the temperature, and they had necessarily to look for a remedy against this sorry malady. As, moreover, during the time when the Incas reigned the Indians were versed in the knowledge of plants and skilled in discovering their virtues, the experiments which they make with divers vegetal productions led them to find in the bark of *Kina-Kina*, the supreme and almost sole specific of intermittent fever. This tree was designated by them by a name derived from its properties; they called it *yara choucchou, cava-choucchou;* yara signifies tree; cava signifies bark; and choucchou means a chill, cold, the horripilation of the fever; it is as if one had said, 'the tree of fevers,' 'the bark of fevers;' they called it also. *Ayaca cava;* that is to say, 'bitter bark.' By a happy accident there came, on a brief visit to the village of Malacatos, a Jesuit priest afflicted with intermittent fever; the Indian chief, Cacique, having been informed of the sickness of the 'reverend father' said: 'Give me a chance, and I will cure him.' The priest having assented to the proposal, the Indian ran to the mountain and obtained the aforesaid bark, and gave a decoction to the Jesuit; the latter, happily rid of his fever and restored to health, inquired for the remedy which the Indian had given him. He was made acquainted with the bark and obtained a great quantity of it, and returning to his country he proved by further trials that it produced the same effects as in Peru. The fame of it spread abroad, and the name of Jesuit's powder was given to it, and it was by this that it was first known in Europe.

According to a popular tradition, the wife of the Viceroy of Peru, the Countess del Cinchon, had been cured of an obstinate attack of fever and ague by a government officer of Loxa, who administered to her some cinchona. On her return to Spain, in 1640, the Countess and her physician, Jean Lopez de Vega, brought with them a supply of the precious bark and divulged the remedy which took the name of 'Countess' powder.' Later, in 1670, the Jesuit fathers sent home, from Peru, some samples of this bark which was consigned to the Cardinal de Luco, at Rome, and the remedy took the name of 'Jesuit's Powder,' 'Powder of the Cardinal,' 'Peruvian Bark,' and 'Febrifuge Bark.'

Immediately the new remedy was received with favor and enthusiasm, but barks of

siological experimentation to ascertain the *modus operandi* of these preparations of bark, we are still in the dark respecting this subject. Experimental physiology has in fact in the last few years given origin to a great number of works on the action of cinchona, and particularly on that of quinine, and to the primal researches of Magendie, of Giacomini, of Desiderio, of Melier, and Briquet, it has added a considerable number of treatises whose results are unfortunately contradictory.[2] Let us, for example, examine the conclusions which these writers have furnished respecting the action of cinchona and its alkaloids upon the circulatory and nervous system.

Some authorities affirm with Briquet, Giacomini, Chirone, Laborde, that under the influence of quinine there is a diminution of the arterial blood pressure, while on the contrary Desiderio, Germain Sée, and Bochefontaine maintain that arterial pressure is augmented and that consequently quinine is a tonic of the heart.[3] We find the same contradictions with reference to the nervous sys-

bad quality having been furnished, by merchants little scrupulous as to what they were selling, a good many disappointments resulted, and the medicament fell into disrepute. A violent opposition was raised on the part of certain physicians of the time; Guy Patin, Chifflet, Plempius, Ramazzini, Baglivi, etc., declared it to be useless and worse than useless. But the cure of Louis XIV, in 1679, by Talbot's remedy again called attention to this bark. The king bought this remedy, which was nothing but a concentrated vinous tincture of cinchona, caused it to be made the subject of new trials, which were published by Paul de Blegny in 1682. Then all were loud in its praises. Lafontaine composed a poem in its favor; physicians experimented anew and with more care, and the works of Sydenham, Raclo, Morton, Torti, Lancisi, Werlhoff, etc., all agree in affirming the therapeutic value of the precious bark.

Down to the year 1820, the powder of cinchona, or the decoction of the bark alone was used. But Pelletier and Caventou, at this epoch discovered the alkaloids of cinchona and these were henceforth put into exclusive use.

[2] Experimental researches on cinchona and its alkaloids date from Magendie, who at the time of the discovery of quinine, injected this alkaloid in the jugular veins of several dogs. He pretended that quinine was without toxic action and innocuous in animals.

Giacomini, of Padua, showed on the contrary, in a series of experiments made on hares, that sulphate of quinine has very grave toxic effects when administered in large doses, and he noted among the toxic phenomena a considerable depression in the functions of the circulatory system; he concludes that this alkaloid is a cardio-vascular depressant.

Desiderio, of Venice, repeated the experiments of Giacomini, and maintained, on the contrary, that quinine was a *hypersthenisant* medicament (an augmenter of tone). Landri, Balardini, Leidi and Bergoni, who in their turn made experiments with this salt, advanced the same opinion as Giacomini. Melier, in France, repeated these experiments and proved the toxic action of this medicament. Finally, in 1853, Briquet published a large work on cinchona and its alkaloids, and maintained that these preparations are agents which attack and annihilate the nervous power, wherever it exists; hence he considers quinine as a hyposthenisant medicament of the nervous system. Since then very numerous works have appeared on the subject of the action of the salts of cinchona; it cannot, however be said that the views held are yet altogether harmonious. (*a*)

[3] Experiments made on human beings and on animals to ascertain the action of sulphate of quinine on the circulation, have given opposite results. Some experiments affirm that the

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(*a*) Magendie, Journ. de pharm., t. VII, p. 138.—Giacomini, Giorn. Anal. di Med., 1840.—Désidério, Compt. rend. de l'Acad. des sc., octobre 1829.—Melier, Bull. de l'Acad. de méd., p. 727.—Briquet, Traité thérapeutique du quinquina et de ses préparations, Paris, 1853.

tem; ' according to some, quinine abolishes the sensibility and motrocity; according to others, it is an excitant of these functions. There is the same want of agreement moreover in explaining the quinine intoxication, and while Hammond sees here the effects of cerebral hyperæmia, Gubler regards it as resulting from ischæmia of the brain.

How explain such contradictions? Are we to believe that experimental physiology applied to the study of therapeutics can give only false and deceptive results? Must we accuse the experimenters of want of skill? Must we impeach the reliability of our instrumental apparatus? By no means, and all

beatings of the heart and the arterial pressure are diminished, others that they are augmented.

Giacomini considers this diminution of pressure as a characteristic; hence he places quinine among the *hyposthenisants* (enfeeblers) of the cardio-vascular system, and this opinion is shared by the majority of the Italian physicians.

Vincenzo Chirone has recently repeated these experiments, and this, according to him, is the action of quinine on the heart and on the blood-vessels. The systole of the heart is enfeebled and the ventricles are distended under quinine; it is the same with regard to the blood-vessels—vascular dilatation always resulting. This double action on the heart and blood-vessels pertains directly to the muscular fibre and without the intermediation of the vascular system.

In France, Briquet had also noted the diminution of the arterial pressure. According to him, this diminution is proportional to the quantity of quinine injected, and, moreover, this action is the more intense the larger the doses that are employed.

In a series of experiments he has shown that this depressant action on the blood-pressure is prolonged for twenty-four hours after the introduction of the medicament into the economy. Finally, in other experiments he has demonstrated that the contractile force of the heart gradually goes on diminishing and even is ultimately arrested when sulphate of quinine is injected into the veins. Laborde admits also a special action of sulphate of quinine on the heart. This medicament produces a veritable ataxia of that organ.

In opposition to these views we should cite the experiments of Sée and Bochefontaine, who have accepted the doctrine of Désiderio and of Gubler, who assert that quinine augments the contraction of the heart and is a cardio-vascular hypersthenisant (heart tonic). In experimenting on men and on animals, they have demonstrated that there is augmentation of the blood-pressure and a strengthening of systolic action; quinine is, according to them, a tonic of the heart and blood-vessels.

These differences of estimating the physiological and toxic effects of this drug are owing probably to the doses administered, and Jerusalimski has put this fact in clear light by showing in some recent experiments, that in small and medium sized doses, of from 1 to 22 grains, quinine produces acceleration of the pulse and of the blood-pressure, while in larger doses it produces, on the contrary, a very considerable fall in the blood-pressure, as well as diminution of the pulse.

It is perhaps necessary also, in order to explain these variances, to make some account of the kind of animals which were the subjects of experimentation. In fact Schetschepotjew, in studying the action of quinine on the muscles, shows that this action is different in vertebrates and in the frog; in man and in the dog quinine augments the force of the contractions and accelerates them; in the frog it slows them.

In order to explain this action on the heart, whether tonic or depressant, two opinions have been put forth: Briquet, Leweski, Jolyet, have maintained that quinine acts directly on the muscular fibre of the heart and blood-vessels. Chirone has even affirmed that this effect on the muscular fibre is a direct relaxant action, and he has generalized this influence to all the muscular fibres of organic life, the uterus being included.

Others, on the contrary, have maintained that it is by the intermediation of the nervous

these contradictions may be explained by this fact to which I have already called your attention while treating of the tonics of the heart, viz: that the therapeutic action of the medicament is often the opposite of its toxic action.

Have we not seen digitalis, that marvelous tonic of the heart, become a cardiac poison when it is given in large doses? It is the same with quinine, according as it is administered in therapeutic dose or in toxic dose. In moderate doses it tones up the circulation, in large doses it enfeebles it; in moderate

system that this action on the heart and blood is effected, the medicament being either a depressant or excitant of the functions of this system.

Gubler has advanced the opinion that quinine produces its action by galvanizing the great sympathetic.

Schroff, who has always noted a diminution in vascular tension, considers it as resulting from a diminution in the reflex excitability of the vaso-motors. This diminution does not result from a modification in the extra cerebral centres of inhibition, Chaperon thinks, but rather from a diminution of the excitability of the medulla oblongata and spinal cord. (*a*)

[4] According to Laborde, quinine acts especially on the cerebrum, but what chiefly characterizes its action is the absence of convulsions, which readily follow the ingestion of the other alkaloids of cinchona.

Briquet has maintained that quinine causes abolition of the functions of the motor and sensory nervous system.

Dupuis has insisted on the action of quinine on the peripheral sensibility. According to him, quinine almost completely abolishes the general sensibility. This abolition is due to a direct influence on the sensory centres. The nerve does not lose its property of conductibility.(*b*)

According to Chirone and Curci, this effect is not produced except by toxic doses; in therapeutic doses, quinine determines in man only a moderate diminution of tactile sensibility. In animals to which large doses of quinine have been given, sensibility disappears in the following order: first, tactile sensibility, then algesic sensibility, and lastly thermic sensibility; the anterior parts of the body are first affected, then the posterior.

To explain the quinine intoxication, which is a constant symptom in men and in animals under the influence of sulphate of quinine, two contradictory opinions have been advanced. Gubler maintains that this condition is characterized by a veritable cerebral anæmia, demonstrated, according to him, by the antagonism between opium and quinine.

According to Hammond, however, the quinine cerebropathy is due to hyperæmia of the brain.

As for the supposed antagonism between quinine and morphia, it does not exist; there is, however, according to Pantelejeff, an antagonism between quinine and atropine, the one congesting, the other anæmiating the brain.

(*a*) Briquet, Traité thérapeutique du quinquina et de ses préparations, Paris, 1853, p. 58, 61, 63.—Laborde; voir th. Jules Simon, les Succédanés en thérapeutique, Paris, 1883, p. 39.—G. Sée et Bochefontaine, Action physiologique du sulfate de quinine sur l'appareil circulatoire chez l'homme et chez les animaux (Acad. des sc., février 1883].—Jerusalimski, Uber bie Ppysiologische Wirkung des Chinin, Berlin, 1875.—Schtschepotjew. Selbstandige Contraction der Herzspitze, Veranderunged der Muskeln und der weissen Blutkorperchen unter dem Einfluss von Chinin [Arch. f. die Gesammte Phys., t. XIX, p. 53].—Léon Colin, Sur l'action des sels de quinine [Bull. de thér., 1872, t LXXXIII].—Chirone, Meccanismo di Azione della Chinina sul sistema circolatorio e Azione sulla fibra musculare in generale [lo Sper., fasc. 10 et, octrobre et novembre 1875].—Gubler, Comm. de thér.—Schroff, Beiträge zur Kenntnlss der Chininwirkung [Stricker's Jahrb., p. 175].

(*b*) Dupuis, Etude expérimentale sur l'action physiologique de la quinine [thèse de Paris, 1877].—Chirone et Curici, Azone della Chinina sensibilita e sul potere lossico [la Scuol. Med. Mapol., ann. II, fasc. 4, 6, 7, avril, juin, et juillet 1880].—Gubler, Comm. de thér.—Hammond, the Influence of the bisulphate of quinine over the intra-cranial circulation [New York Phys. and Med.-Leg. Journ., octobre 1874, p. 230].—Panteleieff, Das Salzaüre und das Schwefelsaure [Centralb. f. a. Med. Wissensch., n° 29, 1880].

doses it excites the nervous system, in large doses it depresses it. Unfortunately experimental physiology can generally study only the toxic action of medicaments, and hence becomes rather experimental toxicology than experimental therapeutics.

Moreover, this experimental therapeutics in operating on different animals may furnish different results, and Schtschepotjew* has well shown that this is the effect of quinine, opposite results being obtained according as one experiments on frogs, hares, dogs or human beings.

Ignorant, then, of the marsh miasm, ignorant of the principal points pertaining to the therapeutic action of cinchona and its derivatives, we are reduced to hypotheses to explain the anti-periodic effects, so evident and so indisputable of these medicaments, and authorities have by turns invoked in explanation (1) a local action on certain organs, (2) an influence on the nervous system, (3) an influence on the blood:

The theory of a local action of the cinchona alkaloids, as advanced to explain their effect on the morbid periodicity, has had few supporters. It is necessary, first of all, to assume that the periodicity characteristic of this fever results from the hypertrophy of the spleen, which influences more or less directly the ganglia of the coeliac plexus, and through that the entire nervous system; quinine, by diminishing the volume of the spleen, removes the cause of the intermittency.

Two opinions, directly opposite, have been advanced in support of the doctrine which attributes to the effects of the salts of quinine on the nervous system their anti-periodic action.[1] The one is defended by Briquet, according to which quinine, a veritable kind of "anæsthetic easily managed," as he says, annihilates the functions of the nervous system and thereby prevents recurrence of the attack; the other supported by Pidoux, asserts that the alkaloids of cinchona act as a tonic of the nervous system, preventing it from becoming enfeebled under the baneful influence of the marsh miasm.

Struck by the antiseptic properties of the salts of quinine, which Pringle was one of the first to point out, and which Binz and his followers, and more recently Baxter have positively demonstrated,[2] the view has been entertained

[1] Briquet considers quinine as a sort of readily manageable anæsthetic, which by its stupefying and hyposthenisant (tone-lowering) action, prevents the nervous fibre from feeling the morbid influence of the marsh miasm, and in this way opposes the paroxysms of intermittent fever.

Barthez and Pidoux, on the other hand, base the anti-periodic effect of cinchona and its derivatives on the force which it gives to the nervous system. The marsh miasm lessens the resistance of the nervous system; quinine acting as a tonic of the nervous system, re-establishes the stability of the nervous functions. (*a*)

[2] In 1750, John Pringle remarked the antiseptic action of the alkaloids of cinchona.

Baxter has repeated the experiments of Pringle, and also those of Binz and his pupils.

Binz had demonstrated that a neutral solution of sulphate of quinine (two-per-cent.)

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* Schtschepotjew, Arch. f. die Gesammete Phys., p. 53.

(*a*) Briquet, Therapeutical Treatise on Cinchona and its Preparations, p. 271, 1853.—Pidoux, Therapeutics and Materia Medica.

that cinchona and its derivatives exercise their remedial power by opposing the development of lower organisms, and the processes of fermentation which are its consequence. They appeal in support of their doctrine, to the prophylactic action of the salts of quinine, which, in fact, prevent individuals from taking fever and ague, as we shall see further on ; they appeal also to the fact of the presence of parasitic elements in the blood of persons affected with intermittent fever ; parasites which Laveran has of late described with great care.[3] This last hypothesis is much the most probable, and it is as an antagonist of fermentation that quinine acts in this periodical febrile disease. We will now study what are the rules which should preside over the administration of this medicament.

Cinchona occupies such an important place in modern therapeutics that it has been found necessary to take measures to prevent the destruction of the trees which furnish this precious bark. The Indians in the valleys of the Andes, whose business it is to gather the bark, the Cascarilleros, as they are called, were in the habit of destroying the trees to obtain the bark ; hence the rapid rise in the price of this medicine, and the danger of a complete exhaustion of the supply. So on all sides we have seen Europeans making efforts to cultivate cinchona trees in their colonies. The Dutch, for instance, have imported them to Java ; the English to the Himalaya mountains, to the isle of Mauritus, and to Australia ; the Portuguese to the Canary Islands ; and the French to Martinique, to Guadeloupe, and especially to the Reunion.

I shall not say much about the botanical characteristics of this member of the Rubiaceæ, referring you to your treatises on botany. Moreover, the number of the true and false cinchonas is so large that their study constitutes a science of itself, which is called quinology. I will then only remind you that from a therapeutic point of view these barks are of three kinds ; the yellow cinchona of which the cinchona calisaya is the type ; the red cinchona, represented by the cinchona succirubra; and the gray cinchona, furnished by the cinchona condaminea.[4] The chemical analysis of Peruvian bark has furnished a great

produced antiputrescent effects comparable to those of phenol; it arrests the process of fermentation, especially those which are caused by the microzymes.

According to Baxter, a solution of $\frac{1}{2500}$ arrests the spontaneous movements of the microzymes. According to him, the order of activity of these different alkaloids is as follows: quinine, quinidine, cinchonidia, and, finally, cinchonine. He has also studied the salts of berberine, and picrate of potassa. The latter has an action as powerful as quinine. Baxter has also studied the action of quinine on the movements of the leucocytes; movements which are arrested when the proportion of the alkaloids is as one to 1,500. (*a*)

[3] Laveran's pigmented parasites, described minutely in a monograph of his on the subject of the "Parasitic Nature of Impaludism" (Paris, 1882), are believed by Duclaux and Bouchardat to be simply a result of an alteration of the blood globules by bacilli. (*b*)

[4] At the commencement of the therapeutic employment of cinchona only the bark was known. The first descriptions, which were nearly complete, were made in 1737 and 1739,

(*a*) Baxter, on the Action of the Cinchona Alkaloids on Bacteria and the colorless Corpuscles of the Blood [Practitioner, Nov. 1873].

(*b*) Bouchardat on "Impaludism, its Causes and Remedies." (Bull. de Thér., Dec. 15th, 1883.)

number of alkaloids. Pelletier and Caventou, in analyzing the crystallized product which Gomez has just made known under the name of cinchonino, found, in 1820, the two most important derivatives, quinine and cinchonine.

by La Condaminé and Jussieu, who obtained knowledge of the tree in Peru at Loxa. Then came the works and researches of Desportes, in 1742; of Jacquin, in 1763, in Cuba and San Domingo; of Dombey, in 1776; of Ruiz and Pavon, in 1789, who established the botanical character of a great number of cinchonas of Peru. At the same epoch, Mutis studied the cinchonas of New Granada; Humboldt and Bonpland, in 1801, those of Granada, Equador, and the northern parts of Peru; Weddel, in 1804, those of Bolivia and southern Peru.

Many other admirable writers were also occupied with the cinchonas, and have left remarkable works, whose names, even, we cannot mention here.

The cinchonas are dicotyledonous plants of the Rubiaceæ family, tribe cinchoneæ. They are sometimes trees of large size, sometimes simple shrubs; their leaves are opposite, sometimes smooth and shining, sometimes pubescent with large petioles and caducous stipules. The flowers form cymes, in corymbs or panicles; they are white or rose colored, and present a calyx adherent to the ovary, pubescent, with five parted limb; a hypocrateriform corolla, with lanceolated lobes, smooth interiorily, and furnished along its borders with wooly hairs, five stamens included; the ovary surrounded by a fleshy disk, containing numerous anatropous ovules; the style is simple, smooth, the stigma bifid. The fruit is an ovoid capsule, oblongate, or linear lanceolate, with septicide dehiscence; it contains numerous seeds, imbricated from below upward, surrounded at their circumference by a denticulated membraneous wing.

The cinchonas grow at a medium altitude of 1,600 to 2,400 metres, and are met with in the parts of the Andes which extend from Venezuela and New Granada, about 10 north latitude, as far as Bolivia, about 19 south latitude.

Beside these countries where the cinchonas are indigenous, other localities to-day possess this tree, thanks to transplantation and an intelligent culture.

The Dutch have planted it in Java; the English in certain dependencies of the Himalayas, at Mauritius, in Australia, in St Helena, in Trinidad, and Jamaica; the Portuguese in the Canary Islands; the French at Martinique, at Guadeloupe, and with more success at the Reunion. Several attempts have also been made in Algiers.

The cinchonas are very numerous, and present a variety of species. Weddel admits 33 species (1870) and Hooker (1873) describes 36. From a geographical point of view, they are divided into cinchonas; 1, of Bolivia; 2, of Peru; 3, of New Granada. From a commercial point of view in France, the cinchonas are divided into three groups, founded on their outward appearance.

1. The gray cinchonas, the bark of which is sun-dried, shrivelled, and in the form of quills; gray, rough externally, and covered by its epidermis, and certain lichens which grow on it; yellow externally. It has a woody odor, an astringent savor, contains much tannin and cinchonine, and but little quinine.

2. The yellow cinchonas. The bark is thick, quilled, but not rolled inwards, deep yellow, without odor, more bitter, less astringent, poor in cinchonia, but very rich in quinine.

3. The red cinchonas. The bark is very thick, flat, or quill-shaped, blood red color; chemically, is intermediate between the two others.

In fine authorities have admitted a further group, the white cinchonas, which contain but little cinchonia, and are almost inert.

Among the gray cinchonas have been classed: 1, The cinchona of Loxa, which is furnished by the cinchona condaminea (cinchona officinalis) of Linnæus; 2, the cinchona of Huanco, in Lower Peru, or of Lima, which furnishes three principal varieties, the fine cinchona of Lima, the coarse cinchona of Lima, and the white Lima cinchona; 3, the cinchona Huamalis of Peru is got from the cinchona purpurea, and is little esteemed; 4, the red cinchona calisaya of Bolivia.

Since then there have been discovered quinidine, cinchonidine, quinamine, paricine, aricine, cusconine, pitoyine, etc.[5]

Do not expect of me a description of all these alkaloids. I shall content myself with a brief reference to the principal of them, especially those which may in part take the place of quinine. Cinchona bark, in fact, being of relatively high price, it is apparent that quinine itself must be costly, and you will see, as we proceed, that this question of price has considerable importance in the treatment of intermittent fever, and that it is incumbent on us always to endeavor by a good use of the medicament to obtain the maximum thera-

Among the yellow cinchonas we note: 1, The flat or royal red cinchona calisaya, which is the cinchona calisaya the most diffused and best known—the officinal cinchona; 2, the calisaya of New Granada, of which there are two species, the cinchona lancifolia and the cinchona pitayensis, which give barks of the first order; 3, the cinchona carabaya, employed especially for the manufacture of quinine; 4, the yellow cinchona of the King of Spain (of Loxa); it is furnished by the cinchona condaminea.

Among the red cinchonas are: 1, The bright red; 2, the pale red of Equador, furnished by the cinchona succirubra of Quito, the red cinchona of New Granada or of Mutis; 3, the warty red cinchona furnished by the cinchona Humboldtiana.

The French codex admits three varieties which are obligatory on pharmacists: The gray huanco cinchona (cinchona micrantha), the cinchona calisaya or royal yellow (cinchona calisaya), and the red warty or non-warty cinchona (cinchona nitida, or succirubra.)

With the true cinchonas one often finds mixed certain strange or false cinchonas. The principal are: 1, The new cinchona, furnished by the portlandia grandifolia; 2, the cinchona of Caraibes or Jamaica, furnished by the exostema caribeum; 3, the cinchona piton-cinchona of Martinique, of St. Lucie, or of St. Domingo, produced by the exostema floribun, dum; 4, the cinchona cusco or Arica bark; 5, the cinchona jæn (cinchona ovata); 6, the cinchona pitoxa; 7, the cinchona of Para; 8, the white cinchona of Payta.

[5] The cinchona barks used in medicine come from the trunk, the large, middling sized, or small branches of the tree. They have, therefore, a variable thickness, according to the part from which they are taken, and are flat and thick, or thin and curled. The indians employed during the cinchona bark harvest have received the name of cascarilleros. When they have collected a certain quantity of bark they dry it on the spot. The large pieces, arranged on slabs, are piled up in heaps and dried in the sun; they are kept flat by the pressure of some heavy body put on top of the pile. These barks constitute the flat cinchonas (quinquinas en table, en planches).

The thin fine barks are also exposed to the sun, and curl up to form the quilled cinchonas.

The principal centres of the cinchona crop are: 1, In the republic of Equador, Loxa, and the environs of Chimborazo (cinchona succirubra); 2, in lower Peru, Huanco, Cuzco, Hamalies; 3, in Bolivia; 4, in New Granada, Pitayo, Santa Fe, of Bogota; 5, in Venezuela, Maracaibo.

The principal ports of exportation are: Carthagena, Lima, Valparaiso, Arica, and Buenos Ayres—names that sometimes distinguish the various barks.

The cinchona barks contain: 1, Certain alkaloids, quinine, cinchonia, quinidine, cinchonidine (cinchonidia), quinamine (Hesse), paricine (Winckler), aricine (Pelletier and Corriol), cusconine (Lever Koehn), paytine (Hesse), etc. There are also: 2, Certain acids, quinic cinchotanic, quinovic, etc.; 3, neutral substances, such as quinovine, cinchona red, etc.; 4, a fatty matter; and 5, an essential oil.

According to the experiments of Howard, Fluckiger, and Carles, the alkaloids exist in greatest abundance in the cellular parenchyma (meso-phlœum), and the quinine is found especially in the external portions of the epiphlœum or corky envelope. The cinchonia is

peutic effect with the least quantity. This costliness of quinine explains also both the numerous falsifications of which this alkaloid is the subject, and the unwearied endeavors to find good substitutes for it. It is to be hoped that through the incessant progress of chemistry we shall be able in the future to manufacture quinine by a process of synthesis out of relatively inexpensive sub-

almost equally diffused throughout the three layers. It is possible to increase the secretion and production of quinine by a process which has been put in practice by McIvor, director of the English plantations in Hindostan. Having remarked that the thin barks, protected from the light, are richer in alkaloids than those which are exposed, McIvor conceived the idea of covering the trunk of the trees with moss, and it was found that by this simple method, called mossing, the rendition of quinine might be quadrupled. To this mossing another process has been added, that of peeling. From the trunk of the tree chosen the external layer of the bark is removed and the place covered with moss. After suffering somewhat from the injury the tree recovers, and at the end of a couple of years there is obtained by this operation a new rind, richer in quinine than the first bark.

The most active ingredients of the bark are quinine, then cinchonia, then quinidine and cinchonidia.

Quinine was discovered in 1820 by Pelletier and Caventou. It is crystalline or amorphous. Pure quinine may be obtained from calisaya bark, treated successively by hydrochloric acid, lime and alcohol. It may also be procured from sulphate of quinine by decomposing it by ammonia. In the first instance you obtain brute quinine, a substance of firm consistency, resinous, and formed of a mixture of quinine, cinchonine, fatty and coloring matters. Almost insipid, it is employed in powders, potions, and pills. Trousseau prescribed it to infants of two years and below in the dose of 2½ to 5 grains, rolled into little pellets, and mixed with tapioca or sago.

To extract from sulphate of quinine pure quinine, the Codex recommends the following process: Dissolve 100 grammes sulphate of quinine in 3000 grammes of boiling water. Having effected solution, leave the liquid to cool, and pour in sufficient water of ammonia to entirely decompose the sulphate. The quinine set free is precipitated. It is collected on a filter and washed with warm water to remove ammonia. It presents itself under the form of a white porous friable substance of bitter savor after desiccation. It is soluble in two parts, boiling (absolute) alcohol, in 60 parts ether, in 6 parts chloroform, in 400 parts cold water, and 250 parts warm water. It dissolves also in the fatty oils and in the volatile oils; also in the concentrated mineral acids.

On adding an excess of ammonia to a dilute solution of sulphate of quinine, you obtain crystallized quinine, which retains 3 molecules of water. This melts at 120°C, losing its 3 molecules of water, and forms an oil which, on cooling, takes on the appearance of a resinous mass.

Cinchonine exists in greatest abundance in the gray cinchonas. It crystallizes in large quadrilateral prisms, soluble in 2500 parts of boiling water, 40 parts of chloroform, 30 parts of boiling alcohol, and is fusible at 165°C. It forms with acids salts more soluble in water or alcohol than the salts of quinine. The basic sulphate of cinchonia is chiefly employed, and in much larger dose than sulphate of quinine.

Quinidine, discovered in 1833 by Henry and Delondre, studied especially by Pasteur in 1853, crystallizes in rhombric octahœdra.

Cinchonidia, discovered in 1844 by Winckler, and called in Germany quinidine (name which Winckler gave it), crystallizes in rhombric prisms.

Cinchonidia is soluble in 1680 parts cold water, 19 of alcohol, and 76 of ether. It melts at 206°C.(*a*)

(*a*) Pelletier and Caventou Chemical researches on cinchona. (Jour. de Pharm., t vii., Feb., 1821.) Pasteur on the alkaloids of cinchona. (Paris, 1853.) Prunier on the cinchonas. (Nouveau Dict. de Med., et Chém., 1882.)

stances, or, at least, to transform the less active alkaloids of Peruvian bark into quinine. Among these alkaloids I desire to draw your attention only to cinchonine, cinchonidine, and quinidine.

Since Pelletier and Caventou discovered cinchonine,[1] endeavors have been made to apply this alkaloid—which differs, as you know, from quinine only by an atom less of oxygen—to the treatment of intermittent fever, and Marianini, Girault, Pepper, Wahu, and Hudellet have affirmed that sulphate of cinchonine is equal, if not superior, to sulphate of quinine; nevertheless, Laveran, and especially Moutard Martin, who have made of cinchonine a very interesting therapeutic study, have shown us that sulphate of cinchonine, while rendering considerable service in the treatment of paludal fevers, is yet inferior in potency to sulphate of quinine.[2] This salt, then, merits the name of "quinine of second quality," under which it is sold abroad.

[1] It was Pelletier and Caventou, who first discovered this alkaloid in gray cinchona bark about the year 1821.

Cinchonia differs from quinine by having one atom less of oxygen:

Cinchonia ..... $C_{20}H_{24}N_2O$
Quinine ..... $C_{20}H_{24}N_2O_2$

Cinchonia forms with acids a great number of salts. Heated with potassa, it gives rise to several alkaloids, among them to quinoleine.

Attempts have been made to transform cinchonia into quinine. This has not yet been accomplished, but quinine has been turned into cinchonia.

Cinchonia is not soluble in ether. This enables us to separate it from quinine, which is soluble in this menstruum. Cinchonia is obtained from the mother liquor used for the preparation of sulphate of quinine.

Certain cinchonas contain even more cinchonia than quinine. Thus the C. scorbiculata, which has in 1000 grammes 12 of cinchonia and 4 of quinine. Cinchona cordifolia mutis contains 12 parts in 1000 of the former to 2 or 3 of the latter; while the C. pubescens has 30 per 1000 of cinchonine, and only 3 or 4 of quinine.

[2] Sulphate cinchonia was early applied to the treatment of intermittent fevers. Marianini, Girault, Pepper, Wahu even think it equal or superior to quinine. Briquét shares this opinion.

The military physicians have bestowed much study on the comparative effects of these two alkaloids. Laveran regards cinchonia as much inferior to quinine. Moutard Martin has best summarized the action of the former:

1. Sulph. cinchonia, administered in intermittent fever has incontestable though variable action.

2. Sometimes its effect is rapid, it cuts short the attack like sulphate of quinine; at other times it is slow, whatever may have been the dose administered, and the paroxysms wear themselves out little by little.

3. The dose ought always to be large; at least a third more than that of quinine employed under the same circumstances.

4 To obtain a curative action, you must employ a dose varying, according to individuals, from 10 grains to 15.

5. In this dose it often determines certain physiological effects which it will not be prudent to exceed.

6. The therapeutic action is not in proportion to its physiological action, for it sometimes cures without the patient having felt its effect. In other cases where the physiological action is energetic the therapeutic action is *nil*.

Laborde has put in clear light the physiological difference between quinine and cinchonine, the latter being "more convulsivant" and determining in all animals to which it is administered, an aggregate of symptoms to which he has given the name of cinchonic epilepsy.[3] Cinchonidine (cinchonidia) and quinidine are isomeric respectively with cinchonine and with quinine;[4] long

7. It cannot replace quinine in grave intermittent fevers.

8. It may become a precious adjuvant to quinine; in completing the cure begun by one or two doses of the latter. In this way you may economize quinine, which is much the more expensive.(*a*)

[3] Magendie was the first to study the physiological and toxic action of the salts of cinchonine (cinchonia), and concluded from his experiments that this alkaloid was not toxic. According to Briquet, cinchonine and quinine differ only by the intensity of their effects, sulphate of quinine manifesting a toxic power double that of sulphate of cinchonia. These results have been contradicted by the experiments of Bouchardat, Delondre, and Girault, who have found the toxic power of cinchonia far superior to that of quinine.

Berandi regards sulphate of cinchonia as an excitant. Sée and Bochefontaine, in their recent physiological experiments, have arrived at the same conclusions as Briquet, and consider quinine as more active and more toxic than cinchonia. Both substances, according to them, are convulsivant; cinchonia the most so. Ten grammes of sulphate of quinine injected subcutaneously, would put the life of a man in the same jeopardy as 16 grammes of sulphate of cinchonia.

According to Laborde, what characterizes the toxic action of cinchonia is the production of epileptiform convulsions, described by him under the name of cinchonic epilepsy. These symptoms follow 25 centigrammes in a guinea-pig weighing 250 to 300 grammes, and 75 centigrammes in a dog weighing 12 kilogrammes, after subcutaneous injections. (*b*)

[4] Cinchonidia was first distinctly separated from quinidine by Pasteur. Its formula is as follows:

$$C^{20}\ H^{24}N^{2}\ O^{1}.$$

It is isomeric with cinchonia. This alkaloid seems to predominate in certain barks of cinchona, as Winkler has shown. It is scarcely soluble in water and ether, and combines with acids to form a series of salts; it is laevogyrus (polarization being left-handed). According to Laborde, the physiological and toxic action of cinchonidia is as follows: The animal is taken at first with a trembling similar to that of paralysis agitans, then with an attack of epilepsy resembling that produced by cinchonia.

Chirone and Curci have arrived at like results. They find cinchonidia more active than quinine and its toxic power greater. It produces epileptiform convulsions, which are the more intense the higher the animal is in the zöological scale, and the more developed his brain; it acts more especially on the motor cortical centres and leaves intact the spinal.

Gubler has employed the dibromhydrate of cinchonidia in subcutaneous injections. This salt, obtained by Petit by decomposing sulphate of cinchonidia by barium bromide, is in fine prismatic crystals of feeble yellow color, and having for formula :

(*a*) Laveran, Etude sur l'action comparée du sulfate de quinine, du sulfate de cinchonine et du quinium dans le traitement des fièvres intermittentes d'Afrique (Gaz. méd de Paris, 1856).—Hudellet, Etude comparative des deux sulfates de quinine et de cinchonine dans le traitement des fièvres intermittentes (Ann. thér de Bouchardat, 1856, p. 121).—Corps de santé militaire, Résultats de l'expérimentation faite dans les hôpitaux militaires sur les succédanés de la quinine (Rec. de méd., de chir. et de pharm. militaires, 3e série, t. II, 1859).—Moutard Martin, Mémoire sur la valeur du sulfate de cinchonine dans le traitement des fièvres intermittentes (Mém. de l'Acad. de méd., t. XXIV, 1860.

(*b*) Briquet, Therapeutical Treatise on Cinchonia and its Preparations, Paris, 1853. Bouchardat, Delondre and Girault, Physiological and Therapeutical History of Cinchonia. Magendié, Jour. de Pharm., Vol. VII, p. 138. Sée and Bochefontaine, on the Toxic Power of Quinine and Cinchonine. Compt. Rend. de l'Acad. des Sc., 1883, No. 96, p. 266.

confounded together under the name of commercial quinidine, it is to the brilliant researches of Pasteur on the alkaloids of cinchona that we owe their definite separation. Like cinchonine, they are, from a toxic point of view, convulsivant ; from a therapeutic point of view they antagonize morbid periodicity. Cinchonidine especially, according to the observations of Gubler, Wessell, Bouchardat, Coletti, and Bourru, is equal, and even superior to quinine in the

$$C_{40}\,H_{24}\,N_2\,O_2\,HBr. + 4\,H^2\,O.$$

The solution which Gubler used for hypodermic injections is as follows:
Take of:

Dibromhydrate of cinchonidia .....10 grammes.
Distilled water, q. s., to make 50 cubic centimetres.

Each syringeful containing one cubic centimetre, represents twenty centigrammes of the active principles. These injections have an action (according to Gubler) equal to that of sulphate of quinine.

Palcolo Machiavelli has made use of sulphate of cinchonidia in 851 cases. He claims the same results as are obtained from sulphate of quinine.

Le Judge, of Mauritius, considers sulphate of cinchonidia just as efficacious as sulphate of quinine in the treatment of intermittent fevers; it is well tolerated by the stomach, and produces neither buzzings in the ears nor nervous troubles. Weddell has pointed out the importance of cinchonidia in the treatment of malarial fevers at Madrid and the East Indies. He gives statistics relating to 1145 patients treated by cinchonia, cinchonidia, and quinidine; the therapeutical results were similar with all of them; he maintains, therefore, that it would be well to substitute cinchonidia for quinine.

Coletti has studied the physiological and therapeutical action of cinchonidia. This substance, while producing convulsions, did not, in his experiments, produce veritable epileptic attacks as in the experiments of Laborde and Dupuis. In his estimation, cinchonidia is equal, therapeutically, to quinine.

According to Bourru, who has also made comparative trials with quinine and cinchonidia in malarial fever, the latter produces, generally, favorable results, being unattended with vertigo and other accidents. Out of twenty-seven cases, cinchonidia arrested the attacks in twenty-four. The same dose was given as of quinine. The alkaloid should be given six or seven hours before the probable onset of the paroxysm.

Quinidine was brought to notice for the first time by Henry and Dilondre, in 1833. Pasteur, in his work on the alkaloids of cinchonia, has shown that under the name of quinidine is found in commerce a mixture in variable proportions of cinchonine, of quinine, of cinchonidia, and of quinidine. Quinidine and cinchonidia are very often confounded. This quinidine forms with the acids certain basic and acid salts.

Wunderlich, in 1865, was the first to experiment with quinidine. These trials were resumed in 1878, by Machiavelli. This medicament, in the dose of about a scruple, caused a fall in the temperature equal to that of quinine. Its antipyretic properties in fevers were found equal to those of quinine, only it produced vomiting, which was readily met by opium.

According to Laborde, quinidine produces, like cinchonidia and cinchonia, epileptic attacks in toxic doses; that is to say, in doses of from 20 to 25 centigrammes for a guinea pig weighing from 350 to 400 grammes.

Dougall, at Madras, has experimented comparatively, with quinidine, cinchonidia, and cinchonia. It results from these researches, that quinidine has the first place in order of efficacy, then cinchonidia, then cinchonine. (*a*)

(*a*) Dougall, on the Febrifuge properties of Cinchonia, Quinidine, and Cinchonidia (Edin. Med. Jour., Sept., 1873). Laborde, Thése de Paris, 1883.

treatment of paludal fevers; so interested pharmaceutical firms, in captivating pamphlet monographs, urge on the profession the substitution of cinchonidine for quinine, and this especially by reason of its cheapness.

By the side of these alkaloids I will mention quinoleine (chinoline)[1] and quinoidine (chinoidine). The first has this character, that it has been obtained by way of synthesis, and that this body, which forms a part of the aromatic series, and which furnishes, as you know, kairine, serves as intermediary between the alkaloids of cinchona and the antipyretic medicaments of the group of phenols and oxy-phenols. If we can trust the experiments of Loewy, this quinoline has an anti-periodic action of the most marked kind.

As for quinoidine it is not, properly speaking, a genuine alkaloid, but rather a combination of all the alkaloids which remain in the mother liquid after the preparation of quinine. Burdell, of Vierzon, continuing the experiments of Natorp, at Berlin; of Fraser, in Ohio; of Ossieur and Vanoye, in Flanders, has shown all the advantages which may be derived from quinoidine in the treatment of intermittent fever of the quartan form, especially in the telluric cachexia. Unhappily this substance, which is of low price, presents a varied composition, and it is easily understood that, according to the process of preparation, you obtain different quinoidines.[2]

Having concluded this rapid survey of the alkaloids of cinchona, I hasten to the most important of them, viz., quinine. I have already spoken to you of its physiological action; it remains to consider the question of its absorption and elimination.

Quinine has a local irritant action which is indubitable. The most marked proof of this is the multiple eruptions with which operatives are affected who are occupied in the manufacture of quinine. This irritant action is also

[1] Quinoleine, obtained by Gerhardt by distilling cinchonia with quinine and potassa, is a body analogous to *leucol*, which Runge extracted from coal tar, in 1843. It has been experimented with by Donath. It is given in the same doses as quinine, and is said to produce the same effects. Loewy claims good results from it in intermittent fever. (*a*)

[2] Sertuerner was the first to designate under the name of quinoidine an uncrystallizable and alkaline substance obtained from the mother liquid employed in the preparation of quinine. It is a mixture of quinine, cinchonia, cinchonidia, and quinidia. It has been employed by Natrop, of Berlin, Fraser, of Ohio, Ossieur, in Belgium, etc. Briquet has noted the same action from this substance as from sulphate of quinine.

Burdel employs quinoidine, and considers it superior to quinine in chronic malaria. He gives it pure, or in the form of soluble sulphate; prescribing from eight to fifteen grains to an adult, and continuing the treatment for several weeks in gradually increasing and rather infrequent doses. Administered in this way, Burdel thinks that he finds in quinoidine a more powerful febrifuge than quinine in the treatment of quartan fevers and malarial cachexia. (*b*)

(*a*) Loewy, Wein. Med. Presse, No. 39, 1881. Gerhardt, Revue Scientifique, t. x, p, 186. Runge, Pogg. Ann., t. 31, p. 68.

(*b*) Stertuernerner, Ueber die neuest. Fortschrift in d. Chem. Phys. u. Heilk., t. III, p. 269). Ossieur et Vanoye, De la quinoïdine dans le traitement des fièvre intermittentes (Ann. de la Soc. méd. d'émul. de la Flandre occidentale, mai 1848, et Bull. de thér., t. XXXV, 1848, p. 43). Briquet, Traité thérapeutique du quinquina, 1853, p. 469. Burdel (de Vierzon), Du traitement des fièvres intermittents telluriques par la quinoidine (Un. méd., 30 novembre et 5, 7 et 9 décembre 1878).

manifested on the mucous membranes, and this explains to you the gastric and intestinal disturbance which is produced when we give quinine salts by mouth in too big doses or too prolonged doses. This same local irritant action of the salts of quinine explains also why it is that subcutaneous injection of quinine solutions may be the point of departure of indurations and even suppurations.

When quinine enters the stomach it is dissolved by the acid of the gastric juice, and it is probably in the state of hydrochlorate or of lactate of quinine that this alkaloid is absorbed. At the same time, when quinine salts of the vegetable acids are given, they are changed to carbonates in the blood.[1] Quinine and its salts, after being absorbed, are forthwith eliminated by the various emunctories, and in particular by the kidneys. As Kerner has well shown, this elimination is the more active and more prompt the more soluble the salt of quinine.[2] From this fact we may adduce a very important conclusion, viz., that the activity varies with the solubility of the preparations, and hence we should choose those saline combinations of quinine which are the most soluble.

[1] According to Briquet and Quevenne, the salts of quinine pass unchanged into the blood when their acid is undecomposable; when the acid is decomposable, as is the case with the vegetal acids, it passes into the blood in the state of carbonate. Miahle even thought that quinine must always be set free in the blood by reason of the carbonic acid of that fluid liberating it from its saline combinations, but Delioux, of Savignac, shows this theory to be inadmissible, and that the sulphate of quinine must remain as such in the liquor sanguinis without undergoing any decomposition. (*a*)

[2] The following is the reagent proposed by Bouchardat for the detection of the alkaloids of cinchona in the urine:

℞ Iodine ..... 15 parts.
Iod. pot. ..... 4 "
Water ..... 300 "
M.

Briquet's modification of the above, which shows well the precipitate, though less delicate, is as follows:

℞ Iodine ..... 1 part.
Iod. pot. ..... 4 parts.
Water. ..... 125 "
M.

These liquids give an orange red precipitate of ioduret of iodohydrate of quinine, of cinchonia, etc.

We here give Kerner's table, showing the rapidity of elimination of the various alkaloids of cinchona:

The figures indicate the proportion of quinine eliminated in the urine for 100 parts of the alkaloid contained in the dose employed—

(*a*) Briquet, Therapeutical Treatise on Cinchona, 1853. Delioux of Savignac, Art. Quinine in Dict., Encyclop. des Sciences Med.

These quinine salts are very numerous,[3] as you can judge by the following table, made at my request by Tanret. This table contains the quinine combinations most in usage, classed according to the quantity of base which they contain, for you easily understand that the activity of a quinine salt depends on the one hand on its solubility, and on the other on the quantity of the alkaloid which it possesses, and you see what an elevated rank the chlorhydrate of quinine occupies in comparison with the sulphate.

DATE OF THE EXAMINATION OF THE URINE AFTER TAKING THE MEDICINE.

	15 minutes.	30 minutes.	45 minutes.	1 hour.	3 hours.	6 hours.	12 hours.	24 hours.	36 hours.	48 hours.	50 hours.	62 hours.
Chloride of quinine dissolved in gaseous water.....	1	4	4	8	15	19	30	12	2	1	0	0
Bisulphate of quinine.....	0	1	2	6	14	26	19	16	6	2	0	0
Sulphate of quinine.....	0	0	5	6	13	25	18	15	8	4	1	0
Carbonate of quinine.....	1	4	4	10	12	22	15	12	10	3	0	0
Acetate of quinine.....	0	2	5	6	13	27	16	12	8	3	0	0
Citrate of quinine.....	0	1	4	7	15	29	14	10	7	4	1	0
Tannate of quinine.....	0	0	0	0	1	2	9	28	14	4	2	2

Instead of employing the test proposed by Bouchardat, Kerner utilizes the fluorescent properties of solutions of quinine in order to determine the most minute quantities of this alkaloid contained in the urine. (*a*)

[3] Quinine is an energetic base, which readily enters into combination and forms crystallizable salts. These salts, less soluble than those of cinchonia, are very bitter. They are incompatible with alkaline hydrates, ammonia, iodureted iodide of potassium, tannin, double iodide of potassium and mercury, etc., which precipitate them from their aqueous solutions. We may divide the quinine salts into three groups:

1. Those perfectly soluble (the bisulphates, chlorhydrates, lactates).
2. Those less soluble (the neutral sulphates, acetates, valerianates).
3. Those little, if at all soluble (the phosphates, ferro-cyanates, arsenites).

The salts the most soluble are also the most active. We shall here specify a few of the most known of these salts:

Sulphate of quinine.—There are two sulphates: the neutral and the acid sulphate. The neutral sulphate crystallizes in prismatic, white, silky needles. Is efflorescent, inodorous, very bitter, little soluble in water (740 parts of cold water and 30 of boiling water being required); almost insoluble in ether, very soluble in glycerine, soluble in 60 parts of cold, absolute alcohol. Solution in water is favored by a drop or two of some strong acid.

The acid sulphate, or bisulphate, crystallizes in rectangular prisms. Is soluble in 11 parts of water at 59° F., making an intensely bitter solution. On account of its high price, various falsifications have been resorted to: 1, salicine, which may be detected by adding concentrated $H^2 SO^4$ to the suspected preparation, in presence of salicine it gives a red coloration; 2, sugar, which blackens under sulphuric acid; 3, stearine; dilute sulphuric acid does not completely dissolve the salt; 4, starch and magnesia; the preparation containing these adulterations would not completely dissolve in alcohol. Recently, sulphate of quinine has been largely adulterated with sulphate of cinchonidia.

(*a*) Briquet, loc. cit. Kerner, Pfluger's Arch. f. die Gesammte Physiologie, 1870.

The sulphate is the salt most employed, at least in France. It is one of the most stable combinations, but which presents the inconvenience of being little soluble when neutral; so whenever you wish to administer the sulphate in potion you must make it into a soluble bi-sulphate. Regnault has, moreover, furnished the most precise indications in regard to the solubility of this salt.[4]

Lactate of quinine crystallizes in flat, silky needles; savor is disagreeable; therapeutic action feeble.

Tartrate of quinine.—There is a neutral tartrate and an acid tartrate; the latter is very soluble and crystallizable.

Acetate of quinine is very soluble in boiling water, though little soluble in cold water. Is much employed in Germany.

Arseniate of quinine.—White, soluble in water and dilute alcohol. Is given in doses of 2, 4, and 6 centigrammes a day.

Iod-hydrate of quinine occurs in white, opaque, lamellated crystals.

Valerianate of quinine.—Octadædral crystals, of bitter taste, slightly soluble in cold water, very soluble in alcohol. Dose, 20 to 50 centigrammes (2 to 9 grains), in intermittent fever.

Tannate of quinine.—An amorphous, yellow-white powder, little soluble in water, more soluble in alcohol. Almost tasteless.

Phosphate of quinine.—Crystallizes in needles. Little soluble in cold water, soluble in alcohol. Dose, 5 to 20 centigrammes. Is employed in Italy.

Citrate of quinine.—Crystallizes in needles. Little soluble. Is employed in Italy. Dose, 20 centigrammes.

Ferro-cyanate of quinine.—Crystallizes in needles. Little soluble in water, soluble in alcohol. Employed in Italy in pill form. Dose, 20 to 40 centigrammes.

PERCENTAGE OF QUININE IN DIFFERENT SALTS OF THE ALKALOID.

	Percentage of Anhydrous Quinine.
Acetate of Quinine $C_{20}H_{24}N_2O_2C_2H_4O_2$	87.34
Hydrate of Quinine (Quinine precipitated and dried) $C_{20}H_{24}N_2O_23H_2O$	85.70
Basic Chlorhydrate of Quinine—the sole chlorhydrate employed, the Neutral Chlorhydrate not being stable—$C_{20}H_{24}N_2O_2,HCl.2H_2O$	81.60
Lactate of Quinine $C_{20}H_{24}N_2O_2C_3H6O_3$	78.26
Basic Bromhydrate of Quinine $C_{20}H_{24}N_2O_2BrHH_2O$	76.60
Valerianite of Quinine $C_{20}H_{24}N_2O_2(C_5H_{10}O_2)$	76.05
Basic Sulphate of Quinine (the ordinary sulphate) $C_{20}H_{24}N_2O_2SO_4H_{2,7}$ H_2O	74.30
Sulpho Vinate of Quinine $C_{20}H_{24}N_2O_2SO_4C_2H_6$	72.
Neutral Bromhydrate of Quinine $C_{20}H_{24}N_2O_2BrH\ 3H^2O$	60.
Neutral Sulphate (or acid sulphate) $C_{20}H_{24}N_2O_2SO_4H_28H_2O$	57.24
Tannate of Quinine $C_{20}H_{24}N_2O_2(C_{14}H_{10}O_9)$	20.60

[4] Regnauld has studied the solubility of sulphate of quinine, and these are the results:

One gramme (15 grains) of sulphate of quinine dissolves in two litres (Oiv) of water at 59° F.; 560 grammes (℥ xix) in the same quantity of water at 212° F.; one gramme is soluble in 1.133 grm., of absolute alcohol at 59° F.; in 1.926 grm., of chloroform at 59° F.; in 22.632 grm., of ether, at 59° F.

One gramme (15 grains) of tannate of quinine demands for its solution 20 litres (5 gallons) of water.

If the sulphate is the most use in France, it is the chlorhydrate which is employed the most in England and in Germany.[1] This salt, in fact, is more soluble than the sulphate, and contains more quinine, so that, according to the rules previously laid down, it would be better to employ the chlorhydrate, and this is a point worthy of remembrance. As for the acetate, which contains so large a quantity of base, it is too unstable a salt for constant use.

In combining salicylic acid with quinine the intent has been to increase the antipyretic power of this medicament,[2] and notwithstanding the very interesting experiments of Maury, of Lyons, and the therapeutic results of Graham Brown and of Antonescu, the usage of this salt is very limited.

Of all the salts of quinine the most stable is the tannate.[3] and it has been claimed that it may even traverse the economy without undergoing decomposition. At the same time the experiments of Kerner and especially of Vulpian

[1] There exist two combinations of quinine with hydrochloric acid: one neutral, which is not stable, and a basic salt, which has the following formula :

$$2\,(C^{20}\,H^{24}\,N^{2}\,O^{2},\,Hcl) + 3\,H^{2}\,O.$$

This salt crystallizes in long, silky fibres; it is more soluble in water than the sulphate; it contains also more quinine.

[2] Salicylate of quinine has the following atomic formula :

$$C^{20}H^{24}N^{2}O^{2}C^{7}H^{8}C^{20}H^{34}N^{2}O^{2}C^{2}H^{6}O^{3}.$$

It crystallizes in silky tufts; is soluble in 1430 parts of water at 68° F., and in 100 parts of boiling water. It has been especially studied by Graham Brown (Edin. Med. Journ. Nov. 1876, page 421), who considers it a very active antipyretic medicament.

Maury, of Lyons, has made some interesting experiments with this salt, showing its great antiseptic power.

German Sée has also experimented with this salt in his hospital service in intermittent fevers and typhoid fever, but with indifferent success. Antonescu, however, claims good effects from this salt in malarial fevers.

[3] Tannate of quinine was described for the first time in 1821 by Pelletier and Caventou under the improper title of gallate of quinine. This salt contains 26 per cent. of quinine and 3.50 grm., of the tannate (52½ grains) corresponds to one gramme (fifteen grains) of the sulphate.

Regnauld's process of manufacture (Journ. de Pharm. et de Chim. t. xix, 1879) gives a preparation with the following formula:

$$C^{40}\,H^{24}\,N^{4}\,2\,(C^{54}\,H^{22}\,O^{34}).$$

Becker, of Bonn, considers tannate of quinine as a good medicament. He has especially derived benefit from it in whooping cough. Hagenbach also considers tannate of quinine as a good febrifuge. It combats the fever and diarrhœa of typhic patients.

Vulpian has shown that tannate of quinine is absorbed and eliminated. At the same time this medicament has a very feeble action. It is especially beneficial in preventing profuse sweats (Delioux, of Savignac.) It may also be employed in infantile diseases. (*a*)

(*a*) Regnauld, On tannate of quinine, in Jour. de Pharm et de Chem., 1879.—Vulpian, On tannate of quinine (Acad. de Med., 1872).—Delioux, of Savignac, On the employment of tannate of quinine in the treatment of night sweats (Un. Med., 1853.)

show that it does undergo decomposition, though very slowly; it is then one of the least active preparations.

As for the bromhydrate, it is to-day chiefly employed in subcutaneous injections, and I shall return to this salt when I come to speak of the hypodermic use of quinine.

To introduce these salts of quinine into the economy, we can make use of several ways; the stomach, the intestine, the skin, the subcutaneous cellular tissue and the lungs. In giving it by mouth you can administer it in solution, in suspension, in powder or in pills. By very careful experiments Briquet[1] has shown us that the solution is the most prompt and certain of these forms of administration, and the pill form is the worst.

In making your solution[2] you should either prescribe the bisulphate or order enough of sulphuric acid to effect the change into a soluble bisulphate.

[1] Briquet has made comparative trials of solutions, powders and pills containing sulphate of quinine. He endeavored to ascertain by the presence of quinine in the urine the rapidity of absorption, and by the manifestations of encephalic troubles, the action on the nervous system. These are his conclusions:

Complete solution.—1st. There is manifested at the end of from two hours and a half to three hours after the ingestion of the solution of bisulphate of quinine, signs of absorption in two-fifths of the patients who took fifteen centigrammes (2½ grains); in about two-thirds of those who took from 20 to 25 centigrammes (3 to 4 grains), and in three-fourths of those who took from 30 to 35 centigrammes (5 to 6 grains).

2d. There were manifested signs of action on the encephalon in one-fifth of the patients who took fifteen centigrammes (2½ grains); in a little more than one-third of those who took twenty centigrammes (3⅓ grains); in more than two-thirds of those who took 25 centigrammes (4 grains), and in three-fifths of those who took 50 centigrammes (7½ grains).

In the case of the administration of the pulverulent form, these were the results:—1st. There were no signs of absorption at the end of three hours save in one-fifth of the patients who had taken 25 centigrammes (4 grains); in one-sixth of those who had taken 30 centigrammes (5 grains), and in one-fourth of those who had taken 35 centigrammes (6 grains); a degree of absorption which considered *en masse* is not equal to that of 15 centigrammes (2½ grains) of acid sulphate in solution.

2d. There were no signs of physiological action in at least one-third of the patients who had taken 25 centigrammes (4 grains) of neutral sulphate in powder, in one-sixth of those who had taken 30 centigrammes (5 grains), and in a little less than one-third of those who had taken 35 centigrammes (6 grains). This degree of action, taken as a whole, is less than that of 15 centigrammes (2½ grains) of bisulphate in solution.

Administration of quinine in pill form.—1st. With the pill form there did not exist at the end of three hours any signs of absorption of quinine except in a very feeble proportion which might be approximately estimated at one-sixth as many as were markedly affected when the same dose was given in solution.

2d. The signs of absorption observed at the end of two hours were noticed in a larger proportion than in the case of those to whom the quinine salt was given in powder (as 2 to 3) but in less proportion than where the quinine was given in solution (as 4 to 5).

3d. Whatever may have been the dose in the pill form, no physiological action on the nervous system was ever noted, (*a*)

[2] Below are several formulæ for potions of sulphate of quinine :

(*a*) Briquet, Therapeutical Treatise on Cinchona and its Preparations. Paris, 1853.

You can use tartaric or citric acid in making your solution, or you can do as Herard directs, dissolve your quinine in a small wineglassful of brandy or rum.

Unfortunately, all these active preparations have the disadvantage of being exceedingly and persistently bitter to the taste. One of the best means of getting rid of this inconvenience is to give immediately after the draught a little licorice powder. Bear in mind that when you wish to obtain a speedy effect, and utilize the whole of your dose of quinine you must give it in solution. If you choose to give it suspended in some liquid menstruum you cannot do better than administer it in strong coffee, which well disguises the bitterness of the salt. This form, however, is less active than the preceding, as a certain quantity of the sulphate remains adherent to the cup, and a part is transformed into tannate of quinine, a combination, as above stated, ill-fitted for absorption.

The pulverulent mode has been recommended in order to obviate the bitterness of the quinine, which is given in capsules or in pearls. If the administration of the salts of quinine is rendered easier by this means, there are the inconveniences attending it that the therapeutic action is less prompt than with the solutions, and the direct contact of the powder of quinine with the gastric mucous membrane is apt to be attended with a sensation of heat and burning. So whenever you resort to this convenient way of giving quinine, recommend to your patients to drink after each dose a tumblerful of tartaric or citric lemonade, which effects the solution of the quinine.

The pill form, as I have said, is the worst, by reason of the tardy solution of these pills.[3] I advise you, then, if you have occasion to give quinine in pills, to see that they are made with some soluble excipient, as honey or conserve of

GRAMMES.

(1) ℞ Sulphate of Quinine..... .50
Acid tannic..... .60
Distilled water..... 60.00
Syrup of ginger..... 3.00

M. For one dose in malarial fevers.

(2) ℞ Sulphate of Quinine..... .75
Acid tannic..... .10
Acid sulphuric..... gtt. ij.
Distilled water..... 100.00
Syrup of orange..... 40.00

M. The whole would be a full dose.

(3) ℞ Sulphate of Quinine..... 1.00
Acid sulphuric,..... q. s.
Water..... 100.00
Syrup,
Syrup poppies..... ℥iij 20.00

M. The above represents one full anti-malarial dose for an adult.

[3] Formulæ for quinine pills:

℞ Quiniæ sulph..... 1.—
Acid tartaric..... .20
Conserve of red roses..... .10

M. Ft. pil. No. x.

red roses, and not of gum arabic, which is hard to undergo solution in the digestive fluids.

In certain cases, either because the patient has an invincible repugnance to the quinine potions, or because he cannot take the capsules or pills, as in the case of young children, it has been proposed to give the quinine in enemas. Briquet[4] has shown us that the action of the medicine is often more rapid by this method than by the mouth, but much less persistent; you can then order enemata of sulphate of quinine, having care to change the sulphate into bi-sulphate,[5] but to insure their activity these injections should be kept up, and you know how difficult this is when your patient is a child. So in cases of this kind it has been advised to administer the quinine by lotions and pomades, thus making use of the skin as a channel of introduction. This is a means that will give disappointment, for it has been demonstrated that the skin covered

℞ Quiniæ sulph..... .10
Citric acid, pulv..... .20
Honey..... .05
Starch..... q. s.

M. For one pill.

℞ Quiniæ sulph..... .60
Ext. Absinthe..... q. s.

M. Ft. in pil. No. vi.

Starke has also proposed to give quinine in pill form with tartaric acid and sugar. The patient should drink freely of tartaric acid lemonade before swallowing these pills.

[4] Briquet, in giving lavements containing one half gramme of quinine to fever patients, has observed:

1. That generally sulphate of quinine given in lavements is absorbed.
2. That this absorption is very prompt, and twice as rapid as by the stomach.
3. But it is too feeble, and insufficient in three-fourths the cases to determine appreciable effects on the encephalon and heart.
4. That finally absorption abruptly and completely ceases in most cases after an hour and a half.

Hence Briquet considers lavements of sulphate of quinine as of only secondary importance, and to be efficacious they must be given at the very moment even when their therapeutic effect is desired.(*a*)

[5] The following is a good formula for a quinine lavement:

℞ Sulph quinine..... gr.x.
Acid sulph..... gtt.i.
Warm water..... ℥ v.
Tinct Opii..... gtt.x.

M. Quinine is used in suppositories; seven or eight grains being incorporated with sufficient cacoa butter to form a suppository. This method is not to be recommended.

Where this salt cannot be borne by the stomach, or as an adjuvant to its internal administration, it may be rubbed up with lard and a little alcohol, in the form of an ointment, one drachm being incorporated with half an ounce or an ounce of the fatty excipient.

(*a*) Briquet Loc. Cit., p. 338.

with its epithelium does not absorb the salts of quinine, or if it absorbs them, it is in such trifling quantity that no therapeutic result can be obtained.

But if the skin does not absorb, the cellular tissue, on the contrary, lends itself rapidly to the introduction of the salts of quinine, and the hypodermic method finds in the paroxysms of pernicious fever one of its most useful applications. You will see, in fact, as I shall further on point out, that there are cases of paludal intoxication when it is necessary to act with extreme rapidity, and you understand of what utility must be in these cases the subcutaneous injections of quinine, which to promptitude of absorption add a great therapeutic activity. Albertoni and Ciotto,[1] by their brilliant experiments on the channels of elimination of quinine, have shown us that this medicament, when it is introduced by the mouth, passes through the liver, and a certain quantity sojourns there, to be eventually eliminated in the bile; while, when introduced by the hypodermic method, quinine salts pass immediately into the circulation and are eliminated by the urine.

Only, as these salts to be soluble must be acid, it is easy to see that such injections introduced under the skin may determine there local inflammations; therefore, endeavors have been made by Albertoni and Ciotto by the addition of glycerine or tartaric acid,[2] or by seeking more soluble salts of quinine, to render these solutions less irritative. Tanret has recommended the lactate of quinine,[3] of which he dissolves one part in five parts of distilled water. Paul

[1] Pietro Albertoni and Francesco Ciotto have especially studied the channels of elimination of quinine. They have found it in the bile from two to five hours after its ingestion in the stomach. When the salt is introduced in other ways it does not appear in the bile, but in the urine. They have found it in the blood during the first hour after its ingestion. Quinine sojourns long in the blood, and may be found in all the viscera, and in particular in the spleen, liver, and brain.(*a*)

[2] Reynolds has proposed the following solution for hypodermic injection :

		Grammes.
℞	Quin sulph.....	28.
	Acid sulphuric.....	q. s.
	Glycerine.....	24.
	Water q. s. to complete 170 cubic centimeters.	

Each cubic centimeter (syringeful) contains 16.7 centigrammes of sulphate of quinine.

Kobner prefers the hydrochlorate, as in the following solution:

		Grammes.
℞	Hydrochlorate of quinine.....	1.
	Glycerine.....	
	Distilled water, āā.....	2.

M. Dissolve without acid. One cubic centimetre contains 15 centigrammes hydrochlorate of quinine. This solution keeps well in a warm room. Should be injected tepid.

[3] The following is Tanret's formula :

(*a*) Pietro Albertoni et Francesco Ciotto, Sur les voies d'elimination electives de la uinine (Gaz. med. ital., provi Venete, 18 mars 1876, p. 93, et Bull de thér., t. XC, 1876, p. 360).

advises the soluble sulpho-vinate of quinine, unfortunately of little stability. Generally the bromhydrate is the salt employed.

Described by Latour and Boille,[4] this salt was introduced into therapeutics by Gubler, and since then we have seen Soulez, of Romarantin; Dardenne, of the Isle of Mauritius, and Auliffe extol the effects of this salt in the treatment of intermittent fevers. As the bromhydrate contains more quinine than the sulphate, and is more soluble, it is no wonder that it has been utilized for hypodermic injections, and solutions have been made of one part in ten. But in such large doses, it is necessary to add alcohol, which renders this solution somewhat more irritating.

Finally, struck by the rapidity of action of medicaments introduced by the

		Grammes.
℞	Lactate of quinine.....	1.
	Distilled water q. s. to complete.....	5.

This solution, which is stable, contains in each cubic centimetre 20 centigrammes of lactate of quinine.

[4] The combination of bromhydric acid and quinine was made in 1870 by Latour and in 1872 by Boille. The formula of neutral bromhydrate of quinine is as follows:

$$C_{48}H_{24}N_2O_4Hbr,2H_2O$$

That of acid bromhydrate is:

$$C_{48}H_{24}N_2O_42Hbr,6H_2O$$

This substance is crystalline, and its solubility is greater than that of sulphate of quinine; one part of bromhydrate being soluble in 5 parts boiling water, or 60 parts cold water; it contains more quinine than the sulphate.

Gubler has employed this salt in subcutaneous injections, using ten per cent. solutions in water slightly dosed with alchol; one gramme of this solution contains one decigramme of the active principle; it suffices to inject two syringefuls, in order to introduce into the organism the equivalent of 30 centigrammes of sulphate of quinine.

Soulez was one of the first to make use of this salt subcutaneously in fever and ague. In his experience in the fevers of Sologne it proved superior to sulphate of quinine. Given one hour before the paroxysm, it prevented its occurrence. Moreover, in the dose of half a gramme to a gramme it produced little of the quinine intoxication. He has recommended this method of subcutaneous introduction: Plunge the needle directly through the skin and inject the solution very slowly, at the same time, with the pulp of the fingers, press over the tract of the injected liquid, and diffuse it as widely as possible through the subcutaneous cellular tissue, then withdraw the needle gradually.

Dardenne, of Mauritius, employs the following formula for hypodermic injections:

		Grammes.
℞	Acid bromhydrate of quinine.....	1.
	Dilute sulphuric acid.....gtt. x..	
	Distilled water.....	10.

M.

Or the following solution:

		Grammes.
℞	Acid bromhydrate of quinine.....	1.00
	Tartaric acid.....	0.50
	Distilled water.....	10.00

M.

respiratory passages, Jousset of Bellesme, has practiced intra-tracheal injections of salts of quinine in cases of pernicious fever, and this bold attempt has been crowned with complete success. In a previous chapter I have enumerated these facts and dwelt on the utility of these intra-tracheal injections. I see with pleasure that since the publication of this chapter, the method has won favor: Bergeron has maintained its advantages, and in veterinary practice, where the trachea can be so easily reached, I have seen Cagny and Levi, of Pisa, employ these injections with brilliant success. I believe, then, that in cases of pernicious fever it would be well to always have in mind the possibility of these tracheal injections of the salts of quinine, and not to hesitate to practice them.

I have finished with the modes of administration of the salts of quinine, but before going farther it is well to ask if the introduction of these salts into the economy, apart from the symptoms of local irritation which I have pointed out, has not other inconveniences. You all know that the principal property of quinine salts is to determine a cerebral state known under the name of quinine intoxication; but these salts have also been accused of provoking abortion and hæmaturia.

I will say little about the symptoms which constitute quinine intoxication; the buzzings of the ears, the vertigo, the obscurations of sight, which are the principal symptoms, and which manifest themselves whenever enormous doses are given. Women seem more susceptible than men to this physiological effect, owing to the predominance of the nervous system in females. So great is the susceptibility in some persons that it takes but small doses of quinine to produce these symptoms, and it is difficult in such patients to obtain a therapeutic effect. It may, in fact, be necessary to abandon quinine and employ some other alkaloid of cinchona, cinchonidia, for example, which, in pretty large doses, does not occasion any cerebral trouble.

The question of the influence of quinine in producing hæmaturia[5] has

These injections determine no local accident, except a slight induration. This treatment has given excellent results with marsh fevers of the island of Mauritius.

Auliffe's formula is as follows:

		Grammes.
℞	Bromhydrate of quinine.....	2.
	Sulphuric ether,.....	8 cent. cub.
	Rectified spirits.....	2.

M. A hypodermic syringe full of the above contains 10 centigrammes of bromhydrate. It is proper to inject as much as a gramme of the salt in cases of pernicious fever.(*a*)

[5] Antoniades, of Athens, was the first, in 1858, to call attention to the hæmaturia which often follows intermittent fevers. Berettas, the same year, attributed these hæmaturias to the use of quinine. Karamitzas, of Athens, while admitting that there are intermittent

(*a*) Gubler, Note sur l'emploi thérapeutique du bromhydrate de quinine (Jour. de thér., No. 13).—Soulez. De l'utilité du bromhydrate de quinine dans le traitement des fièvres palustres (Jour. de thér,, Nos. 21, 24, 1879). Remarques sur les précautions à prendre pour éviter les accidents locaux de injections hypodermiques de sulfate de quinine (Jour. de thér., No. 17, 1876).—Dardenne, Contribution à l'étude du bromhydrate de quinine dans les fièvres d'orlgine pàludéenne (Jour. de thér., No. 9, 1877).—Mac Auliffe, Injections éthérées de bromhydrate de quinine (Jour. de thér., No. 21, november, 1880).

been especially agitated by Greek and Italian physicians, and we see Ughetti and Tomaselli maintain that in many cases hæmaturia with bilious fever results from treatment by sulphate of quinine. It is not, indeed, a veritable hæmaturia which is observed in these cases, but rather, as Karamitzas has shown, a hæmoglobinuria, that is to say, that the coloring matter of the blood alone passes out in the urine. For my part, I have little belief in this quinine hæmaturia, for in typhoid fever treated by large doses of sulphate of quinine, you never see hæmaturia or hæmoglobinuria; it is probable then that the malarial condition favors the appearance of these hemorrhages At the same time, I am of opinion that in individuals affected with hæmaturia or hæmoglobinuria, it is well to be chary in the use of sulphate of quinine.

The same reserve should be made when you have to treat pregnant women,[6] affected with intermittent fever. Although the action of sulphate of quinine on the uterine contractions is still a matter of dispute, and to the facts of Monteverdi of Duboué and Warren, who report cases of abortion following large doses of quinine in this disease, we may oppose the observations quite as positive of Thezet, Delmas, Burdel, and D'Alamo, who have shown that pregnant women may with impunity support quinine treatment—it none the less remains demonstrated that in other circumstances quinine may determine

hæmaturic fevers, has shown by precise experiments that quinine does determine hæmaturia, but that in these cases it is not a true hæmaturia, but rather what he calls hæmospherinuria, in which only the coloring matter of the blood is found in the urine, and not the globules.

Moreover, Ughetti and Tomaselli have maintained that the bilious hæmaturia, which sometimes attends malarial fevers, does not result from the marsh poison, but from the toxic action of sulphate of quinine in therapeutic doses.(*a*)

[6] Quinine has long been considered as a congestioning medicament of the uterus, and Tilt and Delioux de Savignac range it among the emmenagogues. It has, moreover, been asserted that it may determine uterine contractions and provoke abortion. Thus it is that Petijean, Monteverdi, Duboué, of Paris, and Warren, have mentioned cases of abortion caused by sulphate of quinine. Thus, too, Cocheran, John Lewis, and Rich consider it a useful medicine in obstetrics to quicken the contractions of the womb. To these positive facts Thizet, Delmas, Alamo, Bardel, etc., have opposed another series of observations, showing that medication by quinine has no danger whatever to the majority of pregnant women. Plantard has collected a great number of cases of pregnancy where treatment by sulphate of quinine was followed by no bad results. Nevertheless, as abortion may supervene, it is well to employ at the same time as the quinine, calmative medicaments, and particularly subcutaneous injections of morphia and sulphate of atropine.

Quite recently, moreover, this oxytoxic action of quinine has been affirmed by Lartigan.(*b*)

(*a*) Ughetti, Introsçicazione Chinica e la febbre biliosa ematurica (lo Sperim., fasc 6, 1878).—Karamitzas, Sur l'hématuric provoquée par la quinine (Bull. de thér., t. XCVII, p. 53, 1879).

(*b*) Plantard, De l'emploi du sulfate de quinine pendant a grossesse (thèe de Paris, 1875).—Duboué (de Pau), De l'action des sels de quinine sur l'utérus (Ann. de gynécol., octobre 1874, p. 286).—Delioux de Savignac, Médicaments obstétricaux (Bull. de thér.. t. LXXXI., p. 298).—Tilt, the Lancet, Feb. 1854, et Bull. de thér., 1851, t. XL.—Monteverdi, Un. méd., 1871 et 1872.—Thézet, Bull. de thér., 1846, t. XXX.—Rich, Charleston Med. Jour. and Rev., March 1881, et Bull de thér., 1892, t. LXII., p. 180.—Lartigan, the British Med. Journ., 2 June 1883.

abortion, and you should always have this in mind when you have to treat patients in a state of pregnancy.

To point out the principal alkaloids of cinchona bark and show you the superiority of quinine, to indicate the modes of administration and preparation, all this does not suffice to make known in their entirety the numerous medications which have been counselled in the treatment of intermittent fever, and I must now point out the succedanea of cinchona and its derivatives. You already know that the principal motive of researches made to find a substitute for quinine is the high price of the latter; you will not then be astonished at the numerous medicines which have been proposed to take its place, all of which have been proved to be inferior to cinchona. These succedanea have been derived successively from the vegetable kingdom, from the mineral, and even from the animal kingdom, and without giving you a complete list of these medicaments, I will only point out the principal of them.

I shall omit mention of the indigenous plants which have been recommended in intermittent fever,[1] making allusion only to berberis vulgaris so much praised by Piorry, centaury recently experimented with by Bertin, euca-

[1] The barberry (berberis vulgaris) contains in the bark of the root, which is very bitter, two alkaloids: berberine and oxyacanthine; the last is one of the most bitter of substances. An extract has been made from the bark of the root which has been counselled in malarial fevers, and oxyacanthine has been used instead of quinine.

The European centaury (centaurea calcitrapa), which grows everywhere in chalky soils, has been employed by Bertin under the form of alcoholic extract of the root, in intermittent fevers. In the Quotidian form, it suffices to give during two or three days, six pills of three grains each, one pill every two hours, to break up the attack. In the grave forms it is necesary to exceed the quantity of fifteen grains a day. The same medicament is valuable in the larvated fevers. (Bertin, on the Employment of Centaury in Malarial Fevers, Montpellier Medical Journal, February and March, 1876).

Under the name of cedron nuts there exist two products of different origin. The one belongs to the *simaba cedron*, or *quassia cedron*; the other to the valdivia (picrolemma valdivia). The first of these fruits contains a product known as cedrine, which is uncrystallizable and which is injected under the skin in doses of $\frac{1}{30}$ to $\frac{1}{15}$ of a grain. In Columbia the cedron powder is used, mixed with a little brandy, in the dose of eight to fifteen grains a day. This powder of cedron has been used by the Indians from time immemorial.

In 1848, Vauvert, of Mean, vice-Consul of France, at Panama, sent a box of cedron nuts to the Academy of Medicine, but no trials were made; in 1852, however, Reyer demonstrated the febrifuge properties of cedron. Purple, of New York, Posada Arango, of Columbia, employed also with success in malarial fever the powder of cedron nuts. Dujardin-Beaumetz and Restrepo have also obtained good results by this means, while Bardel reports only disappointments.

The fruit of Valdivia contains an alkaloid, discovered by Tanret, and crystallized under the name of valdivine, and which has for formula:

$$C^{36}H^{24}O^{2}{}_{5}HO.$$

This valdivine is eminently toxic; $\frac{1}{30}$ grain killed a hare in eighteen hours; it determines vomiting in man in the dose of $\frac{1}{15}$ grain. In cases of hydrophobia, valdivine causes abatement of the convulsive paroxysm, without, however, accomplishing a cure. (*a*)

(*a*) Restrepo, a Study of Cedron, of Valdivia, and their active principles, Paris, 1881.

lyptus which Gubler and Gimbert introduced into therapeutics, and lastly, cedron, which I have studied along with my pupil, Restrepo.

This experimental investigation showed us, first, that there exist two kinds of cedron; the one belonging to the simaba cedron, the other to a variety of plant whose botanical characteristics Planchon, our colleague at the Academy, has determined, viz: the *picrolemma valdivia*. From the first a neutral non-crystallizable substance has been obtained called cedrine, from the other a crystallizable alkaloid, discovered by Tanret, viz: valdivine. Cedrine alone has an action in intermittent fever, in the dose of four milligrammes ($\frac{1}{15}$ grain) in subcutaneous injections, or under the form of cedron powder as the Indians of Columbia prepare it, and which is given in the dose of one-half gramme to one gramme a day (7½ to 15 grains). The trials which Restrepo has made in Sologne with cedron and cedrine, while showing us the febrifuge properties of this substance, have also proved its inferiority to the salts of quinine.

Eucalyptus has enjoyed a much greater reputation, and it was thought that we had found a real substitute for cinchona, having this singular advantage that the cultivation of this tree, so strange in color and in the shape of its leaves, has the power to destroy the marsh miasm.[1] Hence it is that you may see in the Campagne Romaine the railroad stations in the most unhealthy localities, surrounded with eucalyptus trees. But more rigorous observation of the facts has shown that the preparations of eucalyptus are untrustworthy medicaments

[1] The eucalyptus globulus is a tree of the Myrtaceæ family, which often attains a colossal size. All the parts of the tree and especially the leaves contain an aromatic essence, eucalyptol, which has been analyzed by Clöez.

This tree was introduced into France in 1857 and 1858 by Ramel. It is to-day cultivated in abundance in the Maritime Alps, and in Algeria.

Gubler and Gimbert have studied the physiological action of eucalyptol. It produces excitation in the dose of several drops, and irritation, if the dose is augmented from half a drachm to a drachm.

This tree, which is called fever tree, has been employed from the earliest time by the Aborigines of Australia in the treatment of intermittent fever. More than forty years ago the captain of a schooner from Salvy saw the good effects of the bark and leaves in an epidemic of pernicious fever which broke out among the sailors of the French sloop, La Favorite, at Botany Bay. In Corsica, Regulus Carlotti, of Ajaccio, obtained remarkable results from eucalyptus in the treatment of paludal fevers, and he had similar success in Algeria.

In these cases the tincture of the leaves or the powder is generally used. Gubler gave of this powder from sixty to ninety grains a day. Kirchberg treated nineteen patients by eucalyptus, and all got well without sulphate of quinine. Burdel, of Vierzon, has obtained only incomplete results in the treatment of the malarial fevers of Sologne.

Eucalyptus has still another property, that of destroying on the spot the marsh miasm, and this results either from the rapid absorption of the water by this tree (which is very greedy of water), or from the aromatic emanations which it develops. (*a*)

(*a*) Gubler, l'Eucalyptus et son emploi en thér. [Bull. de thér., 1881, t. LXXXI, p. 145].—Castan, Montpellier méd., 1872, t. XXX, n° 6.—Burdel [de Vierzon], l'Eucalyptus globulus en Sologne [Bull. de thér., t. LXXXV, p. 529].—Gimbert [de Gannes], l'Eucalyptus globulus, 1870, p. 69.—J. Campian, l'Eucalyptus globulus et l'Eucalyptol [thèse de Paris, 1872].—Régulus Carlotti, Mémoire sur l'action thérapeutique et la composition élémentaire de l'écorce et de la feuille de l'eucalyptus, présenté à la Société d'agriculture d'Alger, 1869 — Kirchberger, Observations de fièvres intermittentes traités au moyen de l'eucalyptus globulus [Journ. de méd. de l'Ouest, 1re série, 6e année, t. VI, p. 260].

in the treatment of intermittent fevers, and that it will not do to depend on the cultivation of this tree to effect the disappearance of malaria.

I will say nothing of jaborandi or pilocarpine.[1] Rokitanski and Griswald have indeed recommended this alkaloid in the first period of intermittent fever, but this is an exceptional kind of treatment which is not applicable to the paroxysmal stages of the fever as ordinarily witnessed.

Among the substances not of vegetable origin[2] which have been recommended in the treatment of fever and ague, I will enumerate only picric acid and the picrates, arsenic and the arseniates and the medicaments of the aromatic series.

A dozen years ago, I made some researches on the physiological action of picrate or carbazotate of ammonia, and, while recognizing that this medicament diminished the number of pulsations and produced on the part of the brain a symptomatic aggregate comparable to quinine intoxication, I noted, after Braconnot, Calvert and Mossa, Haspland, Parisel,[3] etc., its febrifuge action; only this action, like that of the succedanea of quinine generally, is uncertain.

[1] Griswald counsels in intermittent fevers subcutaneous injections of one-sixth grain of pilocarpine. These injections, according to him, not only cause the chill to subside, but they often throttle the paroxysm, and when one or two attacks have been cut short the fever does not return. He advises the employment of these injections in pernicious fever. (*a*)

[2] Certain mineral substances have been recommended in intermittent fever, such as chlorate of potassium (febrifuge salt of Sylvius; chloride of sodium, vaunted by Thomas, of New Orleans, Selles, of Mount Desert, and Piorry; chloride of ammonium, extolled by J. Franck, Aran, and Padiolo; tincture of iodine (Seguin, Boinet, and Barilleau, of Poitier); solution of iodide of potassium (Wildebrand and Helsingfors); the sulphites and hyposulphites, by Polli.

[3] Picric or carbazotic acid was discovered in 1788 by Hanssmann. Obtained in 1794 by Welter, by the action of nitric acid on silk, it was prepared in 1834, by Runge, by exposing tar oil to nitric acid. Laurent in 1841 showed that this substance was a derivative of phenic acid [C^{12} H^5 O,HO], in which three molecules of NO^3 are substituted for three atoms of hydrogen; it is called on this account trinitrophenic acid. Certain alkaline carbozotates are very explosive, but the carbazotate of ammonia is not so. It crystallizes in brilliant yellow rectangular plates or six-sided prisms, and is of an intensely bitter taste.

It was Braconnet, of Nancy, who first, in 1830, employed the picrate of potassa as a febrifuge. Calvert and Massa, in 1836, pointed out the antiperiodic properties of picrate of ammonia. In 1862 Aspland again took up the subject and showed that one could derive the same effects from carbazotate of ammonia as from sulphate of quinine in the treatment of the malarial fevers of the Indias.

Parisel, in 1868, quotes the reports of Barot (Son), who obtained a cure in more than sixty cases of fever and ague by frequent three-grain doses of picrate of ammonia. The same success was obtained by Henry, of Tureaux, in the province of Cher, by Chazereau, at Aubigny, by Charles Flain, at Sancerre, and Manoha, at Medeah.

Dujardin-Beaumetz has studied the physiological and therapeutical action of carbazotate of ammonia. This salt causes diminution in the beatings of the heart, and in the dose of one grain brings down the pulse ten beats. In the frog there is produced arrest of the heart with one-sixth grain; in the hare three grains diminish by one-half the pulsations of the heart. When you exceed one grain or a grain and a half a day, you produce a train of symptoms

(*a*) Griswald, Pilocarpine in Intermittent Fever [New York Med. Jour., August, 1880].

Boudin has given us the most precise directions, how to treat intermittent fever by arsenic.[4-5] Everybody is agreed in acknowledging the great service which arsenical preparations render, not so much in the treatment of the morbid periodicity, where they are proven to be very inferior to quinine, as in the malarial cachexy, where arsenic is superior to cinchona and its derivatives. The arsenical medication cannot then take the place of cinchona, but it is the admirable complement of the latter.

The powerful antiseptic and anti-thermic effects of medicaments derived from the aromatic series have also been applied to the treatment of the paludal fevers, and in the case of certain of them this action was one of the first théra-

which Parisel described under the name of picric poisoning, very similar to quinine poisoning, and characterized by headache, vertigo and general enfeeblement. Dujardin-Beaumetz administers carbazotate of ammonia in pills containing one-sixth grain. He gives five or six of these pills a day. This medicament acts well in intermittent fevers, but its action is untrustworthy and inferior to that of quinine. (*a*)

[4-5] It is to Boudin that we are indebted for the best directions for the treatment of intermittent fever by arsenic. Nevertheless at the beginning of the seventeenth century Hadrien, Slevogt and Melchior Frick definitely established the antiperiodic and febrifuge properties of arsenic. Plencitz senior, and Slevogt made great use of arsenious acid, and affirmed almost constant success in the treatment of malarial fever. The latter was in the habit of giving from one-half to one grain daily. Boudin has gone so far as to give three grains a day. Millet has never exceeded two-thirds of a grain; Sistache begins by doses of one-half grain. Boudin's solution is as follows:

℞ Acid arsenions,..... ..... 1 part.
Water,..... 1,000 parts.
Mix.

Delioux, of Savignac, has reduced the formula of arsenious acid to fifty centigrammes to the litre (1000 grammes) and each dose of a tablespoonful represents one centigramme (or one-sixth of a grain) of arsenious acid.

Sistache employs a solution containing five centigrammes (five-sixths of a grain) of arsenious acid to fifty grammes of water, *i. e.*, one centigramme to every ten grammes. Out of 229 patients affected with intermittent fever, treated with arsenious acid, Sistache has never had a failure. He affirms that arsenious acid is as efficacious as quinine, but that it acts more slowly. Also in pernicious fever it is completely inefficacious.

Delioux, of Savignac, prefers arsenic to quinine in the treatment of periodic neuralgias.

Moutard Martin considers the arsenical medication as superior to every other in the treatment of paludal cachexia. Hydrotherapy alone can be compared with it.

During the last few years, Mosler has proposed a different medication for impaludism with induration of the spleen. He injects directly into the parenchyma of the organ, from ten to twenty drops of Fowler's solution, following each injection by applications of ice.

[From Fowler's summary of his own experience, it appears that 171 out of 247 cases of ague were radically cured by the arsenical solution which bears his name. The cures generally took place within four days from the time when the administration of the medicine was commenced. Withering cured thirty-three patients out of forty-eight by the solution

(*a*) Braconnot, Ann. de phys. et de chim., t. XLIV, p. 297.—Aspland, Med. Times, 1862.—Parisel, Action physiol. et thér. de l'acide picrique (thèse de Paris, 1868).—Dujardin-Beaumetz, De l'emploi du carbazotate d'ammoniaque comme succédané du sulfate de quinine (Soc. de thér., juillet 1872, et Gaz. méd. de Paris, 1872, Nos. 37, 38 et 39). Nouveaux faits relatifs à l'emploi du carbazotate d'ammoniaque (picrate d'ammoniaque) comme succédané du sulfate de quinine (Bull. gén de thér., 1872, t. LXXX, p. 385).

peutic effects observed; thus, for instance, when salicin was first extracted from willow bark, it was considered a succedaneum of quinine. Since salicylic acid has been obtained by way of synthesis, this acid and salicylate of soda have also been applied to the treatment of fever and ague.[6] But it must be admitted that these medicines have been but little efficacious in the treatment of febrile intermittence; therefore, notwithstanding the results obtained by Bartels and by Zielewicz, this mode of treatment has not come into use.

I may say as much of resorcin, and, although Kahler and Lichtheim have maintained that this medicament is equal and even superior in rapidity of action to quinine, I have never obtained such an effect in the trials which I have made of it.[7] As for quinoleine, which is now obtained from the phenols and oxyphenols,

alone; in the remaining fifteen cases it failed entirely. Willan prescribed it in about fifty cases of different species of intermittents, and it succeeded almost instantly in every case. It was found by Winterbottom to be equally successful in the African intermittents at Sierra Leone.

In Philadelphia it was early employed by Wistar, Griffiths, Barton and Currie; the last named of whom mentions that it was a common practice in the State of Delaware to give the Asiatic pills, composed of arsenic and black pepper, for the cure of agues. In 1820 Dr. T. D. Mitchell found it more effectual than bark during an epidemic at Norristown, Pennsylvania; but unless he gave Fowler's solution in doses of fifteen or twenty drops, his patients derived no benefit from its use. Eberle was of opinion that it was best suited to the disease in persons of a firm and healthy constitution, and most apt to act injuriously when given in a debilitated, cachectic and irritable state of the system. In England, as late as 1833 we find Dr. Joseph Brown stating that he had given the arsenical solution in many hundreds of cases, without witnessing any permanently ill-effects produced by it, and he states that he has met with cases which were cured by arsenic where quinine had failed.

Extensive trials have been made with this medicine in intermittent fevers in this and foreign lands the past forty years, and it must be confessed, without establishing its superiority over the cinchona preparations in any form of malarial affections, unless it be certain chronic forms which have resisted quinine.

The rules for the administration of Fowler's solution in intermittent fevers are as follows: Children of from two to five years of age to take one-half drop at a dose for each year; between the ages of eight and twelve years, the dose should be from two to four drops. Beyond this age, three to five drops should be given three times a day for five days, then suspended for two or three days and again resumed to prevent a relapse. (Stillé, Materia Medica and Therapeutics, Art. Arsenic).—TRANS.] (*a*)

[6] Bartels considers salicylate of soda as an excellent medicament in intermittent fever. Zielewicz is of the same opinion, and gives the salicylate during the paroxysm to prevent a second attack: he admits, however the inferiority of this medicament to quinine, than which it is far less certain.

[7] Resorcin has been given in intermittent fevers by Lichtheim and by O. Kahler, in the dose of one-half drachm to a drachm at the onset of the attack. This dose

(*a*) Delioux de Savignac, Examen comparé des propriétés fébrifuges du quinquina et de l'arsenic [Bull. de thér., 1853, t. XLV, p. 294, 295).—Sistache, Emploi thérapeutique de l'arsenic [Gaz. méd., 1861, p. 67].—A Millet [de Tours], De l'emploi thérapeutique des préparations arsenicales, Paris. 2e édit., 1865].—Boudin, Traité des fièvres intermittentes et contagieuses des contrées paludéennes suivi de recherches sur l'emploi thérapeutique des préparations arsenicales, Paris, 1852.—Fremy, De la médication arsenicale dans les fièvres intermittentes, Paris, 1857.—Moutard-Martin, Médication arsenicale dans le traitement des fièvres paludéennes [Acad. de méd., 1872].—Mosler, Uebr Parenchymatose injection von solution arsenicales Fowleri in chronische Mitztumoren [Deutt Med. Woch., n° 47, 1880].

I have already alluded to it while speaking about the derivatives of cinchona, and I do not know that kairin, which has since been similarly obtained, has given any positive results.

There are several succedanea of quinine derived from the animal kingdom, such as oyster shells and cuttle-fish bones, formerly vaunted by Brault and Peneau, and especially spider's web, a popular old remedy of which Oliver has lately shown the real efficacy.[8] Despite the affirmations of these men I believe that the sulphate of quinine is still preferable and that in many cases nothing will take its place.

It remains for me now, having finished the enumeration of medicaments, to tell you how to use them to obtain as speedily and economically as possible the cure of intermittent fever. I emphasize the word economically, for this is an important matter. Do not forget that sulphate of quinine is to-day sold in our drug stores at a medium price of 1½ francs (or about 30 cents) a gramme. In regions, moreover, where the marsh miasm is prevalent you are apt to find an indigent population, and it will always be incumbent on you to effect the desired therapeutical results with minimum quantities of quinine, that is to say, with the least possible expense.

We ought from the point of view of the treatment of intermittent fever, to

markedly attenuates the symptoms, sometimes even causing their subsidence and cessation. Its action is immediate, as all observers testify, so that it may be given in the midst of an attack. It also lessens the volume of the spleen, and hence ought to be mentioned in the same rank as quinine. Dujardin-Beaumetz and Callais, in their researches on the action of resorcin in intermittent fevers, have obtained but meagre results; it is true that they gave much less doses than the above, and never exceeded fifteen grains. Perraton has also obtained uncertain and temporary results from resorcin in the treatment of malarial fevers. (*a*)

[8] Spider's webs have been used from time immemorial. In 1809 we read of a French curate who treated intermittent fevers by making patients swallow little balls of spider's web.

Dr. Oliver has again taken up the subject, and has made over ninety-three trials with pills made of spider's web. His conclusions are as follows:

1. Spider's web may cure malarial fevers of quotidian and tertian type;
2. The dose for an adult is thirty grains. For children a proportionately smaller dose;
3. Its effect is not so prompt as that of quinine; hence it should not be relied on in grave cases;
4. Spider's web has a better taste than quinine;
5. Relapses are less frequent than with quinine.

Brault and Peneau have also counselled the bones of cuttle fish and oyster shells in malaria. (*b*)

(*a*) Dujardin-Beaumetz and Callias, on Resorcin and Its Employ in Therapeutics, Paris, 1881—Perraton, on the Employment of Resorcin, [these de Paris, 1882).

(*b*) Corre, Sur la toile d'araignée dans le traitement des fièvres intermittentes [Bull. de thér., 1883, t. CV, p. 331, et Trés. des mén., Paris, 1828].—Oliver, Toile d'araignée contre la malaria [Allgem Wiem. Med. Zeit. 10 aoril 1883, et Zeits. d. A. o. Apoth. Vereins, avril 1883].—Brault et Peneau, De la guérison des fièvres intermittentes et larvées au moyen de l'os de seiche et de l'écaille d'huitre, 1864.

examine the three following points, and in their order: treatment of ordinary intermittent fever, treatment of pernicious fever (malignant intermittent), treatment of the paludal cachexia. Finally, we shall finish by a rapid examination of the hygienic conditions which one should recommend to prevent the development of intermittent fever.

As for the treatment of ordinary intermittent fever, we should place ourselves in two special conditions: either the individual resides at a distance from the marshy locality, or he is still exposed by his residence to the marsh miasm. In the former case by the sole fact of his removal to a more healthy region he may get well; this it is that explains how in our hospitals at Paris we are in such an unfavorable position to study the anti-periodic action of certain medicines. For generally the intermittent fever which we observe is light, and consists of relapses in individuals who have formerly contracted malaria in other countries. Therefore we cannot rely altogether on trials made in the hospitals of Paris, in deciding the febrifuge virtues of this or that medicine, and it is in regions where this fever reigns that such essays should always be made. In Paris then you can witness the disappearance of intermittent fever under the influence of repose, a simple emetic, or a small dose of quinine.

When your patient resides in the country where the marsh miasm is developed, your treatment will be more difficult, and you will have to study successively what preparation to use, at what moment to give it, and the proper dose.

As for the choice of the preparation, you had better discard all the pretended succedanea of quinine, also the powdered peruvian bark and the various old remedies that contain it,[1] the extracts of cinchona as well,[2] not because

[1] The bolus *ad quarternam* had the following formula:

		Grammes.
℞	Pulv. cinchona,	30
	Tartar emetic,	08
	Carb. pot.,	4 00
	Syrup papaver,	q. s.

M. Make up into 60 boluses; all to be taken during the 24 hours.

The *Remède du Calvaire* is similar to the above; its formula is as follows:

		Grammes.
℞	Yellow calisaya bark [pulv.],	40
	Tartrate of antimony,	05
	Rhubarb, ana.,	4
	Carb. pot., ana.,	
	Syrup of cinchona,	q. s.

M F. S. A. bol, No. x. Sig. One bolus morning and evening.

[2] The extracts of cinchona are very numerous; they are all acid, and present, according to the bark which has furnished them, a very variable composition. Tanret has given a table indicating for each gramme of the divers extracts the quantity of alkaloids and tannin contained, as well as the acidity, represented in lactic acid. According to this table, the Java bark is richest in alkaloids, each gramme having 0.157 of active principles, while the Loxa is among the poorest, each gramme representing only 0.014 of the alkaloids. The cinchona calisaya is an excellent bark, with the decimal figure, representing richness in alkaloids, of 0.115. Some of the red cinchonas are poor in alkaloids, but rich in tannin; the proportion of the latter varies in them all from 0.050 grm. to 0.210, grm. a

they are inert but because they are more beneficial in the chronic form of marsh poisoning than in intermittent fever. You should reject all the other alkaloids of cinchona and rely on quinine alone, whose effects can be determined with almost scientific precision.

You should prescribe either the sulphate or the hydrochlorate of quinine, and I cannot too strongly urge you, breaking the bonds of tradition which has given the preference to the sulphate, to use the chlorhydrate instead, a salt more soluble, more rich in quinine, and for that reason more active. In adjoining countries this substitute is an accomplished fact, and we should not be behind them in this regard.

You will administer the chlorhydrate of quinine in solution when your patient is poor, in capsules when he is rich, and you will understand the reason for this; the capsules as I have before told you, are a little less active than the solution; as for the latter the simplest and most economical way consists in

quantity contained per gramme in some of the red barks. We give below the table in part:

SPECIES OF CINCHONA.	TANNIN.	ALKALOIDS.	ACIDITY IN LACTIC ACID.
Cinchona huanuco,	0.065 grammes.	0.050 grammes.	0.054 grammes.
Cinchona Loxa,	0.014 "	0.176 "	0.047 "
Cinchona flava [without any other denomination]	0.010 "	0.062 "	0.050 "
Java cinchona,	0.157 "	0.030 "	0.074 "
Cinchona calisaya,	0.115 "	0.047 "	0.063 "
Indian cinchona,	0.065 "	0.050 "	0.070 "

Tanret has proposed to substitute tannate of quinine for the soft extracts, and would replace the potions made with soft extracts [so fashionable in France] by the following formula, which has the advantage of being always of uniform strength:

℞ Tannate of quinine, ... As many times 23 centigrammes as you would have put grammes of the extract.
Acid lactic, ... q. s. to dissolve.
Syrup, ... 30 grammes.
Water, ... 120 grammes.

Mix and dissolve.

Quinium is a complete extract of cinchona, obtained by alcohol and lime. This quinium represents 33 per cent of its weight of quinine, plus all the other active principles of cinchona. The formula of its preparation is given by Delondre and Labarraque. [It is a popular cinchonic preparation.] (*a*)

(*a*) Tanret, study of the extracts of cinchonia (Bull. de Thér., 1883, t. 105, p. 65).

causing your patient to take his quinine in a small glass of rum or brandy. But what shall be your dose, and when shall it be given? I will explain.

You know that the attack of intermittent fever is characterized by periods or stages, which are described under the names of period of chill, period of heat, period of sweating; that moreover, according as the fever returns every day, every two days, or every three days, you have to do with the fever in a quotidian, tertian, or quartan form. You know also, that these types may be double, and then you have double tertian and double quartan. I shall not dwell on this point, but pass at once to the consideration of the first question: at what period should you give the sulphate of quinine to derive the most advantage from it?

Practitioners have long hesitated between three methods;[1] that of Torti called the Roman method, that of Sydenham, called the English method, and that of Bretonneau, called the French method. According to Torti's method, you would give the quinine at the moment of paroxysm, not to arrest it, but to

[1] In the treatment of fever and ague, cinchona was administered according to three different methods:

1. The Roman method, indicated by the Jesuit fathers, and adopted by Torti.
2. The English, or Sydenham's method.
3. The French, or Bretonneau's method.

According to Torti's method, the cinchona is given in one dose, immediately after the attack. First fifteen grains, in one dose; then, two days after, a dose of sixty grains, and after an interval of eight days of rest, a thirty grain dose was administered.

According to Sydenham's plan, the cinchona was given after the attack, but in fractional doses in the interval of the attacks (half dram to dram doses every two hours, till from half an ounce to an ounce was taken). Sydenham prescribed the cinchona in the form of an electury, in pills or in wine. He used to put an ounce of powdered Peruvian bark into two quarts of wine, and direct the patient to shake it and drink eight or nine teaspoonfuls every four hours. Morton, Stoll, and Van Swieten adopted Sydenham's method. Cullen rejected it, and returned to the Roman method, somewhat modified; the cinchona was taken in small doses repeated every hour, and administered, not after, but before the paroxysm.

The method of Bretonneau consisted in giving two drachms of powdered yellow Peruvian bark, or fifteen grains of sulphate of quinine, in one dose or two doses, near together, immediately after the paroxysm. After five days of rest, the same dose was repeated, then after an interval of eight days, and so on, every eight days for a month. Trousseau, a pupil of Bretonneau, used to give two drachms of yellow calisaya bark in powder (or fifteen grains of quinine) in a couple of doses, one hour apart. He let the patient rest a day, and then gave the medicine in the same way the third day, generally in two doses, one right after the other. Then he allowed three days of interval, then four, six, seven, and eight, and for a month or two returned every eight days to the same treatment, never diminishing the dose. The medicament was always given at meal time.

Briquet has made a series of experiments to ascertain the best time to give sulphate of quinine, and these are his conclusions:

1. A dose of 4 to 6 grains of sulphate of quinine suitably administered, is sufficient to cut short any attack of simple intermittent fever in the climate of Paris, and in all other places not paludal.

2. When there is an interval of but a few hours in which to administer the febrifuge before the time of paroxysm, one may still hope to arrest the next attack.

3. If you have only 12 hours before the regular attack, you have almost a certainty of

prevent the following ague fit. Sydenham gave his Peruvian bark in one large dose after the attack, and in smaller doses in the interval. Bretonneau and Trousseau followed the method of Sydenham, but they employed larger doses, which they gave immediately after the attack; this is also Briquet's method, who would have at least fifteen hours between the giving of the dose and the ague fit which he wished to prevent.

While admitting the views of these three French authorities with regard to massive doses, I believe that the space of time which separates the administration of the doses from the onset of the attack is too long, and I am of the opinion that it is well to give it, not as Torti recommends, at the period of chill, but three to four hours before the paroxysm.

As to the dose, it should be variable according to the intensity of the fever, and you can give 50–75 centigrammes or one gram (from seven to fifteen grains) of chlor-hydrate or sulphate of quinine. When the fever is tertian, which is its most frequent type, you should give your quinine every other day, and note the action of your medicine, which ought to produce retardation and diminution in the intensity of the attacks until they completely disappear. Even then it is not best to cease the administration of the quinine, but to continue it for eight days or so, in smaller doses, a short time before the usual return of the paroxysm. All the rules which I have given apply to simple intermittent fever, and you should change your mode of treatment when you have to do with pernicious fever[2] (called malignant, remittent, or intermittent fever).

arresting it, but it is, at the same time, not best to leave a shorter interval than 15 hours between the administration of the last powder and the paroxysm.

4. As, finally, the febrifuge action of quinine continues without losing its power for a space of two days, at least, one may, if circumstances require, give the quinine that length of time before the attack. (*a*)

[2] Intermittent fevers may be pernicious from the first, or succeed simple attacks; after having been attended, for awhile, with the ordinary symptoms, the disease presents suddenly, or gradually, frightful phenomena, which are followed by death unless the disease be arrested by some remedial means.

The varieties of pernicious fever are numerous. We will notice them according to the symptomatology—the morbid phenomena accentuating themselves in certain organs and functions—as follows:

1. Pernicious fever, of cerebral form.
2. Pernicious fever with algid, choleriform, sweating symptoms.
3. Pernicious fever with cardialgic, dysenteric symptoms.
4. Pernicious fever of thoracic form.

1. *Pernicious fever of cerebral form* is the most frequent. It is characterized by coma, delirium, convulsions, paralysis.

The comatose form is the most common. It is this which is met with oftenest in children. It is characterized by somnolence, lethargy, and finally, coma, which generally succeeds the febrile paroxysm. It is rare that death comes on before the third or fourth attack.

The delirious form is characterized by a delirium more or less violent, sometimes

(*a*) Briquet, Therapeutical Treatise on Cinchona and its Alkaloids, p. 500.

This kind of fever, as you are aware, manifests itself by attacks of great gravity, and may be fatal in the first, second or third attack; here, then, there is no precise therapeutic rule, and as soon as you have diagnosticated the pernicious character of the affection, you may administer your quinine even during the paroxysm, in the promptest way possible.

You know that in light cases Jousset, of Bellesma, does not hesitate to have recourse to intra-tracheal injections of quinine, and I am inclined to think

furious; the agitation is extreme, the skin warm, covered with sweat, the pulse strong and vibrating, the pupils dilated, then coma and convulsions set in. You may observe a general tetanic rigidity, cataleptic phenomena, epileptiform convulsions, laryngeal spasms (hydrophobic fever), syncopes (syncopal fever). It is quite rare that the delirious forms develop at first; ordinarily, they are preceded by regular ague fits, attacks of fever, and violent pain in the head. At Senegal, according to Fonssagrives, the comatose form is sometimes observed among the fevers which are pernicious from the onset; this form is the most grave.

The delirious and convulsive form is but the prelude to the comatose fever, to which the patient succumbs in an insensibility as complete as apoplexy. When the attack is not fatal, the patient, little by little, after 12, 24, or 36 hours, comes to himself, and may regain fair health till the next fit.

A paralytic fever has also been described; this is rare. It is characterized by partial paralysis, by hemiplegia, or by paraplegia, as was observed in numerous instances at Senegal, by one of our confrères.

2. *Algid and choleriform pernicious fever.*—This is especially observed in hot climates. The algidity may be the first stage of the fever, or it may appear in the second stage. It is sometimes during the sweating period that the patient begins to become cold and turns pale. He complains of internal heat, demands cold drinks, then all at once he experiences a deadly chilliness, his face becomes cadaverous, there is agitation, thirst, the voice is broken, the pulse becomes small and precipitate, the skin is covered with a cold clammy sweat, and death often comes speedily, the patient remaining in full consciousness; or it may be, in a few hours, heat returns little by little, and the patient recovers.

The *choleriform* form exists alone, or is linked to the preceding. It is characterized by profuse, incoercible diarrhœa, and symptoms resembling those of cholera; suppression of urine, choleriform voice and aspect, cramps, vomiting. If a prompt remedy is not forthcoming, the patient succumbs to a cholera asphyxia. In the diaphoretic form, which is especially frequent in India, the two first stages are normal, or shorter than ordinary. During the period of sudation the sweats are of an excessive abundance, but become cold; there is general cutaneous chilling; the pulse falls; the patient is greatly oppressed; often there is suppression of urine; profuse stools, resembling beef washings, which, later, are colorless.

3. *Pernicious fever with cardialgic symptoms.*—These symptoms are often observed without any previous prodrome. They are characterized by a severe rending pain in the epigastrium and heart, generally supervening in the stage of chill, and often accompanied by nausea and vomiting, general anguish, coldness in the body and syncope. Death generally attends the second attack.

4. *Pernicious fever of thoracic form.*—Intermittent pneumonias have been described; Grisolle admits the existence of a pleuritic pernicious fever, and especially a pneumonic pernicious fever. In the case of intermittent pneumonia, the chill, the fever, the dyspnœa, the bloody sputa exist as in ordinary pneumonia, the crepitant râles localized in one side of the chest; then with the sweating stage all the symptoms are mitigated, or disappear if there be nothing but hyperæmia of the lung, but the stethoscopic signs persist, if the lesion is more advanced, only the fever and the subjective symptoms diminishing. Rarely there are true intermittent pneumonias; oftener there are intermittent bronchites or broncho-pneumonias, coinciding with the febrile paroxysms, and giving rise to cough, dyspnœa, thoracic pain, etc.

favorably of this practice; at any rate, we witness here the triumph of subcutaneous injections, and you ought always to resort to them, whether you make use of the bromhydrate, the sulpho-vinate, or the lactate. You will require large doses, and you ought never to hesitate to give fifteen or twenty grains, and even twice as much, increasing your dose according to the urgency of the case; there have been cases where as much as 75 grains have been administered.

When the individual has for a long time suffered from attacks of intermittent fever, and when, moreover, he continues to live in localities infected by malaria, grave modifications are often effected in the functions of certain viscera. The spleen becomes enormously hypertrophied, the liver is enlarged, the blood is profoundly altered, and symptoms supervene whose aggregate constitutes the malarial cachexia. I shall not here describe this cachexia, but what I can assure you is that the alkaloids of cinchona are impotent against it. Here you will often witness the triumph of arsenic, and hydro-therapy is of benefit.[1] This last means is one of the most powerful resolvents in splenic and hepatic engorgements, and signal success has been obtained in these cases by douches of cold water directed over the spleen or liver.

Here the tonic medication is indicated under all its forms, but all means of this kind are without avail if the individual does not submit to the hygienic treatment which enables him under certain circumstances to avoid the toxic action of the marsh miasm. This hygienic treatment I shall now explain.

The measures of prevention are of two kinds; the one on which I shall now insist, concerns the drying-up of the marsh itself and its purification, the other concerns private hygiene.[2] As for the first, you know that three methods have been employed to get rid of stagnant waters, namely, by filling in with

[1] Fourcade is the great advocate of the treatment of intermittent fevers by hydrotherapy. It gives, he says, good results where quinine fails. (*a*)

[2] The reclaiming of marshes and rendering them salubrious, is accomplished by drainage (where practicable), by filling in with earth (atterrissement), and by exhaustion (by immense hydraulic machines, moved by steam, wind, or water). *Atterrissement* is in some places successfully accomplished by utilizing the muddy water of torrents and directing it into the marshes where the earthly sediment is deposited, which gradually fills in the marsh with alluvium, making it arable. In some places in proximity to the sea, the tide water is employed for the same purpose, being conducted into the paludal district by means of suitable canals.

The clearing and cultivation of marshy lands is a very dangerous operation, being, as Vallin says, "the first trench which one opens under fire of the enemy; the more rapidly one digs, the more rapidly he finds shelter from death." These clearances, then, should be effected as rapidly as possible, and the reclaimed land should be utilized for large plantations of trees, which, by the active evaporation of the leaves, dry up the soil.

Considerable enterprise and vast sums of money have been spent in reclaiming these marshes, and one of the most astonishing works of modern genius is the drying up of Lake Facino, by Prince Torlonia, who spent more than 40,000,000 francs in this sanitary undertaking.

When the marsh cannot be filled up, drained, or exhausted, it can sometimes be made

(*a*) Fourcade, on the Treatment of Intermittent Fever by Hydrotherapy—These pe Paris, 1872.

earth, draining off the water by suitable ditches, and, finally, subjecting the land to thorough drying; and in many countries where marshy regions exist, attempts have been made by the expenditure of enormous sums of money and arduous labors to render those localities healthy.

As for private hygiene, the physician and the physiologist can do much to establish rules as to residence and alimentation. You know that the higher you ascend the less you have to fear from marshy emanations; you know, too, that these emanations are carried to some distance by the wind, and this is the reason why a habitation should be chosen on a high elevation and sheltered from the winds that blow over the marshes.

The dietary of the patient should be restorative, and wine should be a part of it; the water that is drank should be pure and free from any paludal contamination. Despite all these precautions, you will not always be able to avoid the malarial intoxication. Nevertheless, there remains for you one resource, namely, to keep the inhabitants of miasmatic countries continually under the influence of Peruvian bark. In fact, there is no doubt that cinchona and its derivatives possess a prophylactic property, and in a recent expedition to the gold regions of Africa, the English officers derived great benefit from the preventive and protective use of salts of quinine. This is a very important fact, and I cannot too strongly recommend to you, when called to advise persons who are going to travel through, or sojourn in countries where this marsh miasm prevails, to insist upon the adoption of a prophylactic treatment by the salts of quinine. This finishes what I have to say about the treatment of intermittent fever, and I pass to the final lecture on the treatment of the eruptive fevers.

more wholesome by converting it into a lake, by digging around it, and heaping up earth all about its margins, and rendering these more perpendicular, so as to diminish as far as possible, the extent of the surface which the waters generally leave exposed during dry times. (*a*)

(*a*) Vallin, art. Marais, in Dict. encycl.—Bouchardat, Traité d'hygiène publique et privée, 1881.—Becquerel, Traité d'hygiène publique et privée, Paris, 1877, 6e édit., p. 292.—Durand-Claye, Mémoire sur le desséchement du lac Fucino, Paris, 1878.

ON THE TREATMENT OF ERUPTIVE FEVERS.

SUMMARY.—The Eruptive Fevers—Variola—Its Prophylactic Treatment—Variolic Inoculation—History of Variolization—Vaccine—Importance of Vaccine—Its Results—Origin of Vaccine—Cow-pox and Horse-pox—Attenuated Virus—The Microbe of Vaccine—Animal Vaccine and Humanized Vaccine—Vaccination—Dangers of Vaccination—Vaccinal Syphilis—Vaccinal Tuberculosis—Activity of Preservation by Vaccine—Conservation of Vaccine—Importance of Vaccination—Treatment of Small-pox—Period of Invasion—The Rachialgia and the Constipation—Treatment of the Eruption—Abortive Mask—Period of Suppuration—Disinfectant Lotions and Baths—Cardiac Complications—Ether-Opium Medication—Period of Desiccation—Treatment of Complications—Hygienic Cures—Prophylactic Treatment of Scarlet Fever—Treatment of Measles—Treatment of the Eruption—Treatment of the Complications.

GENTLEMEN: By their symptomatic aggregate the eruptive fevers constitute a natural group in the class of fevers, and the therapeutic indications which pertain to them deserve to arrest our attention for a short time. Of these so-called zymotic fevers, small-pox possesses especial interest on account of the prophylactic treatment peculiar to this disease, and on this subject I have a good deal to say.

In consequence of the hideous aspect which the face presents when covered with pustules, the repulsive odor that comes from the patient, the unsightly cicatrices which the malady leaves behind it, and its extreme contagiousness, small-pox deserves to be regarded as one of the most terrible of epidemics, and it is an important duty, on the first appearance of this formidable scourge, to endeavor by every means to limit its ravages.[1]

Do not persuade yourselves, gentlemen, that this word "ravages" is a figure of speech; it is, on the contrary, the rigorous expression of the truth. When in fact small-pox smites populations which have had no protection or immunity from the disease, as is sometimes seen in certain races that inhabit the interior of Africa, or the Polynesian Islands, whole communities have been swept away by the lethal epidemic, and you can judge of the fatality

[1] It is unknown at what epoch the first epidemics of small-pox appeared. It is said that in the books of Brahmins, dating back three thousand years, descriptions of small-pox have been given. It has been stated that this disease also reigned endemically in China, and some even affirm that variola was one of the seven plagues of Egypt; others claim that it was contemporaneous with the birth of Mahomet in 573. What is certain is that the Arabs and Rhazes in particular were acquainted with small-pox, and that the latter taught the treatment of the disease by cold baths. The Arabs passed over the disease to the Spaniards, and the latter introduced it into America.

In France, in the sixteenth century, Gregory, of Tours, designated small-pox under the name of *morbus varius*, from whence came the name of variola; Marius, bishop of Avranches, gave it the name of *varus*, whence it derived the name *verole* (pox) and to which a diminutive has been added to distinguish it from the disease which Voltaire called its elder sister (*a*)

(*a*) Barthelemy, Researches on Small-pox. Thèses de Paris, 1880.

of these epidemics, in recalling what happened only five years ago (in 1880), at the time of the arrival in Paris of a tribe of Esquimaux, which contracted small-pox during its peregrinations in Europe. All were attacked, and all succumbed. The observation of facts furnished a first means of preservation; it was remarked that persons who had once had the disease were ever after protected from its invasion, and either as the result of accident, or by a process of experimentation, inoculation for the prevention of small-pox came into vogue.

This inoculation or variolation has been, for many centuries, practiced by the Chinese, who make use of pock-scabs, which they introduce into the nasal fossa.[1] Then it was put in use in Circassia to protect young girls

[1] Variolization, or inoculation for small-pox as a prophylactic means, dates from the most remote antiquity. Practised in Georgia, in Circassia, in China, in India and in Persia, it was introduced later, in 1673, into Turkey by Timoni and Pitarino; thence it was imported into England, into most of the states of Europe, and finally into France. The operation was performed at all ages and in all seasons; pregnancy, menstruation, epidemic diseases and acute phlegmasias alone contra-indicating it. Variolization was practised by causing the dried scabs in fine powder to be aspirated by the nose (as in China), or the patient was inoculated with it by applying the matter to the skin denuded by a blister or otherwise broken by a seton, an incision or a prick. In England and in France the pock matter was pricked into the skin, the inner part of the arm being chosen for this purpose.

The variolization having been performed, certain peculiar phenomena follow. In spontaneous variola, there is only one eruption, which spreads indiscriminately over the whole body. In inoculated variola there are two eruptions. For seven or eight days the patient is without fever, and there are only local symptoms; a gradual development from the point of inoculation of a pustule which about the eleventh or twelfth day dries up and leaves a cicatrix. About the eighth day, to the local disease succeeds a general constitutional disturbance with a heavy feeling in the head, malaise, chills, fever, nausea, vomiting and three days after, the appearance of a secondary eruption which begins on the face to extend to the neck, thorax and limbs. These pimples, which are in greater or less number according to the individual, enter into suppuration at the end of three days and follow to the end the habitual march of the pustules of small-pox of the most mild form, without leaving any cicatrices.

By the side of the advantages which variolization procures: mildness of the febrile phenomena, diminution of the number of pustules, abbreviation of the duration of the disease, and especially attenuation of its gravity, must be reckoned special inconveniences to the subject and to his family. The disease engendered by the inoculation may sometimes be of a very grave character, and always by these inoculations made on several persons, foci of the disease are created which may cause it to spread.

It was in the heighth of the popularity of inoculation that Jenner came upon the stage, and revealed to the world his marvelous discovery of vaccine. (*a*)

(*a*) Timoni, Historia varlolarum quæ per incisionem excitantur, Constance, 1715.—Maitland, Account of inoculating the small-pox, London, 1722.—De La Condamine, Mémoire sur l'inoculation de la petite vérole, Paris, 1754. Histoire de l'inoculation de la petite vérole, Paris, 1776. Montucla, Recueil de pièces concernant l'inoculation de la petite vérole, Paris, 1757.—Tissot, l'Inoculation justifiée, Lausanne, 1754.—Gatti, Eclaircissements sur l'inoculation de la petite vérole, 1764. Réflexions sur les préjugés qui s'opposent aux progrés et aux perfectionnements de l'inoculation, Bruxelles, 1766. Nouvelles réflexions sur la pratique de l'inoculation, 1766.—Wrisberg, De inoculatione variolarum, Gottingue, 1765.—Petit (Ant.), Premier rapport en faveur de l'inoculation, 1766.—Gaudoyer de Poigny, Traité pratique de l'inoculation, Mancy, 1768.—Dunsdale, the present method of inoculation and small-pox, London, 1766, 1767, 1772. Tracts on inoculation, 1782.—Noel, Traité pratique de l'inoculation, Reims, 1789.—Satinade, Traité pratique de l'inoculation, Paris, an VII.—Desotens et Valentin, Traité historique et pratique de l'inoculation, Paris, 1800.

who were to be sold in the markets of Constantinople, and it is from this source that the wife of the English Ambassador, Lady Mary Wortley Montague, in 1721, obtained her knowledge of inoculation, which she communicated to the people of her country; whereupon this practice speedily spread over all Europe. But, notwithstanding all the precautions that were taken, this variolation was not without danger, for inoculation from a mild case of the disease may engender small-pox in its most serious form, and although a real progress was made by inoculation, there was, nevertheless, a mortality of at least one in three hundred. Jenner, who was, as you know, a physician-inoculator in England, by his immortal discovery, substituted vaccination for inoculation, and from henceforth civilized man was in possession of a perfect prophylactic treatment for small-pox.[1]

[1] Known and practised, as it is said, for ages in India, Persia, and even by the aborigines of South America, vaccination had not yet been introduced into Europe, and at the moment when Jenner made his first trials with animal vaccine in England, variolization was greatly in vogue. Certain physicians had remarked that some persons remained refractory to the inoculation of small-pox virus, and that these were generally persons who had before presented a pustular eruption on the hands contracted from milking cows affected with cow pox, but these observations passed unperceived and unappreciated. It was reserved to Jenner to derive profit from these observations, and after long researches, to bring into general usage the practice of vaccination.

Edward Jenner, born at Berkley, Gloucester county, England, in May, 1749, had for twenty years for his first teacher Ludlow, a surgeon of Sodsberg, and it is from him they say, that he learned accidentally that the cow disease preserves from small-pox.

His second master was John Hunter with whom he was always on the most intimate terms. Charged with the performance of variolic inoculations in the county in which he practised, Jenner noted that certain persons were refractory to inoculation, and thus escaped the contagion of small-pox. He observed, moreover, that these same individuals employed on farms had previously been affected with pustular eruptions on the hands, which they seemed to have contracted by milking cows, which had like eruptions on their teats.

Struck by these facts, he undertook various experiments and attempted to substitute for the variolizations properly so-called, inoculation with the virus contained in the pustules developed primarily in the animal or secondarily on the human subject.

He considered, moreover, cow pox and small-pox as having for first origin one sole and same disease, an affection of the horse called *grease*, and which in France is called *eaux aux jambes*. According to him, *cow pox* comes from *horse pox*, and is communicated by the stable-boys charged with the care of horses and the milking the cows. Jenner made his first experiment on his own son in 1789; he inoculated him with *swine pox*, then a little while after he variolized him; the disease did not take.

In 1796 he took from the hands of a farm girl, Sarah Holmes, the virus contained in some pustules, acquired from milking cows, and he inoculated a child by the name of Phipps; the eruption appeared at the points of inoculation, and four months after he variolized the child, the infection did not take, the child seeming to be fully protected. The vaccine discovery was made, but it was not till two years later, in 1798, that Jenner published the results of his experiments in a little book of sixty pages.

Physicians rallied around Jenner, and among them Pearson was the first to repeat the experiments, and with the same results. But like Simmons, Coleman, and other experimenters, they did not believe with Jenner that *cow pox* was derived from the *grease* of horses. Woodville, physician to the hospital for inoculations in London, having found a case of spontaneous cow-pox, made experiments with it; he noticed that the eruptions were not all

I shall not here discuss the value of vaccination. I am aware that there exists a small and uninfluential group of physicians who, under the name of anti-vaccinators, pretend that not only is the discovery of Jenner inefficacious, but that it is even dangerous; but their specious arguments have not lessened the preservative value of vaccine,[2] a value to-day indisputable, and which all the countries of Europe and of the world make haste to recognize, by favoring the promotion of vaccination, and by making it a legal obligation. France has not yet enforced this obligation by legislative enactment, although it has done so in a round-about way, by making attendance at schools and military service obligatory, and in requiring a certificate of vaccination and of revaccination as a condition of admission to the public schools and the army.

I shall not examine here all the questions which the origin of vaccine has

alike, and that there was in some cases a real variolic rash. Woodville concluded from this that pustular eruptions were a part of the vaccine disease, and that cow-pox was but a variety of small-pox. But later he abandoned this view; his last experiments were made with more care and he obtained the results announced by Jenner. His first experiments were defective; in fact he confessed that sometimes he inoculated with small-pox matter at the same time as the vaccine, or several days later. He also made these operations in a hospital where small-pox was prevailing.

The works of Jenner and his partisans rapidly spread the knowledge of vaccine to Hanover, Germany, Austria, France, Italy and even America. It was everywhere practised, despite the obstacles which were put in its way by numerous adversaries (Mosely, Vaunie, Herz, etc.)

The disparagers of vaccine have accused Jenner of not having faith in his own discovery, because in 1799, after having vaccinated without success his son Robert, who was living in a district infected with small pox, and not being able to procure genuine cow-pox matter, he variolized the child.

As in the case of all discoveries, the claim of Jenner to the discovery of vaccine was contested, and in France even, it was said that Jenner had been anticipated by a protestant minister of Montpelier. Whether this be true or not, it is none the less indisputable that if the idea did not first originate with Jenner, to him alone belongs the glory and the merit of having propagated the practice of vaccination.

Besides questions pertaining to medicine Jenner occupied himself much with natural history and published various works on this subject. He died loaded with honors at the age of 64 years; he had a first attack of apoplexy in 1820; he recovered, but in January, 1823, a second attack carried him off. (*a*)

[2] To judge of the relative mortality of small-pox before and after the discovery of vaccine, we need only consult the tables of Lotz, of Bale. The latter affirms that in the last century a twelfth of the population of Europe succumbed to variola.

The following table will be of interest at the present day amid the scepticism provoked by the wide spread literature of anti-vaccinationists:

(*a*) Jenner (Edw.), An inquiry into the cause and effects of the variolic vacc., London, 1798, trad. franç. par de la Roque, Lyon, 1800. Further observations on the variolic vaccine or cow-pox, 1799. Appendix to the treatise on cow-pox, 1800. A comparative statement of tracts and observations relative to the cow-pox, 1800. On the origin of the vaccine inoculation, 1801. On the varieties and modifications of the vaccine pustule occasioned by an imperfect state of the skin, 1819.—Woodville, reports of a series of inoculation of variolic vaccine or cow-pox, Londres, 1799.—Pearsey, Recherches historiques sur la vaccine, Londres, 1798.—Vaunie, Réflexions sur la nouvelle méthode d'inoculation.—Herz (Marcus), in Journ. de Hufel., vol. XII, 1801.—Baron, the life of Edw. Jenner, with illustrations of his doctrines, London, 1838.

raised,[3] viz., whether it comes exclusively from the cow or in the first instance from the horse. Whether cow-pox and horse-pox are anything but real small-pox developed in animals? Whether there is identity between human variola and animal variola? These are problems of experimental physiology which are far from being solved, despite numerous laborious investigations, in particular those of the veterinary school of Lyons and its chief Chauveau. Yes, it seems demonstrated that horse-pox and cow-pox are the small-pox of the horse and cow, but when you come to inoculate these animals with the human pock you

Names of Countries.	Period Before and After the Introduction of Vaccine, to which Belong the Figures Pertaining to the Mortality from Small-pox.	Annual Average of Mortality in Each Million of Inhabitants.	
		Before the Introduction of Vaccine.	After the Introduction of Vaccine.
Lower Austria.....	1777 — 1806 and 1807 — 1850	2484	340
Upper Austria.....	1777 — 1806 and 1807 — 1850	1421	501
Styria.....	1777 — 1806 and 1807 — 1850	1052	446
Illyria.....	1777 — 1806 and 1807 — 1850	518	244
Trieste.....	1777 — 1806 and 1807 — 1850	14036	182
Tyrol and Voralberg...	1777 — 1806 and 1807 — 1850	911	170
Bohemia.....	1777 — 1806 and 1807 — 1850	2174	251
Moravia.....	1777 — 1806 and 1807 — 1850	5402	255
Austrian Silesia.....	1777 — 1806 and 1807 — 1850	5812	198
Galicia.....	1777 — 1806 and 1807 — 1850	1194	676
Bucowina.....	1777 — 1806 and 1807 — 1850	3527	516
Berlin.....	1781 — 1805 and 1810 — 1850	3422	176
Sweden.....	1774 — 1801 and 1801 — 1850	2050	158
Copenhagen.....	1751 — 1800 and 1801 — 1850	3128	286 (*a*)

[3] Jenner admitted as the origin of vaccine a disease of horses' heels, which being transmitted to the cow by the dirty hands of milk men employed in treating the sick horses, is transformed into cow-pox. He at first called this disease *the grease*, and later he gave it the name of *sore heels*; a name which is the equivalent of *eaux aux jambes*; which our veterinary surgeons apply to the same disease. It is to-day known that this horse disease is not the true origin of cow-pox and does not preserve the animal from small-pox, but that there exists another disease which Bouley calls *natural horse pox*.

This natural horse-pox was observed in France, in 1860, at Rieumes, near Toulouse, by Laforgne, and in 1863, by Bouley, at the veterinary school of Alfort.

This horse pox is an eruptive vesiculo-pustular disease which is seated especially on

(*a*) Lotz, Variola and Vaccine. Report made in the name of the Sanitary Federal Commission. Bâle. 1881.

obtain a product which gives you for the human subject not kine-pox but small pox. The identity of vaccine virus and variola virus is only a hypothesis, but which will, it is hoped, shortly become a scientific reality, thanks to the brilliant discovery of attenuated virus by our illustrious colleague Pasteur.

I cannot here resist the desire to say a few words concerning this doctrine, which, originating only a few years ago, occupies so great a place in the prophylactic treatment of diseases, and which has thrown so much light on the history of virulent and infectious maladies.

Carrying out the fruitful line of inquiry suggested by vaccination, Pasteur has shown that it is possible by special cultures of microbes,[4] the supposed

the skin and on the buccal and nasal mucous membranes, and exceptionally on the conjunctiva. On the skin, the eruption has for seat of predilection the lower portion of the limbs and the head. This eruption is accompanied by a slight febrile movement which comes on three or four days before the appearance of the vesico-pustules. The confluence of the eruption on the legs produces congestion, swelling and ulceration, and it is easy to understand the confusion which has been made between the *eaux aux jambes* (leg waters) and horse-pox.

Chauveau, Viennois and Meynert have studied artificial horse-pox, that is to say, that which results from the inoculation of humanized vaccine on the horse, and have shown the differences which exist when inoculations or injections are made in the veins or in the cellular tissue, or when the product is introduced by the respiratory passages.

In the cow there exists also a vesiculo-pustular eruptive fever which has been described under the name of cow-pox, and which may be produced as in the horse by the inoculation of vaccine matter.

Attempts have been made to ascertain if cow-pox, horse-pox and small-pox are the same disease, and this opinion of the unity of the three diseases has been maintained by Jenner, by Thiele, and by Ceely; and it has been the subject of numerous discussions before the Academy of Medicine, especially in 1863 and 1864. Depaul has been the most ardent defender of this unity, which has been combatted by Bousquet, and this view may be summed up in these words: "There is no special vaccine virus. The latter is nothing but small-pox virus in its action on the cow and the horse."

Unfortunately experiments which have been made down to the present time have not solved this question, and the researches of the Commission of Lyons show that when you inoculate with human small-pox the horse and the cow, you give them a different eruption from horse-pox and cow-pox; and that if you take the product of this eruption and inoculate man with it you do not produce the vaccine disease but genuine small-pox. (*a*)

[4] Thus far inoculation by attenuated virus has been practiced in three affections: chicken cholera, anthrax and swine plague.

The virus of chicken cholera is one of the most active. It owes this activity to certain bacilli which develop in the blood and in the entire organism of the fowl. By the culture of this bacillus, one may succeed in attenuating its virulence and creating a variety of microbe which always reproducing its kind is capable of preserving chickens without determining in them cholera. As for anthrax (charbon), the first attempt at attenuation was made by Toussaint, of Toulouse, who raised to the temperature of 50° C. defibrinated blood of an

(*a*) Jenner, An inquiry into the causes and effects of the variolic vaccine, a disease discovered in some of the western counties of England, particularly Gloucestershire, and known by the name of cow-pox, London, 1798.—Lay, Account of some experiments on the origin of cow-pox, 1802 et Bibl. brit., t. XXI, p. 377.—Bouley, Leçons de pathologie comparée, Paris, p. 175, 1882.—Bousput, De l'origine de la vaccine chez le cheval, rapport sur le mémoire de M. Laforgue (de Toulouse) (Acad. de méd., 27 mai 1862).—Chauveau, Viennois et Meynet, Vaccine et variole. nouvelle étude sur l'identité de ces deux affections (Acad. de méd., 30 mai 1865, et Gaz. hebd. de méd. et de chir., 1865, p. 354).—Warlomont, Traité de la vaccine, 1883, p. 55.

agents of contagion in virulent diseases, to change the character of the bacilli, or, to use the happy expression of Bouley, to domesticate them, and thereby create new varieties, which, while maintaining a protective power on the animal in which they have been inoculated, develop only a mild form of the original disease. This is what he has accomplished for chicken cholera, for swine plague, and especially for anthrax, or splenic fever, and to-day it is by tens of thousands that we count the flocks and herds that he has saved from this deadly anthrax by his experimental vaccination. It ought to be the same for small-pox and vaccine, but we have not yet found methods of culture for developing the variola virus, and it is necessary that small-pox should undergo attenuation in the organisms of certain animals, such as the horse and cow, before the resulting virus can be truly protective.

Does the vaccine virus, you may ask, contain a microbe? Undoubtedly; and Klebs considers it as absolutely identical with that of small-pox. Chauveau, moreover, showed us in 1868 that vaccinal lymph deprived of its solid corpuscles, becomes inert.[5]

animal affected with charbon, and it was with this blood that he prepared his vaccinal liquid. Pasteur, Roux and Chamberland succeeded on cultivating the bacteria in obtaining a variety of these micro-organisms which reproduced themselves only by scission and without spores. This kind of bacterium was obtained by cultivating the anthrax bacillus in a culture liquid at the temperature of 42° to 43° C. These bacteria, deprived thus of spores, lost their virulence and served for attenuated virus.

One may, with these varieties of attenuated bacteria of chicken cholera and of charbon reproduce the virulent species, and for this purpose it suffices to inoculate these bacteria in certain species of animals of small size, the guinea pig for charbon, the sparrow for chicken cholera; then to take the microbe which develops in these organisms and subject it to another culture, and thus by successive cultures we succeed in reconstituting the original virulence of these bacteria. To-day these preventive inoculations for charbon are an accomplished fact of immense practical importance, and it is by the thousands that such inoculations are practiced among sheep in all the countries of Europe.

Detmers, of Chicago, afterwards Thuillier, of France, have discovered a microbe in the blood of hogs infested with swine plague. Pasteur and Thuillier have attenuated the virus and modified the microbe in causing it successively to pass through the pigeon and the hare, and this attenuated microbe inoculated in hogs, preserves them at least a year from swine plague. (*a*)

[5] Gluge, in 1838, was the first to describe in vaccinal lymph certain crystals which he believed to be the essential principle of this lymph. These crystals were nothing but brilliant corpuscles, which have been since described under the name of corpuscles of Gluge. Chauveau, in 1868, pointed out this capital fact, that when we deprive vaccine matter of the corpuscular elements which it contains, the vaccinal lymph becomes inactive. To obtain this complete separation, Chauveau employed the process of diffusion, and to a stratum of virulent liquid he added, carefully and slowly, a stratum of water; intermingling took place, and all the soluble parts of the serum were diffused through the water; the upper part of this mixture, when animals were inoculated with it, did not reproduce the vaccine. According to Hiller, the contagious principle of vaccine resides in certain pale opaque granules, some

(*a*) Bouley, Leçons de pathologie comparée, Le progrès en médicine par l'expérimentations.—Duclaux, Ferments et maladies, Paris, 1882.—Dujardin-Beaumetz, art. Bactérie, Dict de thér.—Chamberland, Revue scientifique, mai 1882.—Pasteur et Thuillier, Du virus atténué au rouget des porcs (Acad. de méd., séance du 27 novembre 1883).

You all know the methods of vaccination, and I need not here give you any rules for this operation, nor any description of the vaccinal eruption,[6] only reminding you that it seems to-day demonstrated that the number of vaccinations, and the intensity of the vaccinal eruption, have a certain part in the protection conferred, and the statistics of Oppert and of Russell seem to me in this

soluble in solution of potassa, others insoluble. Klebs believes that he has found the microbe of vaccine; he claims that it is identical with that of small-pox; it has for dimensions $\frac{6}{10000}$ of a millimetre; it presents itself often in groups of four, whence the name of *micrococcus quadrigeminus*. (*a*)

[6] The regular vaccinal eruption is developed in the following manner (Bousquet): The first and the second day one sees nothing unless it be some little hyperæmia in the punctures, but to inexperienced eyes the vaccinated subject is as if nothing had happened; it is the period of incubation common to all contagious diseases and especially to eruptive fevers. From the third to the fourth day, a little sooner in summer, a little later in winter, there is seen on each point of puncture a red point, more sensible to the touch than to the sight; in fact the finger distinguishes very clearly a little engorgement, just commencing, but soon to increase.

The fifth day, counting from that of inoculation, or the second day of the eruption, this pimple has become larger, but still without any particular characteristic.

On the sixth day it is no longer possible to be mistaken. Instead of developing towards a point as it had commenced to do, the pimple enlarges, flattens, becomes slightly cupped in the centre and takes on a silvery white, shading a little into a blue color. At the same time the base is surrounded with a little circle still very circumscribed but which spreads further each day.

The seventh and eighth day the same symptoms a little more marked. The pustule then fully formed, presents itself with its distinctive characters; is one or two lines in breadth, of a slightly azure white color, surrounded by an aureola of considerable extent, depressed in its centre, and terminated by hard swollen borders more elevated than the rest of the surface.

The ninth and tenth day this congeries of symptoms acquires still more intensity, but the most remarkable change takes place in the aureola, whose color, more bright and more red, disappears with greater difficulty on pressure of the finger and extends nine or ten lines in every direction. The subjacent parts are engorged, and this engorgement is proportioned to the extent and intensity of the areola.

From the eleventh day the papule begins to fade; the silvery blue changes and becomes brown; the areola contracts, grows pale, and yellowish; finally from the twelfth to the thirteenth day the pimple dries up and is transformed into a hard black crust, which falls on the twentieth or twenty-fifth day, and leaves in its place an indelible cicatrix, so characteristic that an experienced person can always tell what was its source.

The vaccinal cicatrix is round, deep pitted, traversed with rays and studded with a multitude of little black points which correspond without doubt to the cells which the pimples contained in their interior. It is superfluous to add that the older the cicatrix the more it is confounded with the integument, but it is never entirely effaced.

Such is the pustule obtained by human vaccine; with animal vaccine there are certain slight differences. The pustules are ordinarily more voluminous, more flat, more white; the march of the eruption is slower and its local action more violent, and sometimes accompanied with engorgement of the glands of the axilla.

Kine pox sometimes presents irregularities. The period of incubation which lasts

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(*a*) Gluge, Anatom. Microscop., Winden, 1838. Chauveau, Nature des Virus, etc., Acad. des Sc., Feb'y, 1868. Klebs, Arch. für Experim. Path., t. x., p. 2 and 3. Hiller, Untersuchungen über das Contagium der Kuhpocken, Centrabl., No. 20 et 21, 1876.

respect to be very conclusive.[7] But one point on which I ought to insist is the necessity of re-vaccination; in fact, vaccine seems to lose its protective properties in about ten years; therefore, all the governments which have made vaccination compulsory have been careful to enjoin revaccination.

Of all the dangers which have been attributed to vaccine, there is but one which deserves your serious consideration: it is the possibility of inoculating syphilis when the matter is taken from a syphilitic subject.[8] To-day it is perfectly demonstrated, and by observations, unhappily too numerous, which amount in our country to more than 120 cases, that vaccinal syphilis exists, and that too much care cannot be taken in the choice of the subject from whom vaccine matter is obtained. This consideration has had a good deal to do with the success which has attended animal vaccine, a kind of vaccination which Lanoix and Chambon imported from Italy in 1856 to our country, and you may see in this hospital the success which has been obtained by this bovine vaccination, to-day adopted by all the countries in Europe as

ordinarily from three to four days may be prolonged even to the fifteenth or twentieth day. In the eruption one sometimes sees the pimples develop not simultaneously but progressively, the one after the other. Sometimes, also, there develop more pustules than there were pricks, and they are met with not only on the parts inoculated, but also over the whole body. These cases are especially seen in children affected with impetigo. This diffused eruption is unfortunate from the reaction which it occasions, and especially from the indelible cicatrices which it leaves behind. So in the case of children affected with rashes it is well to be prudent; if there is no epidemic of small-pox prevailing, one may put off vaccination; if there is fear of contagion, one need not make but one or two punctures.

In certain cases where inoculation is made very deep, no pimple is produced, and yet the individual may be preserved, as the late observation of René Blache has shown.(*a*)

[7] According to Oppert, the greater the number of raised pustules, the more complete the protection. He gives a table of observations which go to confirm this view.

[8] Vaccinal syphilis is to-day admitted without dispute by all observers, and Viennois in 1860 had collected more than sixty-seven observations. In France we may reckon at one hundred and twenty the number of cases of vaccinal syphilis recorded. In Italy the number amounts to three hundred. In England there have been but thirty-six instances. One may, moreover, on this subject consult the interesting statistics of Lotz, of Bâle. As for France, the number of persons infected, which as we have just mentioned amounts to one hundred and twenty, since attention was first called to vaccinal syphilis, might be augmented by more than twenty cases observed in the garrison at Algiers. Many hypotheses have been put forth to explain the introduction of syphilis by vaccine.

1. The hypothesis of direct inoculation by a lancet which has been in contact with chancrous pus, or by the contact of cloths soiled by pus of the same nature, the vaccinal abrasion taking the infection, or by possible inoculation with syphilitic blood.

This last hypothesis has been experimentally verified in Italy by Pellizari who in 1862 inoculated his pupil, Dr. Bargioni, with syphilis by employing blood taken from the cephalic vein of a woman of twenty-five years of age affected with constitutional syphilis. (*b*)

(*a*) Brusquet, Treatise on vaccine.—R. Blache, Efficacious vaccine without cutaneous manifestations, (Rev. mens. des malad. de l'enfance, Dec. 1883).

(*b*) Viennois, De la transmission de la syphilis par la vaccination (Arch. gén. de med., 1890, t. I, p. 640, t. II, p. 32 et 297).—Depaul, la Syphilis vaccinale (Acad. de med., decembre 1864 et fevrier 1865).—Lotz (de Bâle), Variole et vaccine, Bâle, 1880 p. 107.—Millard, Sur un cas de syphilis vaccinale (Union med, decembre 1865, No. 147, p. 466).

well as in America. For my part, I consider animal vaccine just as good as human vaccine, with this advantage, that there is certainty of exemption from the danger of syphilis.

But now that the experiments of Villemin have been strongly confirmed by the discovery of the *bacillus tuberculosis*, one may ask if in this way tuberculosis, so frequent in kine, may not be transmissible by vaccine.[1] So far we have had no proof of this fact, but it deserves to be discussed, and Warlomont, in his interesting work on vaccine, has devoted to the refutation of the possibility of inoculation of tuberculosis by animal vaccine, an interesting chapter, to which I refer you.

Whether it comes from the infant or from the animal, vaccine matter may be preserved a considerable time. At our Academy of Medicine, where the humanized lymph alone is used, the vaccine is kept only in capillary and glass tubes. In countries where they make exclusive use of animal vaccine, which is more difficult of preservation, they employ the scabs, or dried pustules reduced to powder or paste, and my pupil, Dr. Crando, of Nice, has shown the activity and the easy preservation of these vaccinal preparations.[2]

[1] Toussaint has made experiments respecting the possibility of inoculation of tuberculosis by vaccination.

With a vaccine pustule from a child in excellent health and the issue of robust parents, he inoculated a tuberculous cow; with the serum from pustules thus produced in the cow, he inoculated four hares and a hog; two of the hares, killed two months afterwards, showed all the lesions of tuberculosis.

As for the hog, it also became tuberculous. Vulpian in commenting on this communication, observes that it is with great reservation that one should accept Toussaint's results. Moreover, he remarks that it is not till after having produced these experiments a great number of times with positive results that one should admit the possibility of this inoculation. (*a*)

[Fearing the possibility of syphilitic contamination by using humanized lymph, physicians in America largely rely on animal or bovine matter, of which there are many excellent sources of supply in this country. The danger of communication of tuberculosis by animal vaccine is so slight as to be practically excluded. The bovine lymph is more severe in its effects than the humanized, producing often considerable constitutional reaction and a more or less diffused eruption. I am certain that I have seen septicæmic symptoms developed from impure quality of the lymph, for producers, eager to make the most of the occasion, are not always particular to charge their points only with the pure watery lymph which oozes from the papule of the heifer on the sixth or seventh day, but they by artificial means teaze out more vaccine matter and this is often contaminated with blood. It cannot be too much impressed on vaccinators, that whether humanized or animal vaccine be used, only he clear water that at the end of a week oozes from the papule is suitable, and that the admixture of pus or blood (and on this account the dried crusts are reprehensible) engenders danger from septicæmia.—TRANS.]

[2] Animal or human vaccine is preserved in different ways:

Tubes.—Here the vaccine is in a liquid form and preserved in capillary tubes. You break the tubes when you wish to use the vaccine.

Glass Plates.—You can collect and keep the vaccine between two flat pieces of glass, and it suffices to moisten these plates with saliva to have the vaccine fit for use.

(*a*) Toussaint, Tuberculous infection by the liquids of secretion and serosity of vaccine pustules. Comptes rendus de la séance du 8 Aug. 1881.)

Vaccine constitutes, with hygienic means of isolation, the only prophylactic treatment of variola; all others are illusory, and even dangerous.[3] The hygienic measures comprise an aggregate of means for the isolation of the patient—means especially necessary in our hospitals—and you see to-day the good effects of this isolation, thanks to the measures, incomplete it is true, which have been adopted by the Board of Public Charities, and the Prefecture of Police, which have put at our disposal certain isolated barracks and special vehicles for the transportation of small-pox patients.

We know at the present day almost with certainty the mode in which the contagion of small-pox is received into the system, namely by the respiratory passages,[4] in most cases, if we can rely on the experiments of Zulzer on animals. Brouardel had in fact previously shown us by examination of the air of small-pox wards, that this atmosphere was charged with numerous particles coming from desiccated variola pustules, and it is by the penetration of these particles into the respiratory passages that small-pox virus enters the blood. From these experiments, too, we may conclude that at the period of desiccation

Under these two forms the Academy of Medicine exports human vaccine, the tubes being much preferable to the glass plates.

Ivory points.—Instead of glass plates you may make use of ivory points about as thick as playing cards. These ivory points covered with vaccine, are passed back and forth over scarifications made in the skin, being previously moistened with a drop of warm water.

Animal vaccine is much more difficult of preservation; in Italy they make use of powdered crusts, kept in stoppered tubes, and vaccine paste.

[In this country animal vaccine comes to us from the dealers in this commodity chiefly in the form of ivory points, capillary tubes and scabs. The ivory points and the tubes are alone to be relied upon. The use of scabs is a filthy method, and does not seem to be wholly unattended with the risk of septicæmia. Personally, I like very much the lymph that is one remove from the heifer. A healthy child, known to be free from tuberculosis, syphilis, etc., of good parentage, is selected and vaccinated with matter from the cow. If the vaccine "takes," on the day that the watery lymph exudes from the papule, quills or ivory points are charged with this virus. Enough in that way to vaccinate thirty or forty persons can be obtained. This humanized matter is much milder than the animal vaccine, and seems to afford equal protection.—TRANS.]

[3] Théodore Ruth, of Enten, has instituted the use of vinegar as a prophylactic means in the treatment of small-pox; his method consists in the administration for fifteen days of a couple of tablespooufuls several times a day of vinegar, pure or with water. He also employs the aromatic vinegar which has besides acetic acid, camphor, garlic, lavender and nutmeg.

Roth has by this treatment in a hundred and six cases saved his small-pox patients. According to him, the origin of the name of aromatic vinegar (*quatre voleurs*) comes from the circumstance that at Madrid certain thieves (voleurs) were preserved from the epidemic by employing this vinegar. (*a*)

[4] Zulzer has studied in the monkey the modes of transmission of small-pox. According to his experiments, it results that the blood of the victims of small-pox is infectious, that the infection is not communicated through the digestive apparatus nor through the unbroken skin, but almost exclusively through the air of respiration. (*b*)

(*a*) Deutsch. Klin. No. 40, Oct. 5, 1872.

(*b*) Zulzer, On the etiology of variola. (Centrlbl., 1874, No. 6, 1884.)

of the eruption we should redouble our efforts to prevent the dissemination of contagion. Unhappily, this is the period of the disease when the medical attendant finds himself most impotent, and till persons convalescent from small-pox shall be restrained by stringent legal enactments, we shall find it hard to prevent them from going abroad and carrying with them wherever they go, the contagious elements of the disease.

As for the treatment proper of small-pox I shall have little to say; during the invasion we can in some cases favor determination of blood towards the skin by means of sudorifics, and especially the spirits of mindererus.[1] You will often have to combat the pain in the back, and the obstinate constipation, symptoms of the first stage. You can generally remedy the first by means of certain liniments (such as chloroform and spirits of turpentine of each one part, and liquid opodeldoc eight parts); the constipation can generally be overcome by mild purgatives. Next comes the eruption; if it is discrete, if moreover the subject has been vaccinated, no active interference will be required; not so if the eruption be confluent, and all your efforts will be required, especially if your patient be a young female, to prevent the eruption from following its course, and causing disfiguring cicatrices. For this end various means have been proposed.[2] Mercurial preparations, and in particular Napolitan ointment

[1] Delioux, of Savignac, employs in the first stage of small-pox and to favor eruption acetate of ammonia under the following formula:

1. Take of acetate of ammonia..... 15 parts.
peppermint water,
orange flower water,
balm water, each..... 30 parts.
syrup of ether,
syrup of maiden hair, each..... 30 parts.

M. Sig. A tablespoonful every hour.

[Instead of this formula the ordinary (℥ ij) dose of spirits of mindereras with a few drops of Hoffman's anodyne would answer the purpose equally as well.—TRANS.]

To sooth the pains in the back he rubs on the following liniment:

2. Take of chloroform,
spirits of turpentine, each..... 1 part.
opodeldoc..... 8 parts.

M. Fiat linimentum.

[2] Zimmermann was the first to call attention to the property of emplastrum de vigo cum mercurio, of arresting the evolution of the small-pox pustules, and his trials were repeated by Serres in 1835. Serres made use of mercurial plaster cut up in little strips with which he completely covered the face of the patient.

Briquet employs mercurial ointment mixed with starch in the following proportions:

℞ Mercurial ointment..... 2 parts.
Powdered starch..... 1 part.

M.

And with this ointment he makes a coating over the face two millimetres in thickness; this coating to be kept always unbroken.

Valleix thinks that this mixture is too thin, and adds equal parts of the ointment and

and the emplastrum de vigo have the curious property of preventing the development of these pustules, and this abortive power has been utilized by covering the face of the patient with masks made of these preparations. Aran and Delioux, of Savignac, have proposed to substitute for these ointments a collodion made with corrosive sublimate;[3] unfortunately, this collodion, however elastic it may be supposed to be, yields readily to the distension of the skin attending the eruption, and notwithstanding the real advantages of this method, I have had to abandon it and return to the primitive process of Zimmerman.

This is my mode of procedure: I apply thickly over the face the emplastrum *de vigo cum mercurio*, and over the whole I dust starch powder, and I take care, by new layers of pomade and starch, to fill in all the fissures and

starch. In order that these dressings may have an abortive action, they must be applied from the very first day of the eruption.

Revilliod, of Geneva, applies as abortive treatment of the pustules of the face, the following mixture:

Take of Napolitan ointment	5	parts.
soap	2½	"
Glycerine	1	"

Mix.

This mixture should be applied before the transformation of the pustules into vesicles.

Other topical agents have been proposed. Robert Graves made use of gutta percha.

Schwimmer, of Bonda Pesth, employs to prevent the cicatrices, the following mixture, with which he makes masks which are applied to the skin and members:

Take of phenic acid	1	part.
olive oil	8	parts.
Prepared chalk	12	parts.

Mix.

This mixture is employed in the form of a soft paste spread on strips of linen.

Zulzer proposes to treat locally the variolic pustules by a slight compression. Under the influence of this compression, he says, the pustules dry up with exceeding rapidity and the fever diminishes. (*a*)

[3] Delioux, of Savignac, employs a mercurial collodion with the following formula:

	GRMS.
Take of corrosive sublimate	0.30
Venice turpentine	1.50
collodion	30.00

M.

This collodion is applied by a camel's hair pencil all over the face (*b*)

(*a*) Zimmermann, Traité de l'expérience, t. II.—Serres; voir Gariel, Recherches sur quelques points de la variole (thèse de Paris, 1837).—Briquet, Mémoire sur l'emploi des topiques mercuriels (Arch. gén. de méd., 1838).—Valleix, Leçons cliniques (Un. med., 8 février 1853).—Révilliod, Variole. Traitment abortif des pustules de la face (Journ. de pharm. et de chim., avril 1873, p. 523).—Aran, Soc. méd. des. hôp., 25 septembre 1860.—Dujardin-Beaumetz, Soc. méd. des hôp., 1872.—Robert Graves, Bull. gén. de thér., 30 septembre 1852.—Schwimmer, Zur Therapie der Variola von Standpunkte der Micrococcus-Lehre (Deuts. Arch. f. Klin. Med., Bd. XXV, Heft 2 et 3, p. 178).—Zuelzer, Zur Pathogenese und Mecanischen therapie dar Variola (Bert. Klin. Woch., 1874, 22 juin, No. 25).

(*b*) Dilioux of Savignac, On the abortive treatment of small-pox pustules. (Bull. de Ther., 1845, t. xcviii.

broken places which may afterwards appear in this mask. You will in this way succeed when, be it understood, you have applied this protective mask at the very commencement of the eruption, in causing the pustules on the face to abort, save only those around the lips and mouth, where the incessant muscular movements will be likely to cause the mask to break. In certain cases you may employ the ectrotic method of Serres and Velpeau; a method which consists in opening each vesicle and cauterizing it with nitrate of silver. This process, which cannot be applied to confluent eruptions, ought to be reserved for the pustules which develop on certain points, and in particular on the cornea. As you well know, these pustules may, in their ulterior progress, perforate the cornea and destroy the eye. I have myself seen several instances of total blindness, due to the negligence of the attending physician, who did not interfere in time.

On the part of the mucous membranes, your attention ought especially to be directed to the buccal cavity, where the eruption causes profuse salivation and a painful swelling of the isthmus of the fauces; gargles of Vichy water and chlorate of potassium often relieve these symptoms.

The fever has abated, the general symptoms have improved, and we come to the period of suppuration in patients who have not been vaccinated. Then there is reawakening of the fever, and the grave symptoms appear, in particular the swelling of the hands and the feet. It is to this suppurative period that the efforts of therapeutists have especially been directed. It constitutes the most critical stage of the disease, and it is at this period, more than at any other time, that patients succumb.

Earnest endeavors have, above all, been made to avoid the putrid infection which results from incessant contact of the denuded derm with the pus which bathes it on all sides, and various antiseptic preparations have been used. Chauffard[1] thought that he had found in phenic acid an abortive and curative treatment for confluent variola; Guipon, on the same principle, proposed perchloride of iron;[2] and Jenna, of Buenos Ayres, spirits of turpentine.[3] All these medications have been abandoned, and the profession has returned to local treatment, and in particular to baths and lotions of disinfectant sub-

[1] Chauffard has employed crystallized carbolic acid in the treatment of the secondary fever of suppuration of grave confluent small-pox, and he has seen, under the influence of this treatment, the febrile symptoms diminish as well as the suppuration. He administers daily 15 grains of crystallized phenic acid in a four ounce mucilaginous potion.

Audhoui, who has employed the same medication, made use of the following potion:

℞	Acid phenic.....	gr. xv.
	Mucilage acaciæ.....	℥ iv.
	Syrup of quinine.....	℥ j.

M. Sig.—A tablespoonful every two hours.

[2] Guipon, of Laon, employs in the treatment of small-pox the perchloride of iron (tincture ferri chloridi), and the daily doses have varied between 12 gtt., the minimum dose, and 40 gtt., the maximum dose. This iron preparation acts after the manner of the abortives in small-pox.

There is attenuation and suppression of the secondary fever and more feeble develop-

stances,[4] which render us great service, and which I earnestly recommend. These baths should be of a temperature of 95° F., and you should add to the water of the bath chloral solutions, solutions of thymol or antiseptic vinegar, and in particular that of Pennés. Their duration should be from half to three-quarters of an hour, and you should have care during the bath to give some stimulant, as rum punch.

I have said nothing of cold baths,[5] which have been employed in the treatment of small-pox by König, Winternitz, and by Clement, of Lyons. These

ment of pustules. At the same time the perchloride of iron does not diminish the mortality of small-pox.(*a*)

[3] Jenna counsels the use of turpentine in hemorrhagic small-pox. He gives it in potion in the dose of 1½ drachms a day.(*b*)

[4] Disinfectant baths and lotions are prepared in numerous ways. Delioux, of Savignac, employs baths of hypochlorites, which consist of water containing in solution between three and four ounces of hypochlorite of sodium for a full bath, but he prefers tar water baths (about three gallons of tar water to a full bath). You make the chloral bath by adding to the water of the bath three ounces of chloral.

The antiseptic vinegar of Pennés is made as follows:

℞	Acid salicylic	3 parts.
	Acetate of aluminum	3 parts.
	Concentrated tincture of eucalyptus glob.,	10 parts.
	" " of vervain	90 parts.
	" " of lavender	10 parts.
	" " of benzoin	1 part.
	Acetic acid of 8 degrees	10 parts.

M. For a full bath add about three ounces of the above solution.(*c*)

[5] Rhazes, whose veritable name was Abou Bekr Mohammed ben Zakarya Errazy, the last word of which, Errazy, means native of Rey, whence comes Rhazes, was the first to employ cold baths in small-pox.

The friar Rovida treated small-pox and eruptive fevers by ice. He made his patients drink a quart or more a day of ice water. Currie also made use of cold affusions and iced drinks in small-pox. Bohn says that the cold bath renders the variolic eruption more discreet. Hebra also advised cold baths in small-pox.

König employs cold baths in the treatment of small-pox; they are renewed every hour, and even oftener when the fever is intense. This refrigerant method is applied from the onset of the disease. The temperature of the water, till the appearance of the pustules, ought to be about 43°F., but as soon as the pustules appear it must be raised to 50°. König asserts that by this method he suppresses the period of suppuration, and mitigates the intensity of the disease.

Winternitz has also derived great advantages from this method. Wientraub, however, maintains that the refrigerant applications have no advantage, and that they are not without danger.

Desnos and Huchard have experimented with the treatment of cold baths in small-pox. According to them, the cold water does not act in a refrigerant manner in coherent, con-

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(*a*) Guipon, Abortive properties of perchloride of iron in small-pox.

(*b*) Jenna, of Buenos Ayres, Anales des circulo-medico Argentino.

(*c*) Pennés vinaigre antiseptique, Bull. le Ther. t. xcii., p. 426.

cold baths have quite another object, that of combating the hyperpyrexia; and although this practice goes back to Rhazes, it does not seem to have commended itself by its results, and for my part I have no experience with it.

To these local measures we must add the use of disinfectant powders, such as compounds of salicylic acid and starch or talc, as employed by Baudon,[6] and painting with tincture of iodine, as practiced by Boinet, Delioux, of Savignac, and Pioch.[7] These dressings, joined to the baths and disinfectant lotions, enable you to rid the patient of the sickening odor which he exhales.

fluent, and hemorrhagic variola; it only possesses a sedative action to the nervous system in the stages of invasion and eruption.

Clément, of Lyons, has also employed the refrigerant method in variola. He gives cold baths of 77° and 83°F., and follows the same practice as in the application of the method of Brand. He does not give these baths in the period of eruption, and only applies them at the moment of suppurative fever, and is guided in their administration by the thermic curve.(*a*)

[6] Baudon employs the salicylate of soda internally and externally in the treatment of small-pox; externally he makes use of an ointment having the following formula:

	Grammes.
Take of salicylate of soda	4.
Cold cream.....	100.

M.

And a powder with the following formula:

	Grammes.
Take of Salicylic acid.....	6.
Talc.....	100.

M.

He first anoints the parts with the first preparation, and powders them over with the second.(*b*)

[7] It was Boinet who first recommended tincture of iodine for the local treatment of the small-pox pustule. Delioux, of Savignac, also advises the use of iodine, and this is his manner of procedure. He does not employ tinct. of iodine until at the period of suppuration, and for the pustules of the trunk and members. To avoid an intense reaction, he makes his applications at several intervals, first on a lower limb, then on the arm, and, lastly, on the different regions of the trunk, and he keeps repeating these applications until he has obtained the drying up and shrivelling of the pustules. These applications hasten cicatrization, oppose putrid absorption, and favor the obliteration of cicatrices. He gives at the same time full chlorinated tar baths.

Pioch employs the following mixture:

Glycerine.....	3 parts.
Tinct. iodine.....	1 part.

A mixture which he applies with a camel's hair pencil every four hours.(*c*)

(*a*) König, Sur le traitement de la variole [Corresp. méd. de Boeme, No. 12, 1874.]—Weintraub, De l'emploi de l'eau froide dans la variole [Rev. méd. chir. de Vienne, 30 septembre 1874]. Clément, Du traitement de la variole par les bains froids [Lyon méd., février, 1877, p. 89, 153 et 225].—Hebra, Traité des maladies de la peau, t. Ier, p. 267.—Desnos et Huchard, art. Variole, in Nouv. Dici. de méd. et de chir.—Labadie-Lagrave, Du froid en thérapeutique [thèse d'agregation, 1878, p. 143].

(*b*) Baudon, Treatment of small-pox by salicylate of soda. (Bull. gen. de ther., 1881, t. ci., p. 448.)

(*c*) Delious, of Savignac, New observations upon the abortive treatment of small-pox pustules. Bull. de ther., t. LXXIX, p. 97.—Pioch on the treatment of small-pox by painting with iodized glycerine.

But there is a danger still more formidable than that from purulent absorption. I refer to the cardiac complications.[1] Disnos, Huchard, and Bronardel have given us a faithful picture of the variolic endopericarditis and myocarditis, and have indicated the cause of those sudden deaths which in old people attend the stage of suppuration. It is these troubles in the myocardium which explain the feeble pulse and the anæmic delirium which are also noted in this period, symptoms which we need to combat by tonics and stimulants, especially opium and ether.

Our colleague, Du Castel, has shown us the advantages which we may derive from this ether-opium treatment, and I have myself obtained good results from it in the care of small-pox patients in this hospital.[2] You can employ the ether in subcutaneous injections, being careful to insert them as deeply as possible; as for opium, you can give from two to four grains a day in divided doses of the extract. Or, you may adopt the mode of administration recommended by Constantin Paul for the delirium of febrile diseases, and give every hour or two ten drops of laudanum. To these means you should add alcohol in all its forms; also coffee, caffein, the preparations of cinchona, in a word, all the agents of the tonic medication.

The period of desiccation has arrived, and to hasten the falling of the

[1] The morbid determinations which affect the heart under the influence of small-pox infection, have been studied, especially the last few years, by Desnos and Huchard. These complications are wanting in discrete small-pox with few pustulations, they are more frequent in the coherent form, which Desnos includes in the group of discrete varieties, and become constant in the confluent variety. They are characterized by inflammatory lesions of the myocardium, endocardium, and pericardium.

Variolous endocarditis appears especially in discrete small-pox, where it takes on especially the vegetating form. Myocarditis, on the contrary, is seen in the confluent coherent variolas.

Brouardel, who has also studied the vascular lesions in small-pox, has shown that there is produced a sanguineous effusion in the pericardium on the posterior face of the auricle; he has, moreover, observed lesions affecting the aorta.

These alterations of the heart reveal themselves by a *bruit de souffle*, which is soft, profound, diffuse, and transitory. There is often a reduplication of the second sound of the heart, the pulse becomes oscillatory, polycrotous; in fine, there is delirium, due to cerebral anæmia. Against this condition Huchard counsels caffeine to stimulate the heart's action.(*a*)

[2] Du Castel employs the following treatment in small-pox. He practices morning and evening a subcutaneous injection of a syringeful of ether. Morning and evening from one to two grains of extract of opium are given. The more intense the delirium the larger the dose of opium. Finally teaspoonful doses are given of a potion containing in each drachm 20 drops of tincture of perchloride of iron.

Pecholier, who has employed this method, has obtained favorable results from it,(*b*)

(*a*) Desnos et Huchard, Des complications cardiaques de la variole et notament de la myocardite varioleuse [Un. méd., 1874].—Desnos, Considérations sur le diagnostic, le pronostic et le traitement des principales formes de la variole [Soc. méd. des hôp., 1870]. Notes sur les complications cardiaques de la variole et leur traitement [Bull. de thér., t. LXXXI, 385].—Brouardel, Etude sur la variole. Lésions vasculaires [cœur et aorte] [Arch. gén de méd., décembre 1874].

(*b*) Du Castel, Traitement de la variole par la medication éthérée-opiacée [Bull. gén de ther., 1884, t. CI, p. 241].—Pécholier, Sur un cas de variole traité par la médication éthérée-opiacée [Bull. de ther., 1883].

scabs, you should use soap baths and inunctions with vaseline, that pomade of mineral origin which renders us such service every day.

It is at this period that vast purulent collections form, and your attention should be called to this fact, for these abscesses ought to be opened early. There will also be an indication to endeavor by a substantial dietary regime to repair the profound alterations which the disease has left behind it.

Such are the principal therapeutic rules applicable to the treatment of small-pox, and I pass now to the treatment of scarlet fever.

Scarlatina, unlike variola, has no prophylactic treatment, for nearly all attempts to prevent this disease by inoculation have failed.[1]

Impotent to combat the invasion of the disease by vaccination, some physicians have pretended to be able to prevent it by prophylactic medication, and taking as their basis this strange notion that since the ingestion of belladonna gives rise to a scarlatinous eruption, it must therefore cure scarlatina, and following in the wake of Hahnemann, they have proclaimed belladonna as both curative and prophylatic.[2] To-day this question is absolutely settled, and all are agreed in regarding this pretension of the specificity of belladonna as illusory.

Moreover, I regard scarlatina as the least contagious of the eruptive fevers

[1] Inoculation for scarlatina was attempted by Miguel, Mandl, Petit-Radel, and Most. Miguel made use of blood taken from the scarlatinous patches, and he saw produced around the punctures a red circle, which disappeared the seventh day. These subjects of inoculation are rebellious to scarlatina. Leroy, of Etiolles, witnessed the same results after inoculation with blood from a scarlet fever patient. Mandl has advised inoculation with the product of the miliary vesicles which accompany scarlatina. Darwin practiced inoculation with the liquids furnished by the ulcerations of the pharynx. As for Most, he proposes the inoculation of blood taken from swine affected with a sort of quinsy, accompanied by an erysipelatous eruption.(*a*)

[2] Hahnemann was the first to prescribe belladonna in homœopathic doses as a prophylaxis in scarlatina. He based himself on this fact, that belladonna in large doses determines an eruption analogous to that of scarlet fever. This prophylactic action has been tested in Germany, England, and France, by numerous experimenters, as will be seen by consulting the bibliographical references given below. Notwithstanding the favorable results claimed by some of these authorities, everybody to-day is agreed in admitting this claim of Hahnemann as to the protective power of belladonna in scarlet fever to be a delusion and an absurdity.(*b*)

(*a*) Miguel d'Amboise, Bull. de l'Acad. de Med., 9th September, 1834. Leroy d'Etiolles. A study of the preventive treatment of scarlatina by belladonna and by inoculation (Gaz. Hebd., 1878), Sanné. Art. Scarlatina in Dict. Encyclop. des Sc. Med.

(*b*) Walburton-Begbie, British and foreign medico-chir. review, janvier, 1855.—Berndt, Bestatigende Erfahrungen über die Schutzhraff der Belladonna, etc., Hufel. Journ., t. LI, st. II, p. 5, 1829.—Wolff, Die Schutzkraft der Belladonna geprüft in der letzten Scharlach-Epidemie, Horn. Arch., t. II, p. 490, 1822.—Puchelt, Bella. als Schutzm. gegen das Scharlach, geweirdigt heidelb., Klin. Ann., t. V, 242, 1885.—Hufland, Die Schutzkraft der Belladonna gegen das Scharl., neue, etc., Hufel. Journ., t. LXI, st. 5. p. 3, et Berlin, 1826.—Wildberg Einige wort über das Scharlach fieber und den gebracnh der Belladonna als Schutzmittel gegen dasselbe, Leipzig, 1826 —Maclure, Remarks on the extract of Belladonna given as Prophylactic against the contagion of Scarlet fever, in Loud. Med. Gaz., t. XXI, p. 363, 1838.—Morris, Experiments made to determine the protective power of Belladonna in Scarlatina, Amer. Journ., 2e série, t. XXXIII, p. 334, 1857.—Shevenart, De l'emploi prophylactique de la belladone dans la scarlatine épidémique, 1843.—Féron, Note sur l'emploi de la belladone dans la scarlatine, Journ. des conn. med. chir., 1859, t. II, p. 63.—Ibrelisle, Experiences faites avec la belladone employée comme preservatif de la scarlatine, Bull. de la soc. med. d'em., 1823, p. 204.

(it is so, at any rate, in Paris), and the small number of scarlet fever patients that we receive into our wards have seldom or never given the disease to other patients. You know, moreover, how different is the mortality of scarlet fever according to the country in which it prevails; and while in England epidemics of this disease are characterized by their gravity, in France, and particularly in Paris, this affection is almost always isolated, and is dangerous principally by the complications which may arise during convalescence. I shall then be very brief concerning the therapeutic indications which the question of treatment suggests.

In the period of invasion, which is generally very short, you may employ sudorific ptisans or teas, liquor ammoniæ acetatis, and especially carbonate of ammonia, which has been vaunted by Peart, by Wilkenson, by Strahl, and by Ricken, of Brussels.

During the period of eruption the indication is to diminish the dryness of the skin, and facilitate desquamation by inunctions made with fatty substances.[1] Some, as West, employ lard, others bacon fat. Scoutetten recommends sweet oil. I am in the habit of using vaseline, which does not oxidize or become rancid. You will do well, then, at the period of desquamation, to practice frequent inunctions of vaseline over the whole body, both to hasten the fall of the epidermic scales, and to protect the skin from exterior agents. This state of the skin is, as you know, one of the sources of danger during convalescence, by reason of the renal complications which may arise; you ought then to insist upon the greatest precaution during the period of convalescence, and keep the patient for six weeks in his room, and generally one month in bed, and never allow him to go abroad till there shall have been complete renewal of the epidermis. You can aid this process of reparation by warm baths while the epidermis is scaling off.

I shall not speak here of the pharyngeal complications of scarlet fever; you are familiar with the morbid determinations of this disease to the throat, whether it consist in a pultaceous angina or in a veritable diphtheria, according to Archambault's views, who unites scarlatina and diphtheria in the same description; the same treatment is proper for both, and I need not here repeat what I told you when on the subject of diphtheritic sore throat. But there is another complication which ought to occupy us a few minutes. I refer to the

[1] West recommends during the eruption to anoint the whole surface of the body with lard. Eberth, in 1851, put in use another popular practice, which consisted in making inunctions at all periods of the disease with bacon fat. Scoutetten made use of oil, slightly warmed, and this was his manner of procedure: By means of a piece of flannel wet in this oil, all parts of the body were rubbed for a few minutes, without excepting the face and feet; then the frictions being terminated, the patient was put to bed and kept there for two hours. the next day he was given a bath, with temperature about 90°F., of one hour's duration; being taken from the bath, he was put to bed, and submitted to another rubbing with oil. This treatment is exclusively put in practice when the patient is about to leave his room, and in order to free the skin of the pellicles which cover it.(*a*)

(*a*) West, On the Diseases of Children. London, 1880.—Scoutetten, On Measles and Scarlatina; mistakes and misjudgments in the treatment of scarlet fever. Metz, 1868.

nervous manifestations which accompany certain scarlatinous eruptions, and which are tributary to a treatment to which Trousseau has devoted one of the finest passages of his clinical lectures—I refer to the treatment by cold affusions. Recommended by Currie,[1] this method is become to-day classical, and in the practice of certain physicians, particularly the Germans, it is employed indiscriminately in all cases. Here, also, as in all the applications of the refrigerant method, it is rather against the manifestations on the part of the nervous system, than the elevation of temperature, that these cold affusions can render

[1] Currie was the first to employ affusions and lotions of cold water in the treatment of scarlet fever. He treated his two sons, affected with malignant scarlet fever, and from 1800 to 1804 more than 150 patients in the following manner: The patient was stripped naked and put into an empty bath tub, and four or five pailfuls of cold water were poured upon him. Since then this treatment has been very much employed in England as in France. Reed and Murray in 1803, Bruce in 1812, in England; Caron, of Annecy, and especially Trousseau, have very much vaunted affusions of cold water. Martin, of Nosen; Nasse, of Bielsfield; Besle, of Berlin, have also employed in Germany cold lotions. Moreover, since the application of the refrigerant method to the treatment of febrile affections, cold affusions, and especially cold baths, have been very much employed in the treatment of scarlet fever. Thus it is that Liebermeister affirms that he has employed cold baths with success in the treatment of scarlet fever, that Cohn has maintained that cold affusions constitute a prophylactic treatment of this affection, that Pelz has employed these baths to bring down the temperature, without, nevertheless, deriving the same advantages as in other febrile affections.

Eddison applies cold water as a general method in the treatment of scarlet fever. The temperature of the bath ought to be about 98°F. at the commencement, and it should be gradually cooled down to 72°F. The duration of the bath should be according to circumstances. He asks if it would not even be well to leave the patient several hours in the bath, if not all day.

John Taylor has studied the action of the wet pack in scarlatina. It is, in his estimation, one of the best therapeutic means to arouse and promote the cutaneous elimination, interrupted in scarlatinous patients. The application of the wet pack should be renewed from two to four times during the twenty-four hours, each application lasting from half an hour to an hour. Taylor's method is as follows: A night gown, open in front, is taken and dipped in a basin of warm water, which may be pure, or medicated with a little mustard or tincture of pimento. This is well wrung out and wrapped around the patient, and the feet are enveloped in a towel, wrung out of warm water; then the patient is covered with three woolen blankets, and over the whole a thick coverlet is spread.

Fraser employed, during an epidemic of scarlet fever, warm baths gradually cooled, or cold baths, guiding himself by the rectal temperature and the state of the nervous system. He gave one to six baths during the twenty-four hours to his patients. Under the influence of these baths he always observed an amelioration.(*a*)

(*a*) Currie, Medical reports on the effects of water, cold and warm, as a remedy of fever and other diseases, Liverpool, 1798 et 1804; extr. dans Biblioth. britann., t. XVII et XXX, par Odier, idem, 5e edit., 2 vol., 1814.—Reid et Murray, Scarlatine traitée par les affusions froides, Med. and Phys. Journ., t. XI, p. 27, 1803.—Bruce, Scarlatine traitée par les affusions froides, Med. chir. Trans., t. IX, p. 275, 1812.—Trousseau, Des affusions froides dans le traitement des accidents nerveux de la Scarlatine et du délire fébrile dans cette maladie, Un. méd., 1857, p. 411, Clin méd. de l'Hôtel-Dieu, 5e édit., 1877.—Martin, de Nosen, Scarlatine traitée par les affusions froides, Bull. des sc. méd. de Ferussac, t. X, p. 349, 1814.—Liebermeister, Handbuck der Pathologie und Therapie des Fiebers, Leipzig, 1875.—Cohn, Hydrotherapie des Scarlach. Berlin, 1868.—Pilz, Mittheilungen über Behandlung des Scarlachfiebers mit, Bædern Jahrb. fur Kinderh., t. III, p. 253.—Eddison, Note on the treatment of Scarlet fever by the external application of cold water with two cases, the Lancet, 4 et 18 septembre, 1875, p. 340 et 414.—Taylor, the wet pack in Scarlatina, the Lancet, 14 november, 1875, p. 692.—Fraser, the Bath treatment in Scarlet fever, the Pract., vol. XXVII, no. 1, p. 34, 1881.

service; and you will not need to put this mode of treatment in practice unless there shall supervene at the commencement of the period of eruption, ataxo-adynamic phenomena of great gravity. For my part I have never found, since I began the practice of medicine, cases of scarlet fever sufficiently grave and menacing to require such treatment. Scarlatinal dropsy does not offer any special therapeutic indication apart from that which I enunciated while on the subject of the treatment of albuminuria; and without dwelling longer on antiseptic medications[1] proposed for scarlet fever, I pass now to the treatment of measles.

This very contagious, but little dangerous malady, (unless by the complications which may arise), does not present any very special therapeutic indications, and treatment should be directed rather to the morbid manifestations determined by the disease than to the disease itself. I shall then say very little on this subject, and you will have to apply here only the general hygienic and therapeutic measures proper to all the eruptive fevers, and which consist in warm sudorific ptisans, as well as the greatest care to prevent all exposure to chills, and in attention to the thoracic organs, so that you can interfere in time if any pulmonary complications manifest themselves.

I have now finished the therapeutic indications which I desired to give you for the management of the eruptive fevers.

These lectures complete the course on which I had determined; and incomplete as they are, they will furnish you data of a practical kind concerning the principal diseases which, in our country at least, you will be oftenest called upon to treat.

[1] Samson has proposed to treat scarlatina by antiseptics. He administers the sulphocarbolate of soda in the dose of a gramme and a half. Brackenbridge has adopted this method of treatment, and has derived good results; he has even employed it as a prophylactic means, and, according to him, this medicament prevents infection.(*a*)

(*a*) Brackenbridge, On the prevention and treatment of scarlatina. Med. Times and Gaz., 1875, t. II p. 92.

APPENDIX TO THE CHAPTER ON MEDICAL ELECTRICITY.

—o—

BY DR. C. L. DANA.

—o—

Since writing the chapter upon Medical Electricity, good absolute galvanometers have become attainable. They constitute an extremely important addition to the armamentarium of the electro-therapeutist. The unit of measurement is the milleampere as suggested by De Watteville. The dose of galvanism, measured in these units, ranges from one to 40 or 50 milleamperes, a current of moderate strength being about ten milliamperes. Vertical galvanometers are probably the best. Hirschmann, of Berlin, John S. Barrett, and Waite & Bartlett, of this city, make trustworthy instruments. The price is from $15.00 to $25.00.

Additional accuracy in recording and dosing electricity is gained by indicating by formula the frequency, and length of time that the current is passed, and the size of the electrode. A prescription for the administration of galvanism, for example, can be written thus: ℞. Galvanic current, 10 m. a. $\frac{5}{15}$ cm. daily; Polar; Labile; which means that a galvanic current of ten milleamperes' strength is to be given daily for five minutes with an electrode 15 centimeters square, by the polar method, the active pole being rubbed over the affected part (labile).

New York, June, 1885.

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