Formulary for the preparation and employment of several new remedies : such as morphine, codeine ... / translated from the eighth edition of the formulaire of M. Magendie, with an appendix by Charles Wilson Gregory.

FORMULARY

FOR THE

PREPARATION AND EMPLOYMENT

OF SEVERAL

NEW REMEDIES;

SUCH AS

MORPHINE, CODEINE, PRUSSIC ACID, STRYCHNINE, VERATRINE,
HYDROCYANIC ETHER, SULPHATE OF QUININE,
CINCHONINE, EMETINE, SALICINE, BROMINE, IODINE,
IODURET OF MERCURY, CYANURET OF POTASSIUM,
SALTS OF GOLD AND PLATINA, CHLORURETS OF LIME AND SODA,
PHOSPHORUS, LACTIC ACID,
ETC., ETC.

TRANSLATED FROM THE EIGHTH EDITION

OF

THE FORMULAIRE OF M. MAGENDIE.

WITH

AN APPENDIX,

BY

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MDCCCXXXV.

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TRANSLATOR'S PREFACE.

ALTHOUGH we are not sanguine enough to aver with M. Magendie, that all prejudice against the new remedies has disappeared, it is quite certain that their efficacy is much less a matter of dispute now than it formerly was. The commencement of M. Magendie's Preface to his last edition resembles the exultation of a warrior who, after a tedious conflict, beholds the utter discomfiture of his enemies. But prejudice has too firm a hold on the stubborn soil of error to yield unresistingly or at once. It is to be feared that the bigotry of some practitioners, and the apathy of others, will still continue to prevent the general adoption of these valuable medicaments; but they will ultimately be appreciated as they deserve.

The circumscribed use, however, of these remedies, detracts nothing from the praise of the man, who with untiring vigour has prosecuted his labours and asserted the justice of his views respecting them, until every enlightened practitioner has acknowledged their importance. Encomium, here, is superfluous; the ills of suffering humanity, which he has been instrumental in subduing, are at once his praise and reward.

The Translator has endeavoured to perform his task with fidelity, and to give the ideas of the Author in his own words, as often as the different idioms would permit; therefore he has not attempted to remodel every sentence, or to paraphrase those passages which may be designated by some critics as prolix and diffuse. It may also be added, that the present is an entire translation, and whatever its positive defects may be, undiluted by cursory disquisitions.

As the English weights and measures do not exactly correspond with the French terms, it has been deemed ad-

visable to retain the latter, a table being given at the end of the volume, by which they may be easily reduced to their equivalents in English.

The expressions relative to the doses, as cuillerée à bouche, and cuillerée à café are, to ensure accuracy in the administration of these powerful remedies, denominated the former five *gros* or ʃ℥vss, and the latter five *grammes* or ʃ℥i ℥20. These are the only deviations from the text.

As Kreosote, which M. Magendie has entirely omitted, promises to become a useful therapeutical agent, its preparation, qualities, &c., are briefly described in the Appendix: references to various publications and memoirs which are not alluded to in the body of the work, are also subjoined.

C. W. Gregory.

Edinburgh, Aug. 3d, 1835.

THE AUTHOR'S PREFACE

TO THE

SEVENTH EDITION.

NOTWITHSTANDING the hostility of the physicians of the seventeenth century, and the famous act of parliament which proscribed emetic tartar,—in spite even of the spiritual sarcasms of Guy-Patin, the utility of antimonial preparations has been a long time acknowledged: for once prejudice has succumbed to evidence.

It will be the same, I trust, with the new substances which chemistry and physiology have eulogized as valuable remedies; the repugnance still manifested towards them by many enlightened practitioners will soon disappear before the results of an experience which is daily investing them with fresh interest.

Among the causes which have retarded the progress of the Materia Medica, must be reckoned the impossibility of isolating, by chemical analysis, the different elements of which a medicine is composed. But although analysis has accomplished this, the belief that has arisen, and is still entertained by some, that medicines act altogether differently on man to what they do on animals, has prevented the recognition of the properties of their ultimate principles. Still nothing can be more erroneous than this belief. A varied experience of twenty years, both in my laboratory and at the bed-side of the patient, enables me to affirm that MEDICINES AND POISONS ACT IN THE SAME WAY UPON MAN AS UPON ANIMALS *. Such is my confidence in this respect, that I should not hesitate to take those substances myself which I have observed to be innocuous to animals. But I recommend no one to make the experiment inversely.

By pursuing this course, I have been enabled to deter-

* I refer, of course, to those animals which approach nearest to man in their organization.

mine the physiological properties and medicinal virtues of most of the substances brought together in this Formulary.

These substances, which are already sufficiently numerous, act in a small dose; they are not associated with any principle which can mask or hinder their action; their effects are decisive, and cannot be misunderstood, for they have been carefully studied on animals and on man, both in health and disease; their chemical properties, and the mode of obtaining them, are well known, so that there is no fear of their varying in strength, or in their manner of action; finally, each of them constitutes a medicine in its simplest and most energetic state.

Time alone can decide upon the advantages or disadvantages of these new remedies; but whatever be the result, I thought it most expedient to acquaint practitioners with the mode of preparing them without resorting to general treatises on chemistry and pharmacy. I have, in like manner, omitted nothing that will enable medical men to submit these medicines to personal experience, the only means, in general, of realizing success.

I shall receive with lively gratitude, any critical or other remarks, relative to the substances which are contained in this work. I offer my thanks, beforehand, to those of my brethren who may be kind enough to address them to me, and I shall hasten to turn them to the advantage of science, by inserting them in a future edition.

This edition differs from its predecessors, by a great number of additions and changes, which the daily progression of medical and pharmaceutical chemistry have induced.

I especially refer to iodine, bromine, and chlorine, a singular family of bodies, which, both alone and in a state of combination, exercise an undoubted influence upon nutrition and the accidental secretions, and hence seem destined to occupy a distinguished place among therapeutical agents. It is quite certain, that by a wise and judicious employment of them, many diseases may be subdued which have been hitherto considered incurable.

THE AUTHOR'S PREFACE

TO THE

EIGHTH EDITION.

The fate of the remedies inserted in the first editions of this work is henceforth decided; old habits, usages, and antipathies have all been vanquished by the power of truth. Who would now give cinchona bark in powder or in extract instead of sulphate of quinine or salicine? What physician of any talent or experience would hesitate to prefer morphine to all the ancient preparations of opium,—to recognise strychnine as the most powerful stimulant of the nervous system, and iodine as the best remedy for lesions of nutrition.

But success in the sciences should always instigate to higher achievements: thus while my labours are receiving the approbation of my contemporaries, and the sanction of Time,—that capricious despot, so tenacious of his favours, I must not allow my zeal to slacken.

Nothing is more difficult than to form an unerring judgment of a medicine. There are such wide differences in its action, according to the diseases themselves, and even to the various stages of the same disease, that the properties of a therapeutical agent cannot be too closely studied. Profiting by my situation at the Hôtel Dieu, where the most severe cases occur in rapid succession, I neglect no opportunity of verifying my former observations. The results of present and past experience I have mostly found to agree, but sometimes they diverge not a little: these differences I have not failed to mention.

Moreover, not a year passes but chemistry discovers some new body which wields a powerful influence on the animal system. My scientific and social connexions afford me opportunities of scrutinizing these compounds, and if I perceive any likelihood of their becoming useful medi-

cines, I administer them to the patients: I have thus often obtained success, which I might probably have looked for in vain from usual and well-known remedies.

Many substances of this kind will be found in the present edition; as *codeine*, discovered by M. Robiquet; *prussic ether*, by M. Pelouse; *narceine*, by M. Pelletier; *meconine*, by M. Couerbe; *lactic acid*, *mannite*, &c.

I have devoted especial attention to the elementary composition of the new remedies, and I have described their formulæ as accurately as possible. The time appears to me to have arrived for investigating the connexion between the number, proportion, and nature of their elements, and their influence upon man in health and disease. This subject I recommend to the earnest consideration of my brethren.

December, 1834.

FORMULARY,

ETC.

RESIN OF NUX VOMICA.

In the year 1809, I submitted to the first class of the French Institute, an account of a series of experiments which had led to an unexpected result, viz. that an entire family of plants (the Strychni-Amari) possessed the singular property of strongly exciting the spinal marrow, without affecting, except indirectly, the functions of the brain. In concluding the paper, I announced that such a result might be applied with advantage to the treatment of diseases. This assertion, merely conjectural at the time, has since been confirmed by numerous trials at the bedside of the patient. Some years ago, Dr. Fouquier published several cases in which paralysis was cured by nux vomica; I had myself obtained similar success before I became acquainted with those facts, and I see with pleasure that I have been anticipated by a physician so generally esteemed. This circumstance, however, has not tended to abate my diligence, and the most successful results have followed the employment of the alcoholic extract of nux vomica, not only in paralysis, but in many other kinds of debility of the system, general as well as local.

PREPARATION OF THE ALCOHOLIC EXTRACT OF NUX VOMICA.

Treat a determinate quantity of rasped nux vomica with alcohol at 40°, and at the lowest possible temperature, let it be renewed until nothing further is taken up from the rasp-

ings; then evaporate gently to the consistence of an extract. Alcohol of much less strength may be employed, but in this case, a substance less active is obtained, from the alcohol dissolving a considerable quantity of gummy matter.

Considering the importance and the energy of this preparation, it is highly expedient, that one invariable mode should be employed by chemists in preparing it, that the physician may not be liable to err in prescribing the remedy. The most suitable alcohol for use, because it is most generally diffused, is that which reaches 36° by the areometer of Cartier.

DRY ALCOHOLIC EXTRACT OF NUX VOMICA.

Take the alcoholic tincture, impregnated to the greatest possible degree with nux vomica, made with alcohol at 36°. Filter and evaporate to a consistence fit for pills, and let it be kept in a dry place, on account of its absorbing the humidity of the atmosphere.

This preparation is exhibited, as we shall presently observe, in tincture and in pills; when the latter form is preferred, the precaution should be used of rolling the pills in powder of lycopodium, which, as is well known, does not absorb moisture, and thereby defends the medicine from the humidity of the atmosphere.

PHYSIOLOGICAL PROPERTIES.

One grain of this extract, absorbed into any part of the body or taken into the stomach with the food, will destroy a large dog in a very short time, by producing paroxysms of tetanus, which by their continuance obstruct respiration, so as to produce complete asphyxia and death.

When the dose is much stronger, the animal appears to perish from the direct action of the substance on the nervous system, as M. Segalas has lately proved. Dr. Defermon has described a species of contraction of the spleen in those animals which have been poisoned by the alcoholic extract of nux vomica; I have myself observed the same phenomenon. When we touch an animal submitted to the action of this substance, a sensation similar to a strong

electric shock is produced, and the effect is renewed at every contact.

The division of the spinal marrow behind the occiput, and even complete decollation, do not prevent the usual effects from taking place, and even continuing for some time. This property distinguishes the action of strychnos from that of the majority of exciting substances at present known. The excitement of the spinal marrow is transmitted to the muscles by the anterior nerves exclusively; the posterior nerves are entirely destitute of this property*.

On dissection, no lesion is discovered which can indicate the cause of death.

Experiments made in Java, by Dr. Horsfield, with the fresh juice of the *upas tieuté* tend to confirm what we have here stated†.

ACTION OF THE ALCOHOLIC EXTRACT OF NUX VOMICA ON THE HEALTHY INDIVIDUAL.

The action of the alcoholic extract of nux vomica on a person in health is identical with that above described, and if the dose be sufficiently large, death speedily follows with the same symptoms. In like manner there is no obvious lesion of structure, traces of the asphyxia which produced or accompanied death being only observable: I am convinced of this from the morbid appearances in the body of a woman who was poisoned by ten or twelve grains of this substance, taken at one dose.

ACTION ON THE DISEASED.

The effects in cases of paralysis are similar to those described, but they are exerted in a remarkable manner upon the parts affected, making them the seat of tetanic shocks, of that tingling sensation which announces the action of the medicine, and of a local perspiration which is not observed in any other part of the body. In cases of hemiplegia submitted to the action of nux vomica, the contrast be-

* See *Journal de Physiologie Experimentale*, tom. iii.

† *Ibid.* tom. vii. p. 334.

tween the two halves of the body is very striking; while the healthy side remains tranquil, the diseased side is often violently agitated; tetanic shocks succeed each other rapidly, and a profuse perspiration breaks out. I have seen the affected side covered with an anomalous eruption, while the other exhibited no trace of it. Even the two sides of the tongue are differently affected; one side being sensible of a decidedly bitter taste, while the other remains perfectly free. If a much larger dose be administered, both sides of the body become the seat of tetanic action, though not equally so, and the patient is sometimes thrown out of bed by the violence of the paroxysms. In very small doses, this extract, like many other remedies, has apparently no immediate effect; it is only after a certain number of days that its good or bad consequences are manifest.

CASES IN WHICH THE ALCOHOLIC EXTRACT OF NUX VOMICA MAY BE EMPLOYED.

It may be given in all cases of debility, whether local or general, and in palsies of all kinds, general or partial. Mr. Edwards has used it successfully in amaurosis accompanied with paralysis of the upper eyelid. I have seen the best effects result from its employment in marked cases of weakness of the genital organs, incontinence of urine, &c. I have also employed the resin of nux vomica in cases of sluggish digestion, and in extreme general debility, attended by an irresistible tendency to sleep. I have lately recommended it with advantage in cases of partial atrophy of the superior and inferior extremities. If this substance is employed in paralysis which has followed apoplexy, it must not be administered until a considerable period has elapsed after the cerebral hæmorrhage which has produced the paralysis, and we can only hope for real advantage as there is no important organic lesion; for when such a lesion exists in any part of the brain having an influence on motivity, the palsies which result are of necessity incurable, and it would be dangerous to persist in the use of this remedy.

Dr. Chauffart* has administered even twenty grains of

* Journal Général de Médicine, Oct. 1824.

this extract to a person who was seized with paralysis after an attack of apoplexy, but without success; although the patient experienced severe tetanic shocks, and the employment of the nux vomica was continued up to so high a dose.

The same physician has published three other cases of paralysis cured by the use of nux vomica, and among them a cure of paralysis of the rectum.

Dr. Baxter* also mentions a case of hemiplegia in a child of three years and a half old, which was cured by the extract of nux vomica. He gave this child half a grain of the extract every four hours; the shocks produced were general; they took place on the sound as well as the paralysed side, and continued one or two hours.

One of the most interesting cases is that which has been published by Dr. Gendron†. An individual who had given himself up to every kind of excess, was, after a violent fit of passion, seized with paralysis of the left arm; after some time, numbness and pain in the abdominal regions supervened, and at last, in spite of the utmost attention, the paralysis of the muscles became almost complete, though the sensibility of the parts had undergone no modification. The extract of nux vomica was administered, and in fifteen days the dose was increased to thirty-six grains, taken at three times in twenty-four hours. The disease was perfectly subdued. The only phenomena observed during the treatment, were a very lively tingling sensation in the extremities, and a slight agitation for some nights; the patient also complained now and then of pain in the heels.

M. Cazenave has employed nux vomica with success in a case of chorea sancti viti, which had resisted all other means.

To resume; the utility of the extract of nux vomica has been confirmed in all cases of debility of the nervous system by a great number of physicians, and every day the

* New York Medical Repository, vol. 8.

† Journal Général de Médicine, Nov. 1824.

annals of medicine contain new facts, which prove the happy efficacy of this powerful substance.

MODE OF EMPLOYING THE ALCOHOLIC EXTRACT OF NUX VOMICA.

The preferable form is that of pills, (if we wish to obtain the apparent effect, viz., the tetanic shocks,) each pill containing one grain of the extract: we may commence with one or two, increasing the dose until the desired effect be produced. Evening is the best time for administering the remedy, as the calm and silence of night offer greater facilities for observing the phenomena which may occur.

It is sometimes necessary to increase the dose up to thirty or thirty-six grains in the day, to produce tetanic action; but for the most part, from four to six grains are sufficient. If it should be found necessary to suspend the use of the medicine for some days, it must be recommenced with small doses and gradually increased. When merely slight effects are requisite, a grain or half a grain in the day is sufficient. A tincture may also be employed which is thus prepared:—

TINCTURE OF NUX VOMICA.

Alcohol at 36° ..... 1 once*.
Dry extract of nux vomica..... 4 grains.

This tincture should be given by drops, in any simple liquid, whenever the extract in substance would be admissible; it may also be used by friction upon the parts affected. The latter mode is very extensively employed in Italy; I have found great advantage result from it in my own practice, but I recommend ammonia to be combined with it.

I have obtained satisfactory results from the subjoined formula in the treatment of cholera at Paris.

Tincture of Nux Vomica ..... 1 once.
Concentrated Ammonia..... 2 gros.

To be used by friction.

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* See the scale for reducing French weights and measures to the English standard.

STRYCHNINE.

The Alcoholic Extract of Nux Vomica, Nux Vomica in substance, St. Ignatius' bean, the famous poison of Java*, and the Snakewood, owe their powerful action on the animal economy to two distinct vegetable alkalies, discovered by MM. Pelletier and Caventou, and denominated *strychnine* and *brucine*. These two bases are combined with a vegetable acid which those writers have named *igasuric acid*.

MODE OF PREPARING STRYCHNINE.

Dissolve the alcoholic extract of nux vomica in water, and add to the solution sub-acetate of lead in a fluid form, until no more precipitate be thrown down. Foreign substances being thus removed, the strychnine remains in solution with a portion of colouring matter, and sometimes an excess of acetate of lead; the lead is to be separated by sulphuretted hydrogen, then filter, and boil the liquid with magnesia, which, uniting with the acetic acid, yields a precipitate of strychnine and brucine. Wash the precipitate in cold water, redissolve it in alcohol to remove the excess of magnesia, and then, by evaporating the alcohol, we obtain a mixture of strychnine, brucine, and colouring matter: let the whole be macerated in a small quantity of weak alcohol, which quickly dissolves the brucine and the

* This poison is the *upas tieuté;* it must not be confounded with the *upas anthiar*, a poison equally terrible, found in the same country, on a lofty tree of the family Urticeæ; this plant forms a new genus and species, under the name of Anthiaris Toxicaria. The upas anthiar causes death in a few minutes by exciting vomiting, the other by tetanic convulsions. We are indebted to MM. Pelletier and Caventou for the little we know of the chemical composition of the upas anthiar. These chemists have extracted from it a salt with a vegetable base, which, injected into the pleura of a dog, causes death in a very few minutes. The physiological experiments which have been made on this subject confirm what I advanced twelve years ago. (See Annales de Chimie et de Physique, tom. xxvi. pag. 44; Examen Chimique des Upas.)

colouring matter, and the strychnine will remain in the form of a powder. It is taken up again by boiling in rectified alcohol which dissolves it, and on evaporating the alcohol, the strychnine is deposited in crystals. We must take care to leave a little alcoholized water, in order to recover what remains of brucine.

By repeating the crystallization, the strychnine may be obtained still purer. Notwithstanding, it is almost impossible to obtain strychnine which is not reddened by nitric acid, which is the characteristic sign of its purity. A purer kind is obtained from the St. Ignatius bean, but that from the *upas tieuté*, is the purest and the most easily procured.

SENSIBLE AND CHEMICAL PROPERTIES.

Strychnine obtained by crystallization in an alcoholic solution diluted with a little water and left to itself, appears under the form of microscopic crystals, forming four-sided prisms, terminated by pyramids with four depressed faces. When crystallized rapidly it is white and granular; it has an insupportably bitter taste, and leaves a sensation like that produced by certain metallic salts; it has no smell, and undergoes no alteration by exposure to the air; it is neither fusible nor volatile, for submitted to the action of heat, it only fuses at the moment of its decomposition and carbonization; it is decomposed by a degree of heat inferior to that which destroys most vegeto-animal substances. Exposed to the naked fire, it swells, blackens, gives out an empyreumatic oil, a small quantity of water and acetic acid, and some traces of carbonic acid gas, carbonated hydrogen, and carbonate of ammonia. Distilled with the deutoxide of copper, it yields a large quantity of carbonic acid and azote.

According to M. Liebig, strychnine gives for every hundred parts,

Carbon	76.43
Azote	5.81
Hydrogen	6.70
Oxygen	11.06

The same chemist has found that 100 of strychnine absorbs 15.02 of dry hydrochloric gas, which gives 3024 for the equivalent of the alkaloid of which we are speaking. The above result corroborates that which is obtained by other methods; for if the calculation be made on the atomic system, we obtain 2969.856 for the weight of the atoms of strychnine, which gives us the formula C^{30} A_z^2 H^{32} O^3, representing the exact composition of the strychnine.

It is composed then of oxygen, hydrogen, carbon, and azote. Notwithstanding its very powerful taste, strychnine is almost insoluble in water; 100 grammes of water at a temperature of 10°, dissolve no more than gr. 0.015; therefore it requires 6667 parts of water to dissolve it at that temperature. Boiling water dissolves a little more than double; 100 grammes of boiling water being required to dissolve gr. 0.04. Strychnine then is soluble in 2.500 parts of boiling water.

It is remarkable that a solution of strychnine made in cold water, which consequently does not contain $\frac{1}{6000}$ part of its weight, may be diluted with 100 times its volume of water without losing its intensely bitter taste. Its principal characteristic, however, is its readiness to form neutral salts by uniting with acids.

According to the recent experiments of MM. Pelletier and Cavèntou, the above mentioned process indicates in nux vomica, the presence of two alkaline substances; the one strychnine, of which we are now treating; the other brucine, already discovered in the Brucea Antidysenterica by the same chemists. In performing this process, care must be taken that the substance be repeatedly crystallized in alcohol to render it pure and free from brucine; the latter being very soluble in alcohol and crystallizing with difficulty, remains in the alcoholic *mother-water*. The presence of brucine, however, in strychnine is of no great importance, for it possesses analogous properties, though less energetic.

M. Henry has proposed a different method of obtaining strychnine. It consists in boiling the nux vomica in water, and evaporating to the consistence of a syrup; lime is then

added, which combines with the acid, and sets the strychnine free. This is again separated from the lime by means of alcohol; and the strychnine contained in the alcohol is subsequently obtained by evaporation. To obtain it still purer, it may be redissolved in alcohol and crystallized a second time. This mode of procedure is very excellent; it has the advantage of being very simple, and of furnishing pure strychnine at a small expense, the quantity moreover being the same.

The strychnine procured from nux vomica is always accompanied with brucine, which we have great difficulty in entirely separating. It is easy to assure ourselves of such a mixture, when strychnine is prepared on a large scale: thus, by treating with sulphur the resinous matter which was obtained by evaporating the strychnized alcohol, and precipitating the solution of the double sulphate while it is still warm by very dilute ammonia. The strychnine is precipitated first under the form of powder, and by continuing to add the ammoniacal water, the brucine is precipitated, but under the form of pitch, which runs into a soft mass, and contains within it much strychnine. By decanting the liquid after the first precipitation, we can accomplish a separation of the two alkaloids, but never so exact as to obtain them pure.

Henry has pointed out another method of purifying strychnine, by combining it with nitric acid. The employment of this acid, however, is not without inconvenience in the process of manipulation, and even in pharmacy: the greatest attention is required to prevent the reaction of the nitric acid upon the strychnine; hence the use of the muriatic or sulphuric acids is preferable. The salt is crystallized after the colour has been discharged by means of animal charcoal, and finally the strychnine is precipitated by ammonia. We may observe, that at the time when Henry published his process, it was not known that brucine existed in combination with strychnine; consequently, in his account of the process, no mention is made of the separation of the two alkalies: it will readily be seen, that whenever the strychnine is obtained by crystallization, it

will be free from brucine; but when obtained by precipitation, it will contain a considerable quantity of brucine, and will therefore act with less energy on the system.

It is unfortunate that the bean of St. Ignatius is so rare an article in commerce, as the strychnine afforded by it is nearly free from brucine, and great advantage would result from its employment.

ACTION OF STRYCHNINE ON THE ANIMAL SYSTEM.

The action of strychnine on man and the lower animals, is exactly similar to that of the alcoholic extract of nux vomica, but it is much more powerful. One eighth of a grain is sufficient to kill a large dog, and a quarter of a grain has often produced very marked effects on a man in health.

CASES IN WHICH STRYCHNINE MAY BE EMPLOYED.

Strychnine is employed as a remedy in all those cases which have been mentioned as receiving benefit from the resin of nux vomica. We might dispense with strychnine on many occasions if the extracts of nux vomica were always made in the same manner, and exempt from those variations in strength which result from the mode of their preparation: I think it preferable to substitute strychnine for them because of the greater uniformity of its action*.

MODE OF EMPLOYING STRYCHNINE.

It may be made into pills, each pill containing $\frac{1}{12}$ or $\frac{1}{8}$ of a grain, and the following formula may be used:

PILLS OF STRYCHNINE.

Very pure strychnine	2 grains.
Conserve of roses	½ gros.

Mix accurately, and divide into 24 equal pills.

* Dr. Cataneo, who has translated this formulary into Italian, has published his observations upon strychnine. The memoir is inserted in Omodei's *Annali Universali di Medicina*, No. 32, fasc. p. 236, and contains many interesting particulars.

TINCTURE OF STRYCHNINE.

Alcohol at 36°	1 once.
Strychnine	3 grains.

From 6 to 24 drops may be administered in draughts or in common beverage.

I have often used the following mixture:

MIXTURE OF STRYCHNINE.

Distilled water	2 onces.
Very pure strychnine	1 grain.
White sugar	3 gros.
Acetic acid	2 drops.

Five grammes* to be taken night and morning.

Strychnine is sometimes combined with iron; thus.

Strychnine	2 grains.
Black oxide (officinal) of iron	1 gros.
Powdered sugar and gum of each	1 gros.

Mix and divide into eight portions.

Sub-carbonate of iron may be substituted for the black oxide.

Strychnine may be advantageously employed by means of cutaneous *imbibition*, according to the *endermic* method. The epidermis being elevated by a small vesicatory, the substance is sprinkled over the surface of the denuded chorion. I have often used it in this way upon the temples in cases of amaurosis or palsy of the eyelid.

SALTS OF STRYCHNINE.

United with acids, this substance forms salts, which are crystallizable, and for the most part soluble. This fact is necessary to be borne in mind as regards those mixtures in which strychnine is administered; for lemonades and all acids very much impair its efficacy. The sub-carbonate of strychnine alone is *sparingly* soluble.

Sulphate of Strychnine. This salt is soluble in less than ten parts of cold water; it crystallizes in small transparent

* Cuillerée a café. Gallicé.

cubes, if neutral, and in needles, if acid be present. Its taste is excessively bitter. It is decomposed by every soluble salifiable base. It suffers no alteration by exposure to the air: heated at a temperature of 100°, it undergoes no reduction of its weight, but it becomes opaque. At a higher temperature it fuses, and resolves itself into a mass, with a loss of 3 per cent.; if the heat be increased, it is decomposed. It consists of

Sulphuric acid	9.5
Strychnine	90.5
	100

According to MM. Dumas and Pelletier, 100 parts of the base saturate 10.486 of acid.

The Hydrochlorate of Strychnine is still more soluble than the sulphate; it crystallizes in needles, which, viewed through a lens, appear to be quadrangular prisms; heated to the temperature at which the base is decomposed, it disengages muriatic acid.

The Phosphate can only be obtained perfectly neutral by double decomposition; it crystallizes in four-sided prisms.

The Nitrate is easily obtained by dissolving strychnine in acid highly diluted. Upon evaporation, it crystallizes in needles of a pearly hue. This salt is much more soluble in hot than in cold water, and its action is yet more violent than that of strychnine itself.

The acetic, oxalic, and tartaric acids, also form very soluble salts, susceptible of crystallization; especially if the acid predominate. The neutral acetate is very soluble, and does not readily crystallize. Hydrocyanic acid forms with this base a crystallizable salt.

The sub-carbonate is obtained under the form of white flakes, and is, as we have already mentioned, soluble in a very slight degree.

HYDRIODATE OF STRYCHNINE.

This salt is obtained with the greatest ease by mixing together a solution of ioduret of potassium, and a concen-

trated solution of acetate of strychnine. A white crystalline powder is instantly precipitated, sparingly soluble in water, but quite soluble in alcohol.—This is pure hydriodate of strychnine.

A large portion of acid, combined with a very small quantity of strychnine, would form a medicine possessing the double property of acting on the nutrition of the organs, and of exciting the nervous system.

ACTION OF THE SALTS OF STRYCHNINE.

The salts of strychnine are more active, and consequently more poisonous, than the base, because of their greater solubility.

MODE OF EMPLOYMENT.

It may be advantageous in some cases, where the patient has become habituated to the use of strychnine, to employ the salts in its stead.

I have tried the sulphate, and I have found it produce decided effects, in a dose of a twelfth of a grain, upon a female affected with paraplegia. I have sometimes substituted the iodate * and have obtained the most beneficial results from it, in many cases of paralysis reputed to be incurable.

To conclude, strychnine, and more especially the salts of that substance, are the most active medicines with which we are acquainted in a solid form, and may therefore more easily be rendered poisonous. Too much precaution, then, cannot be taken, both in the preparation and the administering of such a remedy.

BRUCINE.

This salifiable organic base was discovered in 1819, by MM. Pelletier and Caventou, in the bark of the false Angustura (Brucea antidysenterica). It is there combined with gallic acid in the state of gallate acid. These chemists have since found it in association with nux vomica.

* See the article Iodine, for the preparation and physiological effects of this substance.

In the bean of St. Ignatius, and in upas tieuté, the brucine bears the same relation to the strychnine, that cinchonine does to quinine; the more active barks contain the most quinine; in the same way, the bean of St. Ignatius and the upas, which are more active than the nux vomica, contain but little brucine, and a great quantity of strychnine.

MODE OF PREPARING BRUCINE.

Brucine is obtained from the inner bark of the brucea antidysenterica, by a similar process to that directed for the preparation of strychnine, with this difference, that the magnesian precipitate should not be so diligently washed, brucine being much more soluble in water than strychnine. By evaporating the alcoholic liquors, employed for the treatment of the magnesian precipitate, the brucine is obtained in a resinous form, for it is not yet sufficiently pure to crystallize. To purify it, oxalic acid must be added, and the oxalate treated with a mixture of alcohol at 40°, and ether at 60°. The colouring matter is thereby dissolved, and the oxalate of brucine remains under the form of a white powder: this oxalate is decomposed by magnesia, and the brucine taken up by alcohol. On evaporating the alcoholic solution in the open air, the crystallized brucine is obtained: if it be evaporated by the aid of heat, the brucine will be obtained fused, but not less pure.

Brucine may be easily procured, by boiling the inner bark of the brucea antidysenterica in acidulated water, decomposing the liquid by moderately slaked lime, and treating the calcareous deposit with alcohol. The residue left after the distillation of this vehicle is brucine, which freely combines with the sulphuric and hydrochloric acids, so as to form well crystallized combinations.

The water decomposed by the lime may also contain a certain proportion of the alkaloid, and by concentration and treatment almost similar to that described, we obtain the remaining particles of this substance.

PROPERTIES OF BRUCINE.

Its taste is intensely bitter; it is not very soluble in water, although more so than strychnine. It dissolves in 500 times its weight of boiling water, and in about 850 of cold water. When regularly crystallized, it appears under the form of oblique prisms with a parallelogramic base.

Crystallized brucine is a true hydrate, its affinity for water being considerable; while pure strychnine is not susceptible of passing into the state of an hydrate. Brucine loses a large quantity of water by fusion.

Two hundred parts of brucine crystallized yield:

Residue	163 parts
Water	37

One hundred and sixty-one parts crystallized in alcohol yield:

Residue	134 parts
Water	27

Which establishes the constitution of the hydrate, taking the mean between the two results:

Brucine	100 parts
Water	21.165

Brucine fuses at a temperature nearly equal to that of boiling water, and in cooling, assumes the consistence of wax. Exposed to the moisture of the air, it increases in volume, whitens, and becomes pulverulent while passing into an hydrate. It unites with acids, and forms with them neutral salts, which for the most part crystallize regularly. On placing it in contact with nitric acid, it acquires an intense crimson colour, which passes into a yellow by the application of heat. If, while in this state, a solution of the proto-hydrochlorate of tin be added, we have a most beautiful violet-coloured precipitate. This phenomenon is the peculiar characteristic of brucine.

Strychnine procured from nux vomica, treated in the same manner, sometimes assumes a violet tint. In this case, we may be assured it results from brucine; for the strychnine obtained from the bean of St. Ignatius, and even

from nux vomica perfectly purified, does not produce a violet colour with the proto-hydrochlorate of tin. Moreover, pure strychnine is not reddened by the action of nitric acid.

Many chemists have been employed in the analysis of brucine; I shall only adduce the analysis of M. Liebig, because his account corresponds with the capacity of brucine for saturation, which fixes the atomic weight at 3485.23.

Carbon	$70.88 = C^{32}$
Azote	$5.07 = A_z^2$
Hydrogen	$6.66 = H^{36}$
Oxygen	$17.39 = O^6$

ACTION ON THE ANIMAL SYSTEM.

The action of brucine on the animal economy is analogous to that of strychnine, but less powerful: its intensity compared with strychnine being as 1 : 12. Four grains of brucine are required to kill a rabbit; and the same quantity administered to a large dog, produced sharp paroxysms of tetanus, but not sufficient to cause death.

M. Andral, who has made comparative experiments with brucine and strychnine, has arrived at this conclusion,—that six grains of brucine are required to produce the effects of a grain of impure strychnine, and of a quarter of a grain of pure strychnine.

The difference of action may therefore be greater than that we have calculated above.

Brucine may in all cases be substituted for strychnine; it has the advantage of producing analogous effects without the same intensity of action.

MODE OF ADMINISTERING BRUCINE.

It may be given either in pills or tincture, increasing the dose gradually. For medical use, that which is extracted from the bark of the Brucea antidysenterica should be preferred; as that which is obtained from nux vomica is liable to be combined with a certain quantity of strychnine, which increases its energy, and prevents us from calculating the effects with certainty.

CASES IN WHICH BRUCINE MAY BE EMPLOYED.

Since it possesses the properties of strychnine in a milder degree, it may be given to the extent of one, two, and even three grains, without fear of accident, under the same circumstances as the preparations of nux vomica. Much larger doses may probably be given, but circumspection always becomes us.

M. Andral has used it with advantage in several cases of palsy, in doses of half a grain to five grains *. I have also employed it successfully in two cases of atrophy, one of the arm and the other of the leg. The patients took six pills daily of one eighth of a grain.

PILLS OF BRUCINE.

Very pure brucine	12 grains.
Conserve of roses	½ gros.

Mix intimately and divide into 24 equal pills.

TINCTURE OF BRUCINE.

Alcohol at 36°	1 once.
Brucine	18 grains.

From 6 to 24 drops may be taken of this tincture in ordinary drink.

STIMULATING MIXTURE.

Distilled water	4 onces.
Very pure brucine	6 grains.
White sugar	2 gros.

Five *gros* to be taken night and morning.

SALTS OF BRUCINE.

Brucine, by combining with acids, generates neutral and super salts.

Sulphate of Brucine.—This salt crystallizes in long needles resembling four-sided prisms, terminated by extremely

* See Majendie's Journal de Physiologie experimentale, July, 1823.

delicate pyramids. It is very soluble in water and in alcohol. Its taste is very bitter. It is decomposed by potash, soda, ammonia, baryta, strontia, lime, magnesia, morphine, and strychnine.

The super sulphate crystallizes more readily than the neutral sulphate; it is composed of

Sulphuric acid	8.84
Brucine	91.16

Hydrochlorate of Brucine.—This salt cystallizes in four-sided prisms, terminated by an oblique surface. It is unaffected by the air, and very soluble in water. Sulphuric acid decomposes it; nitric acid alters, and even destroys the brucine. It consists of

	atom.
Acid	13.06 = 1
Brucine	100.00 = 1

Phosphate of Brucine is also crystallizable, very soluble, and slightly efflorescent. The acetate, tartrate, and oxalate may also be crystallized.

The *Nitrate* is a mass bearing some resemblance to gum.

The sulphate and the muriate of brucine, being more soluble than their base, presents some advantages, and have probably greater activity: they may be employed instead of brucine in the foregoing preparations.

MORPHINE.

No circumstance more clearly shows the imperfection of the science of medicines, so singularly called Materia Medica, than the history of opium. Alternately it has been proscribed as eminently pernicious, or vaunted as a panacea. Some declare that it soothes and procures sleep; others affirm that it is always exciting: while others, less exclusive, have described it to have stupifying, soporific, narcotic, acrid, assuaging, and other properties. Following the latter supposition, the chemists of the last century endeavoured to find the various properties of opium in different

principles. On the other hand, the most celebrated physicians have not disdained to affix their names to some preparations of opium which they thought preferable to others. But upon what rests the superiority of the laudanum of Sydenham—Rousseau's drops—the tinctures of opium—the syrups of diacodium—the resinous and aqueous extracts, &c. &c.? And upon what grounds are some of these employed while others are excluded?

The sciences mutually depend upon and assist each other: let us hope that the recent perfection of chemical analysis, and the happy discoveries that have thence been made in opium, will soon enable us to penetrate the obscurity that surrounds us.

From the chemical researches of MM. Seguin, Derosne, Sertuerner, Robiquet, Robinet, Pelletier, and Couerbe, it appears that opium is composed, 1st, of a fixed oil; 2nd, of caoutchouc; 3rd, of gum; 4th, of fecula; 5th, of resin; 6th, of lignin; 7th, of morphine; 8th, of narcotine; 9th, of narceine; 10th, of meconine; 11th, of codeine; 12th, of meconic acid; 13th, of another brown acid.

To speak of all these substances would be foreign to our plan: but we shall say a word concerning those which have been submitted to elementary analysis, and more especially of those which are constantly employed in therapeutics, and which appear to us worthy of introduction in this place.

According to the recent investigations of M. Robiquet, neither *codeic acid* nor *codeate of morphine* are present in opium; that which has been taken for them, being, either a super salt, or hydrochlorate of morphine. This salt may even vary with the nature of the saline solution to which the opium is submitted. Thus, there may be sulphate or nitrate of morphine, according as we employ a solution of muriate of soda, sulphate of soda, or nitrate of potash, to obtain the pretended codeine.

Nevertheless, there remains from the experiments of M. Robinet on this head, the interesting fact, that morphine has the property of producing a blue colour with the salts of iron at the maximum of oxidation.

This property will afford means of detecting the presence of morphine in the animal economy, should there occur (which happily there has not yet) a case of poisoning by this vegetable base.

INDIGENOUS MORPHINE.

Morphine may be advantageously prepared from the capsules of the indigenous poppy: M. Vauquelin was the first to announce that he had extracted this base from a small quantity of the *inspissated juice*, obtained by incision. Several chemists, among whom we may mention M. Petit, of Corbeil, and M. Tilloy, of Dijon, have been successfully engaged in the application of this important discovery of M. Vauquelin. They have published facts which prove the possibility of our one day dispensing with exotic opium in the preparation of morphine. M. Caventou, one of the commissaries appointed by the Royal Academy of Medicine to furnish an account of the proceedings of M. Petit, has announced the analysis of a small quantity of inspissated juice, obtained by the incision of the French poppy at mid-day; from which he procured, at the first trial, more than a fourth part of its weight of crystallized morphine. This proportion appears to me, however, a little exaggerated. M. Tilloy, of Dijon, succeeded so well in extracting morphine, that he expected to make it an object of speculation; he assures us that, in the space of a few years, he has furnished commerce with from eight to ten pounds of this morphine *.

MODE OF PREPARING INDIGENOUS MORPHINE.

Make a watery extract of the dry capsules of the indigenous poppy, treat this extract with alcohol, then separate the alcohol from the deposit and distil. By this means you precipitate the gummy matter. The syrup-like residue from the alcoholic distillation, is taken up by fresh alcohol, which, this time, independent of a fresh quantity of gum, separates the nitrate of potash; then decant and distil a second time. The alcoholic residue reduced to the

* Vide Journal de Pharmacie, t. 13.

consistence of an extract, is treated with a quantity of water sufficient to separate a considerable proportion of resinous matter. Finally, from the watery liquid, morphine is separated by means of ammonia, sub-carbonate of soda, or caustic magnesia; and we then proceed as with the gummy extract of opium.

This morphine differs in nothing from the other, either as respects its chemical or medical properties. It is found in the indigenous exactly as in the exotic poppy, viz: in the state of meconic acid of morphine.

PREPARATION OF EXOTIC MORPHINE.

M. Robiquet employs the following method. He boils a highly concentrated solution of opium, with a small quantity of magnesia, (10 *grammes* to the pound of opium,) for a quarter of an hour. An abundant greyish deposit is formed, which is filtered and washed with cold water. The precipitate being well dried, is treated with dilute alcohol, which is allowed to macerate for some time, at a degree of heat below ebullition. By this means a large quantity of colouring matter is taken up, and but very little morphine. He then filters and washes with a little cold alcohol. The deposit is again taken up by a larger quantity of rectified spirit, and boiled for a considerable time. While in this state, the liquor is once more filtered, and upon cooling, the morphine is deposited, which may be deprived of the colouring matter by repeated crystallizations, and by the use of animal charcoal.

Dr. Thomson * has pointed out the elementary composition of morphine, and has described what he considers to be an easy method of procuring this base in a state of purity. He precipitates a strong infusion of opium, by means of caustic ammonia; separates the brownish white precipitate by the filter, and evaporates the liquid down to a sixth part of its volume: to this he again adds ammonia, and obtains a fresh precipitate of pure morphine. He allows it to form a sediment, which is received on a filter, and washed with

* Annals of Philosophy, June, 1820.

cold water. When it is well drained, he sprinkles it with a little alcohol, which, passing through the filter, carries with it a great proportion of the colouring matter, and also a little of the morphine. He then dissolves the morphine in acetic acid, and treats the solution with a little ivory black. This mixture is frequently agitated for twenty hours, and is then thrown upon the filter, through which it passes entirely colourless. He treats this liquid with ammonia, and the morphine is precipitated under the form of a white powder. If this base be then dissolved in alcohol, and the solution allowed to evaporate spontaneously, the morphine will arrange itself under the form of beautiful regular crystals. These crystals are of a perfectly white colour, of a slight opaline transparency, entirely without odour, but intensely bitter, and consisting of four-sided rectangular prisms.

I have generally followed the method of M. Hottot, which is only a modification of that of Sertuerner.

Exhaust opium, by means of tepid water, and let the clear liquors be brought together at a density of 4° *: then add while it is still warm, a small quantity of ammonia to render the liquid neuter or ammoniacal in a very slight degree: a brown deposit like resin will be formed, retaining only traces of morphine and narcotine; then filter, and by adding a fresh portion of ammonia to the refrigerated liquid, morphine is precipitated in the form of a powder, of a white colour, and often appearing as if crystallized. To obtain the genuine crystals proceed as above.

In order to avoid dissolving too much narcotine with the morphine, it is always necessary to treat opium with a quantity of water equal to five or six times its weight.

MM. Henry, the younger, and Plisson have published a method of obtaining morphine, in which alcohol is not employed; but this mode of proceeding does not yield the whole of the morphine contained in opium; and on this account it is less advantageous than the preceding.

This mode has been subjected to a comparative examination with that of M. Robiquet, and similar results have been obtained. Nevertheless the product has always

* Pese-sel of Beaumé.

appeared to be inferior to what is obtained from the greater part of the opium of commerce by other methods. It furnishes morphine, however, of great purity and very free from narcotine, and we think it our duty to give an account of its preparation.

Let opium be treated in pure water, acidulated by means of hydrochloric acid, even to excess, and then concentrated to about two thirds; when the liquid has cooled, let a slight excess of liquid ammonia, or dilute caustic soda, be added. The deposit, collected and washed, is afterwards treated with water very slightly acidulated with hydrochloric acid, until the acid ceases to be saturated. The solutions are then united, and evaporated carefully in a sand-bath until they crystallize. The crystals are soon generated, and are impure, and of a brownish colour: they are separated from the mother-water, which undergoes fresh evaporations or decompositions by means of ammonia, and are purified by a new crystallization. When white, they are dried and preserved in the state of hydrochlorate of pure morphine; or if not, after having dissolved them in a small quantity of water, let them be decomposed by a slight excess of ammonia. The white powder precipitated is pure morphine, which it is necessary to dissolve in a little alcohol, at a temperature of 36°, in order to procure crystals on cooling.

The mother-waters and those remaining after the decomposition by ammonia, retain morphine; they must be rendered slightly acid, concentrated, crystallized, &c., &c., as above.

M. Blondeau has addressed a communication to the Royal Academy of Medicine, in which he announces, that by fermenting the aqueous solution of opium by the help of a little yeast, the viscous colouring matter is destroyed, which disengages the morphine, and yields it more pure, and in greater quantity than by any other method.

ELEMENTARY COMPOSITION OF MORPHINE.

M. Bussy, of the School of Pharmacy, has given an excellent analysis of morphine, in which he has detected

azote, whose presence Dr. Thomson did not suspect, although it was pointed out by M. Dulong. MM. Dumas and Pelletier * have made two analyses of morphine: the first substance analysed was extracted from opium according to the mode of M. Robiquet; the second was obtained from the sulphate of morphine by means of potash. They found for the mean composition, a result which is rather at variance with that of M. Bussy, as respects the proportions of carbon and oxygen.

Analysis of M. Bussy.		Analysis of Dumas and Pelletier.	
Carbon	69.0	Carbon	72.02
Hydrogen	6.5	Hydrogen	7.61
Azote	4.5	Azote	5.53
Oxygen	20.0	Oxygen	14.84
Morphine	100		100

M. Brande † who has analysed several vegetable alkalies, has found the mean composition of morphine to be;

Carbon	72.0
Azote	5.5
Hydrogen	5.5
Oxygen	17.0
Morphine	100

M. Liebig computes that 100 of this substance contain;

Carbon	72.340	C^{34}
Azote	4.995	A^{2}_{z}
Hydrogen	6.366	H^{36}
Oxygen	16.299	O^{6}

The same chemist has remarked, that this singular substance may be considered as a true hydrate, for he finds 6¼ of the water of crystallization for 100 of morphine. He has arrived at this result, by heating the crystals of morphine at the temperature of 120° centigrade.

* See the Memoir before mentioned.

† Annals of Philosophy, April, 1824.

Anhydrous morphine is deprived of all its transparency; it has the property of fusing, and in that case, assumes the appearance of a thick, resinous, and transparent liquid, of a yellowish colour.

The atom of morphine removed from its combination with hydrochloric acid, has been estimated at 3613, which gives for the composition of the hydrate;

Water 112.48
Morphine ..... 7226.00 $= \overset{+}{M^2} + H^2 O$ *

ACTION OF MORPHINE ON THE ANIMAL SYSTEM.

Pure morphine being but little soluble, does not allow us easily to discover the narcotic principle of opium, or rather, according to the actual state of science, whether it is one of the narcotic principles of that substance; nevertheless, there is no doubt on this point: direct experiments and clinical observations have abundantly proved the fact. I have observed, for example, very decided narcotic effects from a very minute dose, such as a quarter of a grain; but the narcotic effects of morphine are most apparent when it is combined with acids, probably because the salts of morphine are more soluble than the base.

It is now more than fifteen years since I first made use of the acetate, the sulphate, and the hydrochlorate of morphine for medical purposes, and I have found that the salts possess all the good properties of opium without the inconveniences †.

PREPARATION OF THE ACETATE OF MORPHINE.

This salt may be formed by mixing acetic acid and morphine directly in a capsule, and then evaporating gently

* M. Couerbe has proposed to represent in this manner the organic alkalies, viz., by their initial surmounted by the sign + as indicating their electrical state; thus $\overset{+}{M}$ is equivalent to $C^{34} A_z^2 H^{36} O^6$ or morphine. $\overset{+}{B}$ to $C^{32} A_z^2 H^{36} O^6$ or brucine. $\overset{+}{S}$ to $C^{30} A_z^2 H^{32} O^3$ = strychnine, &c., which simplifies, as may be easily seen, the formulæ of the compounds of these substances.

† See the Nouveau Journal de Medicine. Paris, 1818.

to dryness in a warm room at 25°. The difficulty of obtaining crystals, on account of its extreme deliquescence, has led to the adoption of this method. The acetate may also be prepared by dissolving the morphine in alcohol and filtering the solution, saturating the liquor with acetic acid, and reducing it to dryness by careful evaporation. The product thus obtained is not altogether acetate of morphine, but a large quantity of the acetate combined with an excess of the base; this is sufficiently obvious on dissolving it in water, when a portion of the acetate will not dissolve; that is the morphine which is not entirely saturated with acid. The same effect may take place with the perfectly neutral acetate, because this salt has the property, as soon as it comes in contact with water, of separating into two salts: the one soluble, and having an excess of acid, the other insoluble, with an excess of the base. This effect, together with the difficulty of obtaining the acetate perfectly neuter, should lead us to prefer the sulphate, which does not present the same inconvenience.

We may, however, obtain the acetate crystallized, thus: when the morphine is dissolved in alcohol, and saturated with acetic acid, it is to be filtered and allowed to evaporate gently in a capsule covered with gauze. The acetate of morphine will then deposit its crystals on the sides of the capsule, in a ramified form.

PREPARATION OF THE SULPHATE OF MORPHINE.

Dissolve morphine in sulphuric acid previously diluted with water. This solution, made warm and evaporated to a certain point, crystallizes, on cooling, in silk-like tufts. This salt bears a great resemblance to sulphate of quinine, with which it may be confounded; but the crystallization is much more close and compact, it also becomes red when treated with concentrated nitric acid,—a phenomenon which is not presented by sulphate of quinine.

It may also be prepared by dissolving morphine in alcohol, saturating with sulphuric acid, and evaporating. We thus obtain the sulphate crystallized in silky tufts.

M. Pelletier considers that the sulphate of morphine

should always be preferred to the acetate, because it may be obtained of the same relative strength, while the latter often contains narcotine, a substance more soluble in alcohol than morphine. The acetate is also in part decomposed by the desiccation which it is obliged to undergo for its conservation. The sulphate obtained by crystallization never forms a sub-sulphate, as is sometimes the case in the evaporation of the acetate.

The sulphate of morphine is soluble in twice its weight of distilled water. It is composed of;

		atom.
Acid	10.33	z
Morphine	75.35	= 1
Water in combination	4.66	= 2
Water of crystallization	9.64	= 4

ADMINISTRATION OF PURE MORPHINE.

We have remarked that morphine is less soluble than its salts; it has also less intensity of action on the animal economy. This furnishes no reason for our neglecting its use: it is sometimes even advantageous to have recourse to it on account of its milder energy.

I often give morphine in the form of a pill, containing a quarter or half a grain, with the view of procuring sleep in those afflicted with chronic and painful maladies. It appears to me that the narcotic effect obtained in this manner is more permanent and complete than that which is afforded by the salts of morphine. But I affirm nothing on this point, for the individual disposition of the patient has much to do with the activity exhibited by somniferous preparations.

ADMINISTRATION OF THE SALTS OF MORPHINE.

I have endeavoured, in the officinal preparations of the salts of morphine, to assimilate them as much as possible to the preparations of opium most in use; and I have, in the first place, prescribed a syrup of morphine after the following formula:—

SYRUP OF MORPHINE.

Perfectly clarified syrup ..... 1 livre.
Acetate of morphine ..... 4 grains.

Make a syrup which will supply the place of the syrup of diacodium, and the more advantageously, as the latter preparation is, as it were, arbitrary.

The syrup of morphine is now generally employed in preference to syrupus papaveris, in the dose of five *grammes* every three hours. Sleep is often procured by a smaller dose, viz. five grammes in a little tepid water, taken on going to bed.

SYRUP OF THE SULPHATE OF MORPHINE.

Perfectly clarified syrup ..... 1 livre.
Sulphate of morphine ..... 4 grains.

The dose is the same as that of the syrup of morphine. I use this when the patient is habituated to the action of the former syrup. For the most part, by varying the salts of the alkaline remedies, their action on the animal economy may be kept up for a long time without much increasing the dose.

SOLUTION OF ACETATE OF MORPHINE.

Acetate of morphine..... 16 grains.
Distilled water ..... 1 once.
Acetic acid ..... 3 or 4 drops.
Alcohol ..... 1 gros.

The last two are added to keep the salt in solution.

This solution is exhibited in drops, instead of liquid laudanum, Rousseau's drops, tincture of opium, &c. The dose is from 6 to 24 drops.

SOLUTION OF SULPHATE OF MORPHINE.

There are some patients who cannot bear the acetate of morphine, but receive benefit from the use of the sulphate. In these cases a solution must be made similar to the preceding; only, using the sulphate in the place of the acetate, and sulphuric acid instead of acetic.

Like the former the dose is from 6 to 24 drops.

The acetate and sulphate of morphine may also be employed in pills, opiates, draughts, and juleps, in the dose of a quarter of a grain to two or three grains in 24 hours. I have made use of them, both in the hospitals and in my private practice, to the extent of four grains per diem, without any kind of inconvenience.

The ideas that were once entertained of the great activity of this substance, and of the necessity of guarding against it as a subtle poison, should be altogether dismissed: in order to become deleterious it must be administered in considerable quantity and not rejected by vomiting. The latter circumstance will be very rare, for if the usual dose of these salts be only moderately increased, nausea and efforts to vomit are excited.

SOLUTION OF CITRATE OF MORPHINE.

The black drop has been long employed in England and the United States, where it is still held in great esteem. In whatever manner the preparations have been made, they all resolve themselves into a combination of some vegetable acid, generally impure, with opium. The two acids most commonly employed are citric and acetic, to which is added some aromatic substance, and a little sugar or honey.

Those who have employed these preparations in their practice, assert that they do not irritate the stomach, nor excite head-ache, vertigo, nausea, &c.; in short, that they are free from the exciting properties of opium.

Dr. Porter, of Bristol (United States), has introduced a preparation which seems to hold out the advantages derived from black drop without the inconveniences. He has named it *liquor of citrate of morphine*. It is prepared in the following manner:

℞. Opium ..... ℥ iv.
Crystals of citric acid ..... ℥ ij.

Pound them well in a porcelain mortar; then add a pint of

boiling distilled water; mix intimately, macerate for twenty-four hours, and filter.

Dr. Porter* has framed the term *citrate of morphine*, because he supposes that the preparation is composed entirely of citric acid, combined with the alkali of opium. But it is evident that this preparation contains morphine, narcotine, and all the other crystallizable products recently discovered. Pure morphine should be employed, or the extract of opium deprived of narcotine; we should then have a compound which would approach nearer to a pure citrate, because it would be less exciting, and more truly narcotic, than the solution of M. Porter.

MODE OF ACTION AND CASES IN WHICH CITRATE OF MORPHINE MAY BE EMPLOYED.

The American physicians have used Porter's preparation with advantage, and they say its effect is more prompt but less permanent than that of opium, either in substance or in tincture. They regard this solution of citrate of morphine as more active than opium, one part of it being equal to about three parts of opium, in those cases where a small quantity is sufficient to produce the desired effect; but when large doses are necessary, we must only reckon upon a double activity.

We must avoid giving, conjointly with this preparation, lime water, solution of ammonia, &c., since these alkaline substances decompose the citrate, which, according to the foregoing mode of preparation, ought always to contain an excess of acid.

The liquor of tartrate of morphine possesses the same advantages as that of the citrate.

Citrate of morphine generally produces its narcotic effects in the space of ten minutes. Some physicians imagine that it does not succeed so well, in arresting dysenteric flux, as some other preparations of opium.

I have generally substituted the following formula for that of Dr. Porter.

* Monthly Journal of Medicine, p. 122. New York.

SOLUTION OF CITRATE OF MORPHINE.

Pure morphine ..... 16 grains.
Crystals of citric acid ..... 8 grains.

Dissolve the whole in distilled water 1 *once*, and colour with tincture of cochineal 2 *gros*.

From 6 to 30 drops of this solution may be given in twenty-four hours.

COMPARATIVE ANALYSES OF TURKEY OPIUM AND INDIGENOUS OPIUM.

Having concluded our account of morphine, we shall now add the comparative analyses of indigenous and Turkey opium made in France and England. It has been found that 700 grains of Eastern opium yield 48 grains of morphine, while from the same quantity of English opium but 35 grains are obtained.

The author of these analyses is M. H. Hennel, and the following is the mode of procedure employed in the two cases.

He treated opium with weak acetic acid, and decomposed the filtered solution by means of ammonia. He afterwards poured hot alcohol upon the precipitate which results from this decomposition; and on leaving the solution to cool, and decanting with care, he obtained the morphine by crystallization. We cannot repose implicit confidence in these numerical results of M. Hennel, for the morphine obtained according to the method which he pursued, ought to contain narcotine.

EMPLOYMENT OF THE SALTS OF MORPHINE BY THE ENDERMIC METHOD.

The salts of morphine have recently been employed in a pulverized state upon the denuded surface of small vesicatories.

These salts are imbibed into the vascular granulations of the skin, and are quickly absorbed. This method, to which the term *endermic* has been given, offers in some

cases great advantages. The quantity to be used in this way is the same as that which is employed when they are to be absorbed by other means. But as the absorption thus produced is exerted upon a surface of less extent, there is no inconvenience in extending the quantity of the medicine; sometimes, indeed, it is the only means of rendering its action efficacious.

In cases of intense neuralgia, and other local disorders, this mode of employing morphine holds out great advantages.

EXTRACT OF OPIUM DEPRIVED OF MORPHINE.

The process already pointed out under the article MORPHINE, does not entirely deprive the opium of that alkali; a certain quantity always remains in the residuum. M. Robiquet having apprized me of this fact, I wished to discover if some advantage might not be reaped from a substance regarded as useless, and abandoned as such by chemists.

I have remarked that this residuum has a certain narcotic effect upon man and the lower animals, less decided, it is true, than that of the common watery extract, but sufficiently pronounced to warrant us to expect some advantages from it in practice.

This extract may be given by grains: it appears to me that four grains are scarcely equal in activity to a grain of the common watery extract, and to a quarter of a grain of morphine.

NARCOTINE.

The researches that I have hitherto made respecting this substance, do not lead me to regard it as a medicine: I will describe however in a few words its physiological history, because it is one of the immediate principles of opium, and much uncertainty has prevailed, and still prevails, with regard to its mode of action on the animal economy.

Narcotine is found in considerable quantity in the indigenous poppy, according to MM. Petit, Dublanc, and Dronsart.

ACTION OF NARCOTINE ON THE ANIMAL SYSTEM.

Given in a small dose (1 grain) and dissolved in oil, it produces upon dogs a degree of stupor, which inexperienced persons may easily confound with sleep; but it is evidently a very different state: the eyes remain open, respiration is not so profound as in sleep, and it is impossible to rouse the animal from its dull and senseless condition. Death generally supervenes in twenty-four hours.

Combined with acetic acid, the effects are entirely different: animals can bear much larger doses (24 grains) without fatal consequences; while they are under its influence, they are agitated with convulsive movements similar to those produced by camphor; there are the same signs of fright, the same backward movements and futile efforts to advance,—froth at the mouth, agitation of the jaws, &c.

I have united in the same experiment, the action of morphine with that of narcotine, and I have found that two different and distinct effects are produced upon the same animal at the same time.

Having introduced into the pleura of a dog a solution of a grain of morphine and a grain of narcotine*, somnolency was soon exhibited, and even at intervals the genuine sleep which is produced by morphine; but at the same time the stimulating effects of the narcotine were evident, and appeared to struggle in a very singular and remarkable manner with the effects of the morphine. This contention lasted more than half an hour, at the expiration of which time, the animal fell into a profound sleep, probably from the influence of the morphine alone. Is it not probable, from the experiments made in various ways, all of which have been attended with analogous results, that to the presence of two such opposite principles the variable effects of opium are to be attributed?

It appears to me an established fact, that those who take morphine do not experience the exciting properties so

* The two substances were dissolved in acetic acid.

distinctly perceptible in the watery extract of opium, in which both morphine and narcotine are present.

Dr. Bally has given narcotine in very large doses; he states that he has administered even 60 grains in twenty-four hours without any ill results. It is to be regretted that this physician has not made known the precautions he took in order to be persuaded that his patients could really bear such extraordinary doses, and that the substance he employed was indeed pure narcotine. If scrupulous attention be not paid to these two causes of error, nothing is easier than to mistake. Nevertheless, admitting as exact the observations of M. Bally, we must come to the conclusion that narcotine exercises great influence upon the nervous system: the brightness of the eyes, the contraction of the pupils, and the vertiginous affections that have followed the employment of this substance, sufficiently prove its powerful stimulating properties.

ELEMENTARY COMPOSITION OF NARCOTINE.

MM. Dumas and Pelletier, have found narcotine to be composed of;

Carbon	68.88
Azote	7.21
Hydrogen	5.91
Oxygen	18.00
	Narcotine, 100

M. Liebig, who has analyzed almost all the vegetable alkalies, has made an analysis of this substance, which differs considerably from the above as to the proportion of azote. M. Pelletier a short time since, while pursuing his important labours respecting opium, instituted an analysis of narcotine, which indicates a little more azote than that of M. Liebig. I insert both these analyses, that chemists may take up the subject and disperse the doubts which hang over the nature and composition of this substance.

The analysis of M. Liebig gives;

Carbon	65.00
Hydrogen	5.50
Azote	2.51
Oxygen	26.99

The last analysis of M. Pelletier;

		atoms.
Carbon	65.16	= 17
Azote	4.31	= 1
Hydrogen	5.45	= 17
Oxygen	25.08	= 5

Narcotine may be obtained in two ways; first, as we have already mentioned, by treating opium or the extract of opium with ether, which only dissolves the caoutchouc and the narcotine, and afterwards purifying by means of alcohol.

But in general, the following method is adopted. Take the residuum of opium which has resisted the action of cold water, treat it with water acidulated by means of acetic or hydrochloric acid; then filter and let ammonia be added to the acid solution. By this means a very abundant brown matter is precipitated, which is rich in narcotine; leave it to form a deposit, which is to be separated from the liquid by washing, then treat with boiling alcohol at 36°, in order to separate the narcotine, which will crystallize as the alcohol cools. If the crystals are not sufficiently white, they may be obtained so by another crystallization.

If the narcotine obtained in this way retain a little morphine, which is very possible if the residue of the opium have not been entirely deprived of it, the narcotine may be taken up again by means of sulphuric ether, which will dissolve it without affecting any portion of morphine with which it may be combined. Morphine may also be separated from narcotine, by treating the mixture with a solution of caustic potass, which dissolves the morphine, and leaves the narcotine in a state of great purity. This method, which is easily practised, and very economical, was proposed by M. Robiquet.

EXTRACT OF OPIUM DEPRIVED OF NARCOTINE.

The experiments which I have made upon narcotine, having convinced me that this substance is injurious when not combined with an acid, and that it is very exciting when it is thus combined*, M. Robiquet has entertained the idea of preparing an extract of opium entirely deprived of narcotine, which has a decided advantage over the common watery extract. For this purpose, he treats the extract with ether, by which the whole of the narcotine is taken up. Nevertheless, truth compels us to admit, that several years before M. Robiquet's method was published, M. Limousin-Lamotte obtained almost the same results, by boiling opium in water with resin, then straining and concentrating the filtered liquor.

MODE OF PREPARING THE EXTRACT OF OPIUM DEPRIVED OF NARCOTINE.

Macerate crude opium in cold water; filter and evaporate to the consistence of a thick syrup; treat in a convenient vessel with rectified ether, and agitate for some time before decanting the ethereal tincture. Having separated it, get rid of the ether by distillation. Repeat this operation, until by the residuum of the distillation you obtain the crystals of narcotine. When the ether ceases to act, evaporate the solution of opium to a pilular consistence.

M. Dublanc, junior, finding by repeated experiments that opium treated in the cold with ether until this liquid had no further action upon it, furnished an extract, which taken up again by the same agent by means of heat, still presented traces of narcotine, has thus modified the process of M. Robiquet.

Take 300 *grammes* of extract of opium, prepared in the cold, and dissolve them in 150 *grammes* of distilled water. This solution is to be poured into a retort, with the addi-

* The truth of this remark has been recently disputed by M. Orfila: I do not know what has prevented him from arriving at the same result as myself, but I am certain of the accuracy of the fact which I have advanced, and I am prepared to show M. Orfila, when he wishes, the phenomenon which he has called in question.

tion of 2000 *grammes* of pure ether. The apparatus is to be raised so as to receive the product of the distillation, and a gentle heat to be applied. Having drawn off about 500 *grammes* of ether, the apparatus must be lowered and the supernatant ether in the retort quickly decanted. The ether obtained by distillation serves to wash the yet warm extract, which is afterwards evaporated to a proper consistence. Lest the ether decanted from the extract after distillation should leave a small portion of narcotine in the mass, this is to be dissolved in distilled water, and on filtering, small crystals of narcotine mixed with a pulverulent extractive matter will be found on the filter, insoluble in the small quantity of water employed to take up the extract. Evaporation must be again performed in order to reduce the extract to its ordinary form. The extract of opium thus obtained may be regarded as entirely deprived of narcotine. It has a powerful attraction for the humidity of the atmosphere; is easily dissolved in water, which it colours much less than the ordinary extract, and leaves no deposition of extraneous matter. A digester may also be used for the purpose of obtaining by means of ether the pure extract of opium.

ACTION ON THE ANIMAL SYSTEM.

This extract is employed in the same manner as the watery extract of opium. I have tried it upon animals, and it appears to me truly narcotic, and its effects exactly similar to those of morphine, but less powerful.

I have also employed it with advantage in practice, particularly on a young Greek physician, who suffered great inconvenience from the common extract.

This new preparation of opium appears to me worthy the attention of practitioners.

NEW IMMEDIATE PRINCIPLES OF OPIUM.

Since the discovery of the substances in opium which we have already signalized, new analyses have made us acquainted with other principles; these are, *narceine*, *meconine*, and *codeine*. We shall examine successively these three substances, one of which deserves to rank amongst the most powerful therapeutic agents.

NARCEINE AND MECONINE.

Narceine was discovered in 1832, by M. Pelletier, and meconine about the same time by M. Couerbe. We unite these two substances, because they are frequently found together, and the process for obtaining the one serves also to obtain the other, although their characters are not exactly similar.

They are procured from the ammoniacal waters in which morphine is precipitated in the following manner: these waters are concentrated under the form of a thick syrup, which is placed in a cellar for several weeks, until it deposit a considerable mass of granular crystals. The crystallized deposit is then separated, pressed, and treated with boiling alcohol at 40°. By distilling the *alcoholate*, we have a crystallized yellowish residue, which is again pressed, redissolved in alcohol, and filtered upon animal charcoal in order to obtain it pure and white.

The great mass of crystals that we obtain in this way, is composed of *narceine* and *meconine;* treat with boiling water, that the little narcotine sometimes contained in it may be separated, and finally with ether, which dissolves the meconine without touching the narceine.

CHEMICAL PROPERTIES OF NARCEINE.

Narceine is white and inodorous; it crystallizes in long, delicate needles very much attenuated; its taste is slightly bitter and somewhat metallic. It dissolves in 230 parts of boiling water, and in 375 parts of cold water. It fuses at 92° *cent.*, and at a higher temperature it is decomposed.

The principal characters of narceine, are those which it presents in combination with acids. Concentrated, they entirely change its nature, especially by the aid of heat. Diluted with half their weight of water, they combine with it, and produce most extraordinary changes of colour. The moment the two bodies come in contact, a beautiful blue colour is produced; and if the water is absorbed by means of chloride of calcium, or chloride of magnesia, we obtain

a fine rose colour. This singular property exhibited by narceine, has induced M. Couerbe to name it the "*vegetable cameleon.*" Nitric acid transforms it into oxalic acid.

Narceine has been analyzed by M. Pelletier, who finds it to be composed of;

		atomic.	comp.
Carbon	54.73	= 16	54.08
Azote	4.33	= 1	3.92
Hydrogen	6.52	= 24	6.62
Oxygen	34.42	= 8	35.37

ACTION OF NARCEINE UPON ANIMALS.

Two grains of this substance injected several times into the jugular vein of dogs, produced no appreciable results.

CHEMICAL PROPERTIES OF MECONINE.

Meconine is white, and crystallizes in six-sided prisms, two of which are larger and parallel. It fuses at 90°, and when fused resembles a colourless liquid. It distils at 155°, and is soluble in water, but much more so in hot than in cold. Eighteen parts of boiling water, and 265 parts of cold water, are required to dissolve one part of meconine. Alcohol and ether dissolve meconine extremely well. The alkalies dissolve it without presenting any remarkable phenomena.

Cold sulphuric acid dissolves it without changing its colour, but by the aid of a moderate heat, the mixture quickly assumes the fine tint of chlorophylle *.

Nitric acid does not transform it into oxalic acid, but rather into a new acid body which is composed of;

Carbon	49.76
Azote	9.50
Hydrogen	4.78
Oxygen	35.96

This composition M. Couerbe has represented by 3 atoms of ammonia and 3 atoms of succinic acid, and of an organic matter which would have for its formula 6 atoms

* The green matter of the leaves of plants. Kraus proposes to call it Phyllochlor. *Tr.*

of carbon and 1 atom of oxygen. The following is the formula;

$$A_z^3\ H^9 + C^{12}\ H^{12}\ O^9 + C^6\ O^1.$$

Chlorine also acts with energy upon meconine at the temperature at which it begins to fuse, making it of a fine blood red colour, and at last transforming it into a new acid, which the discoverer has named *mechloïc* acid, and which has not been analyzed.

Meconine is composed of

Carbon	60.247
Hydrogen	4.756
Oxygen	34.997

Which gives for the atomic formula,

$$C^9\ H^9\ O^3.$$

ACTION OF MECONINE UPON THE ANIMAL SYSTEM.

I have injected at different times, an aqueous solution of a grain of meconine into the jugular vein of a dog, and I have not witnessed any remarkable phenomenon. I do not conclude from this that it is without activity, but, if it has any decided action on the animal economy, a much higher dose will be requisite than any which I have employed. I have not tried this substance upon man.

CODEINE.

Codeine was discovered in 1832, by M. Robiquet. The history of its discovery is so curious, as to authorize my saying a word or two respecting it.

Dr. Gregory, of Edinburgh, adopted a peculiar method for extracting morphine: he macerated the opium according to custom in a sufficient quantity of water, and having drawn off the clear solution, he treated it with muriate of lime (chloride of calcium). The meconic acid is by this means separated from the morphine, and precipitated in combination with the lime, under the form of meconate.

By concentrating the liquors, we easily obtain crystals of hydrochlorate of morphine. It is the salt thus obtained which is still employed in Scotland.

M. Robiquet, who repeated the experiments of Gregory, not having found a decided advantage in the quantity of the product, and the morphine which he obtained not exhibiting the usual characters of a muriate, suspected a mixture in the salt of Gregory, and with his usual sagacity, investigated the cause of this singular phenomenon. He found it in a new substance, crystallizing in fine prisms, soluble in water, ether, and alcohol, and possessing alkaline properties of a very energetic nature. This was *codeine*.

This substance may be easily obtained by decomposing the salt of Gregory, which is a double muriate of morphine and codeine, by means of ammonia: the greater part of the morphine is precipitated, and the codeine remains united to the ammoniacal salt with the morphine which escaped precipitation. The solution separated from the precipitate is then concentrated, until the chloride-hydrate of ammonia gives signs of crystallization; the liquors are left to themselves in quiet, and the double salt of morphine and codeine crystallizes. We purify the crystals thus obtained, by dissolving them in water and filtering the solution over animal charcoal; then add a solution of caustic potass in trifling excess, so as to hold the morphine in solution, and to precipitate the codeine alone, which may be taken up again by alcohol or ether, in order to have it perfectly crystallized.

M. Berthemot, a young chemist of great merit, employed another method, at the same time that he was occupied conjointly with M. Robiquet in the analysis of opium. He precipitated the double muriate of which we have spoken, by means of magnesia, and then for the first time, codeine was detected by this observer, under the form of oil, which passed into an hydrate, and transformed itself into crystals of codeine in the mother-water of the magnesian precipitate.

Codeine has been subjected to some clinical experiments by MM. Kunkel, Gregory, and Barbier. Unfortunately,

the results are so contradictory that it is impossible to admit them without great restrictions; perhaps the experiments have not been conducted with that regularity which is desirable, and above all, they may not have been sufficiently varied. I shall restrict myself to the detail of my own observations, which differ in more than one respect from those which have been made public *.

CHEMICAL PROPERTIES OF CODEINE.

Codeine is insoluble in alkaline solutions; it combines with acids, saturating them, and forming salts which are precipitated by gall-nuts. Nitric acid does not redden it, and muriate of iron assumes no particular colour with this substance. This new production is rendered curious by the geometrical forms which it presents, and it is very desirable that chemists should continue their investigations respecting it, for it will be readily seen, after what we have stated, that it is not rich in remarkable chemical characters.

The elementary analysis of this substance by M. Robiquet gives the following atomic results;

$$C^{31}\ A^{2}\ H^{40}\ O^{5}.$$

Direct experiment gives, for 100 parts;

Carbon	71.339
Azote	5.353
Hydrogen	7.585
Oxygen	15.723

PHYSIOLOGICAL PROPERTIES OF CODEINE.

A grain of codeine dissolved in a small quantity of distilled water, and injected into the jugular vein of a dog of moderate size, induced almost immediately a profound sleep, which was, nevertheless, suddenly interrupted by an

* M. Barbier says that codeine *is remarkable for its special action on the ganglionic nerves, and especially upon those of the epigastric region.* (See *Gazette Medicale.* April, 1834). If M. Barbier can prove what he advances, he has made one of the most important discoveries in modern physiology. In our ignorance of all that is connected with the functions of the ganglionary system, a fact of this nature may lead to the most novel and important results.

intense bruit. This disturbance, however, was of very short duration, and profound and uninterrupted sleep rapidly supervened. The animal continued in this state for several hours, without any other inconvenience.

It was not the same with the hydrochlorate of codeine: one grain only of that substance dissolved like the preceding, and injected in the same manner into the jugular vein, quickly produced sleep; but the animal after sleeping five or six hours was found dead.

Numerous experiments of the same kind have been followed by similar results, which are not of a nature to dissipate the idea of codeine becoming a useful medicine.

ACTION OF CODEINE IN DISEASE.

For the space of twelve months, I have given codeine to a great number of patients in the Hotel-Dieu, and I have found that a grain taken in one or two doses is sufficient in general to produce calm and tranquil sleep, not succeeded the next day by drowsiness and head-ache, as sometimes happens after the exhibition of morphine. From several comparative experiments which I have instituted, it appears that one grain of codeine corresponds in intensity of action, with half a grain of pure morphine.

Two grains of codeine have often excited nausea, and even vomiting. Even in the dose of one grain, many patients have besought me to discontinue the remedy which, they say, makes them sleep too much.

SALTS OF CODEINE.

The hydrochlorate, which I have frequently employed, exhibits an activity sensibly greater than that of codeine itself. Generally, two grains induce sleep, vertigo, nausea, and even vomiting. But in this dose, I have seen facial and ischiatic neuralgiæ, which had resisted all other means, disappear as if by enchantment. I am thus enabled to contradict the assertion of my fellow-practitioner, Barbier of Amiens, who has denied the efficacy of codeine in cases of neuralgia.

From these few observations, it is evident that codeine and its salts claim the particular attention of the faculty.

CASES IN WHICH CODEINE MAY BE TRIED.

Like morphine, codeine may be employed in all cases where it is of importance to assuage pain and to procure sleep; but having less activity than morphine, it is well to make trial of it before resorting to the latter remedy.

MODE OF EMPLOYING CODEINE.

I add codeine in the quantity of one, two, or three grains to a julep or linctus. I also frequently give it to the same extent in pills, each containing but one grain.

MODE OF EMPLOYING THE SALTS OF CODEINE.

The salts of codeine are employed in the same manner as the substance itself; but these salts, like those of morphine, being more active than their base, the dose must be somewhat less. I have only tried as yet the hydrochlorate and the nitrate.

Several patients who have exhausted the narcotic action of morphine and that of its salts, have found the most beneficial results from codeine, alternately with the nitrate or hydrochlorate of that vegetable base.

DOUBLE MURIATE OF MORPHINE AND CODEINE.

(SALT OF GREGORY.)

After all that has been said of the immediate principles of opium, we have not mentioned a particular salt discovered by Gregory; but in reading the article *Codeine* attentively, one cannot help seeing, that the salt is easily obtained by treating a concentrated infusion of opium with a strong solution of muriate of lime, which decomposes the opium in solution, by giving birth to a precipitate of meconate of lime, and to a solution of a double salt of morphine and codeine, or salt of Gregory.

Filter, in order to separate the solution from the meconate of lime, strain the liquor over animal charcoal,

and set it by in a convenient place, that it may crystallize in the form of needles.

If the salt be not sufficiently pure, we must cause it to undergo a second purification, by redissolving it in water and crystallizing anew.

MODE OF EMPLOYING THE SALT OF GREGORY.

This salt may in certain cases be substituted for morphine and codeine, and may consequently be employed under the same circumstances.

EMETINE.

In a memoir laid before the Académie des Sciences, in 1817, M. Pelletier and myself established, by a series of chemical and physiological experiments, that the different species of ipecacuanha owe their emetic properties to a peculiar immediate principle, which M. Pelletier has denominated *emetine;* and that this substance, being much more active than ipecacuanha, without possessing its disagreeable taste or nauseous odour, might upon all occasions be substituted for it with advantage. The nauseous odour of the ipecacuanha resides in a fatty matter, which has not the property of exciting vomiting; for M. Caventou has taken it to the extent of six grains with impunity.

M. Boullay has detected emetine in the root of the violet (*viola odorata*): he has named it *violine* or *indigenous emetine*.

We are informed that M. Torreri has also found emetine in the root of the Florentine iris, but as yet we know nothing positive on this point.

PREPARATION OF COLOURED EMETINE.

Reduce ipecacuanha to powder, and digest it in ether at 60°, to dissolve the odorous fatty matter. When the powder yields nothing more to the ether, exhaust it again by means of alcohol. Place the alcoholic tinctures in a water-bath, and re-dissolve the residue in cold water. It is thus freed from wax, and a small quantity of fatty matter which

still remained: nothing further is necessary but to let it macerate on carbonate of magnesia, to re-dissolve it in alcohol, and to evaporate it to dryness.

Emetine thus prepared is not quite pure, as we at first thought, but it may serve with advantage some medicinal purposes. (See the following article.) It presents itself in the form of transparent scales, of a reddish brown colour; its odour is scarely any; its taste bitter, but not nauseous. This substance will support a degree of heat equal to that of boiling water, without change; it is very deliquescent, soluble in water, and incrystallizable.

PHYSIOLOGICAL PROPERTIES OF EMETINE.

Emetine, given to dogs and cats in the dose of half a grain to two and three grains, produces vomiting, followed sometimes by a long sleep. In a larger dose, 10 grains for instance, it produced upon dogs repeated vomitings, after which the animal fell asleep; but instead of recovering, as in the former cases, where emetine was given in a small dose, death ensued in about twenty-four hours. On opening the body, the cause of death was found to be a violent inflammation of the pulmonary tissue, and of the mucous membrane of the alimentary canal, from the cardia to the anus. These phenomena have the greatest analogy with those produced by emetic tartar, and described by me in a special memoir*.

The results are the same, if emetine be injected into the jugular vein, or simply absorbed into any part of the body.

ACTION OF EMETINE UPON MAN IN A STATE OF HEALTH.

Two grains of emetine taken on an empty stomach, give rise to protracted vomiting, following by a decided disposition to sleep. Sometimes a quarter of a grain is sufficient to produce vomiting.

ACTION OF EMETINE ON MAN IN A STATE OF DISEASE.

The action of emetine in this case, is perfectly analogous to that which takes place on a man in a state of health. It

* De l'Influence de l'Emetique sur l'homme et les animaux. Paris, 1813.

both vomits and purges; but certainly exerts a beneficial influence in catarrhal affections, particularly those of a chronic kind *.

ACTION OF VIOLINE UPON ANIMALS.

M. Orfila has made some experiments upon animals with the extract of violine prepared by M. Boullay; and he states that this substance is endowed with physiological properties similar to those of emetine.

ACTION OF VIOLINE UPON MAN.

M. Chomel has administered six to twelve grains of violine in three separate doses, to nine patients. In six of them vomiting was produced, and two only experienced a slight purgative effect. One of these persons, who was affected with diarrhœa, had a cessation of the flux after the third dose; and two of them were affected neither with vomiting nor purging. Administered pure to two other patients, in the dose of three grains and a half, at three times, it excited no vomiting in the first patient, but merely liquid evacuations. The second only vomited once; and a third dose of two grains produced neither vomiting nor purging.

CASES IN WHICH EMETINE MAY BE EMPLOYED.

They are the same as those for which ipecacuanha is used.

EMPLOYMENT OF EMETINE.

To procure vomiting by means of emetine, four grains must be dissolved in some vehicle, and the solution given in repeated doses. If the whole quantity be administered at once, vomiting will be excited in the first instance, which will expel the medicine from the stomach without producing any other effect.

The following mixture may be used.

EMETIC MIXTURE.

Coloured emetine	4 grains.
Weak infusion of orange-flowers ..	2 onces.
Syrup of orange-flowers	½ once.

* See Recherches chimiques et physiologiques sur l'ipecacuanha, par MM. Majendie et Pelletier. Paris, 1817.

Five *gros* to be taken every half hour.

In chronic pulmonary catarrhs, hooping-cough, and obstinate diarrhœas, I have frequently employed the following lozenges, which may be advantageously substituted for the common ipecacuanha lozenges.

PECTORAL LOZENGES OF EMETINE.

Sugar	4 onces.
Coloured emetine	32 grains.

Form into lozenges of 9 grains each.

It is usual to give these lozenges a rose colour, to distinguish them from similar preparations of ipecacuanha. A little carmine may be used for this purpose. One of them may be given every hour; if repeated oftener they will excite nausea.

EMETIC LOZENGES OF EMETINE.

Sugar	2 onces.
Coloured emetine	32 grains.

Form into lozenges of 18 grains each.

One of these lozenges taken fasting is commonly sufficient to make a child vomit. Three or four will quickly excite vomiting in an adult.

The syrup of ipecacuanha of the shops may be replaced by the following:

SYRUP OF EMETINE.

Simple syrup	1 livre.
Coloured emetine	16 grains.

This syrup is used under the same circumstances and in the same manner as the syrup of ipecacuanha.

PURE EMETINE.

The emetine of which we have spoken hitherto, is by no means in a state of purity; it is to pure emetine what moist sugar is to white and crystallized sugar. M. Pelletier, during a course of chemical research, which is not yet

completed, has entirely isolated the active matter of the ipecacuanhas. This matter is a new vegetable alkali, the principal characters of which are as follow :—

PREPARATION OF PURE EMETINE.

To obtain pure emetine it is necessary to substitute calcined magnesia for the carbonate *; a sufficient quantity of that base being added to take up the free acid that exists in the liquor, and also that which is combined with the emetine.

The emetine thus isolated and rendered less soluble, is precipitated in combination with the excess of magnesia. The magnesian precipitate, washed with a little very cold water, (which takes up the colouring matter not combined with the magnesia,) must be carefully dried and treated with alcohol, which dissolves the emetine. This being again obtained by evaporating the alcohol, should be redissolved in diluted acid and treated with purified animal charcoal. After this process, which is employed to discharge the colour, we must precipitate by means of a salifiable base.

The waters used to wash the magnesian precipitate, still contain emetine, which may be separated by another series of operations. Nevertheless some emetine always remains in combination with the magnesia, which renders this method more difficult and less advantageous than it otherwise would be.

METHOD PURSUED BY M. CALLOUD FOR OBTAINING EMETINE.

The mode which we have pointed out above, consists in exhausting the ipecacuanha by ether submitted to the action of heat, afterwards treating with strong boiling alcohol, which dissolves the gallate of emetine and the other soluble principles; we then distil. The matter left in the water-bath, evaporated almost to dryness, is dissolved in cold water; by this means, it is deprived of a little wax

* See p. 399.

and fatty matter: the liquid is treated with an excess of magnesia, which decomposes the gallate of emetine, and combines with the colouring matter; the emetine is then taken up by means of rectified alcohol.

The method of M. Calloud is as follows*: it very much resembles that of M. Henry for obtaining sulphate of quinine.

Take 125 *grammes* of the cortical part of ipecacuanha reduced to powder: mix it with 800 *grammes* of water, acidulated with 16 grains of sulphuric acid: raise the mixture to the point of ebullition, and keep it a little below that temperature for half an hour, stirring it constantly with a wooden spatula; then let the whole be poured into a shallow earthen vessel, so as to present the greatest possible surface.

This acidulated decoction is then left to cool, and to it are added 125 *grammes* of lime pulverised, or reduced to the consistence of a jelly by adding a sufficient quantity of water, and afterwards left to dry on a stove at a temperature not exceeding 50° of Reaumur.

Pulverise the mass, which is composed of sulphate of lime, gallate of lime, fatty and colouring matter combined with an excess of lime, free emetine, fecula and lignin. On submitting this to the action of boiling alcohol (at 36° or 38°), the emetine is dissolved, together with a small quantity of foreign matter, and may be subsequently obtained by evaporating the alcohol.

To render the emetine perfectly white and pure, it must be dissolved in water slightly acidulated; then treated with pure animal charcoal. Filter the solution that it may be more conveniently concentrated; saturate the acid with weak ammonia; filter; wash with a little distilled water, and let the residuum dry upon the filter at the ordinary temperature and in the dark. This will be pure emetine.

Emetine may be procured from the mother-water and washings by the means already described.

* See Memoirs de la Société academique de Savoie, Tom. 1er, p. 218. Chambery, 1825.

PHYSICAL AND CHEMICAL PROPERTIES.

Pure emetine is white, sometimes with a slight yellowish tinge, pulverulent, not acted on by the air; while coloured emetine is deliquescent. This substance is slightly soluble in cold water; rather more so in warm water: but it is completely dissolved by ether and alcohol. Its taste is slightly bitter. It is very fusible, melting at about 50° of the centigrade. It restores the blue colour of turnsol reddened by an acid: it dissolves in all the acids, diminishing, but not entirely dissipating their acidity. It forms with them salts that are evidently crystallizable: in this respect it resembles veratrine. It is precipitated from its combinations by gall-nuts, like the alkalies of cinchona, so that in case of poisoning by emetine, gall-nuts would be the only antidote. M. Caventou swallowed a dose more than sufficient to produce violent vomitings, but neutralized its action by means of a decoction of gall-nuts.

M. Pelletier has analysed the different species of ipecacuanha, and has detected emetine in the following proportions;

Cephaëlis ipecacuanha. Richard.

Grey Ipecacuanha of M. Merat.

The cortical part of the root contains;

Odorous fatty matter	2
Emetic matter proper to ipecacuanha, *emetine*	16
Wax	6
Gum	10
Starch	42
Lignin	20
Loss	4
	100

The ligneous part contains;

Emetic matter, *emetine*	1.15
Extractive matter not emetic	2.45
Gum	5
Starch	20
Lignin	66.60
Fatty matter—traces.	
Loss	4.80
	100.00

It is obvious from these two analyses that the greater activity of the cortical part of ipecacuanha, compared with that of the ligneous part, is owing to the much greater proportion of emetine contained therein.

Ipecacuanha of the reddish grey kind, deprived of its ligneous part, has been found by M. Pelletier to be composed of;

Fatty matter	2
Emetine	14
Gum	16
Starch	18
Lignin	48
Loss	2
	100

Striated Ipecacuanha of M. Merat *(radix psychotriæ)*.

Emetic matter	9
Fatty matter	12
Lignin, gum, starch	79

White Ipecacuanha *(radix richardsonæ)*.

According to M. Pelletier, this root contains in 100 parts, six parts of emetic matter, two of fatty matter, and very little lignin.

Spurious Ipecacuanha *(viola ipecac.)*.

M. Pelletier has found in 100 parts of this root;

Emetic matter	5
Gum	35
Azotized matter	1
Lignin	57
Loss	2
	100

We see then, that the activity of these substances is in a direct ratio with the quantity of emetine they contain.

MM. Dumas and Pelletier have found pure emetine procured from the *cephaëlis emetica*, to be composed of;

		at. comp.
Carbon	64.57	= 37
Azote	4.00	= 2
Hydrogen	7.77	= 54
Oxygen	22.95	= 10
Emetine	99.29	

ACTION OF PURE EMETINE ON THE ANIMAL SYSTEM.

It is the same as that of the coloured emetine, but much more powerful. Two grains are sufficient to kill a large dog. I have seen vomiting produced by $\frac{1}{10}$th of a grain in a man aged 85, in whom, however, vomiting was easily excited.

EMPLOYMENT OF PURE EMETINE.

I have for some time used lozenges prepared in the following manner;

LOZENGES OF PURE EMETINE.

Sugar	4 onces.
Pure emetine	8 grains.

Divide into lozenges of 9 grains each.

In order to produce vomiting, one grain of pure emetine must enter into the mixture employed; and as this substance is scarcely soluble in water, it will be requisite first to dissolve it in a little acetic or sulphuric acid.

The following formula has been successfully employed:

Emetic Mixture.

Infusion of lime flowers	3 onces.
Pure emetine, dissolved in acetic acid	1 grain.
Syrup of marshmallows	1 once.

Dose.—Five *gros* every quarter of an hour until vomiting is produced.

Or a syrup may be prepared in the following manner:

Clarified syrup	1 livre.
Pure emetine	4 grains.

which may be given in doses of 5 grammes.

ALKALIES OBTAINED FROM CINCHONA BARK.

MM. Laubert, Rheuss of Moscow, and Gomez of Lisbon, published, a few years ago, and almost at the same time, some interesting enquiries respecting the cinchonas; but they did not agree as to the principle in which the febrifuge property resided. MM. Pelletier and Caventou, led by their preceding researches to believe that such a principle did exist, made every effort to discover it: and following the same course which they had so happily pursued in the discovery of strychnine, emetine, &c., they obtained a substance which they recognized as that which M. Gomez had described under the name of *cinchonine*. They also discovered that it was alkaline—a very important property, which had escaped the Lisbon chemist.

It was in the course of their experiments upon the grey bark *(cinchona condaminea)*, that they obtained the cinchonine. They thought it right thus to change the termination, to make the name harmonize with that of the other vegetable alkalies.

The yellow bark *(cinchona cordifolia)* furnished an alkali, which, although it resembled the first in many points, differed in too many remarkable properties to allow of their being confounded. The latter therefore they named *quinine*.

The analysis of the red bark *(cinchona oblongifolia)* was next undertaken. It was an interesting question to determine whether this species, considered by many physicians as eminently febrifuge, contained cinchonine, quinine, or a third alkaline principle. The result was unexpected; they obtained cinchonine in every respect similar to that from the grey bark, but in a threefold quantity; and of quinine almost double what they had procured from an equal portion of yellow bark. Besides this, the quinine yielded by this variety (its greater fusibi-

lity, and the appearance of the sulphate excepted,) exhibited all the characters of the other. Further investigations made upon large quantities of bark, have shewn that quinine and cinchonine exist simultaneously in all the three species of cinchona: but in the grey bark the proportion of cinchonine is much greater than that of quinine. The reverse is the case in the yellow bark, where the quinine so predominates, that it is not astonishing the other should be overlooked when only small quantities are examined. Dr. Michaelis*, of Magdebourg, has analysed several species of cinchona, and determined the proportions of cinchonine and quinine which are contained in a pound of each sort.

	Cinchonine.	Quinine.	Total.
China rubra	32 grains	64	96
—— loxa	18	8	26
—— fusca	—	75	75
—— —— Huanuco	50	32	82
—— —— superf. Huanuco	74	28	102
—— —— superf. Huamalies	—	12	12
—— —— Huamalies	48	28	76
—— —— —— infer.	60	34	94
—— —— Tenn superf.	12	44	56
—— —— —— mediocre	12	80	92
—— —— Carthagena	28	48	76
—— regia (in rolls)	—	154	154
—— —— (in fragments)	—	286	286

PREPARATION OF CINCHONINE AND QUININE.

The cinchonine is first deprived entirely of its bitterness by means of boiling alcohol: distillation is then to be performed in a water-bath to dryness. The alcoholic extract is to be entirely dissolved in boiling water strongly impregnated with hydrochloric acid; then add a large quantity of calcined magnesia, in order to fix the red colouring matter, and to clarify the liquor, which will be accomplished by a few minutes' ebullition. When cold, throw it on a filter, and wash the magnesian precipitate with cold water: dry

* Journal der Practischen, April, 1824.

it on a stove, then treat at different times with boiling alcohol, until the bitterness be entirely removed. Finally, collect the alcoholic liquors, and the cinchonine will crystallize as the fluid cools. The cinchonine thus obtained is still adulterated with a green fatty matter, which may be separated by solution in very dilute acid. If the acid be too strong, it will dissolve a part of the fatty matter, and the object will be thus defeated.

Quinine may be obtained from the yellow bark by a similar process to that already described.

We have observed that cinchonine and quinine are found in three species of cinchona. They may be procured by a single process in the following manner.

Having obtained the sulphate of quinine, (by the method hereafter to be described,) unite the mother-waters, and those which result from the washing, since they contain the sulphate of cinchonine. Until lately this was supposed to be sulphate of quinine, rendered incrystallizable by the yellow matter and a portion of the fatty matter, which it is true are found in those liquors. Having collected these waters, they are decomposed by magnesia or lime. The magnesian precipitate, washed and well dried, is treated with boiling alcohol, which dissolves the quinine and the cinchonine. But in this case the cinchonine being predominant, crystallizes, at least if the liquor be sufficiently charged with it; if not, it must be a little concentrated. The cinchonine thus obtained should be purified by renewed crystallization. For this purpose let it be dissolved in a sufficient quantity of boiling alcohol: it will thus be obtained quite pure. The alcoholic mother-waters contain quinine, which may be separated by evaporation.

In a work recently published by MM. Henry and Plisson, these chemists state that they have extracted immediately from the barks, the *quinates of quinine and of cinchonine:* they also express a very probable opinion that in the cinchonine a part of the febrifuge alkalies is combined with the red colouring matter of Rheuss.

MM. Henry and Plisson have obtained the quinates of quinine and cinchonine by the following process:—they

treat with cold water the product of the aqueous decoction of the grey or yellow bark, reduced to the consistence of a syrup. The clear liquor placed in contact with hydrate of lead until it is saturated and colourless, is filtered, and then deprived of the metallic oxide by means of a current of hydrosulphuric acid gas. The new liquid, being filtered, is saturated with small portions of chalk, reduced to the consistence of a syrup, and treated repeatedly with alcohol: the alcoholic liquors are then left to spontaneous evaporation. These quinates crystallize obviously in an irregular form, but the process is rather tedious.

The compound of the red matter of Rheuss with the febrifuge alkalies is almost insoluble in water, but soluble in weak acids by heat, without being sensibly decomposed; and on cooling it is precipitated as a reddish powder. Alcohol readily dissolves it, and from the alcoholic tincture treated with water, it is deposited in red, orange, or bluish flakes. The alkalies decompose this combination by uniting with the colouring matter, and setting the alkaloid at liberty. MM. Henry and Plisson have from these facts made several inferences which tend to explain that which takes place in many pharmaceutical preparations of cinchona, and which agree with those already made by MM. Caventou and Pelletier. They have also proposed to make the quinates of quinine and of cinchonine quite pure in a direct manner, and to employ them in medical practice.

CHEMICAL PROPERTIES OF CINCHONINE.

Cinchonine is white, transparent, crystallizable in the form of needles, and soluble only in 700 parts of cold water, whence its weak taste. Dissolved in alcohol, or rather in an acid, its taste is very bitter, exactly resembling that of the grey bark. It is but slightly soluble in fixed and volatile oils and sulphuric ether; it unites with acids, and forms salts more or less soluble, some of which crystallize freely. Cinchonine is volatilized at a certain temperature. The greater part of the substance, it is true, is destroyed in

this operation, but a sensible portion escapes the decomposing action of caloric.

Both the sulphate and the acetate of cinchonine are employed in medicine. The first of these salts is very soluble in water; the second much less so, but an excess of acid dissolves it readily. The acetate of cinchonine will not crystallize: besides this it is a granular powder, which serves to distinguish it from quinine, the acetate of which forms beautiful silky crystals.

CHEMICAL PROPERTIES OF QUININE.

Quinine is white; and although it did not appear to be crystallizable by solution, MM. Dumas and Pelletier have succeeded in making it assume a crystalline texture by submitting it to igneous fusion in vacuo, and leaving it to cool slowly. When this is accomplished, instead of preserving its resinous aspect and transparency, it contracts, becomes opaque, and forms on its surface centres of crystallization, which, radiating in all directions, produce an undulated appearance. The fracture of the mass is also crystalline. M. Pelletier has lately succeeded in crystallizing quinine in delicate silky tufts, by leaving undisturbed an alcoholic solution of very pure quinine *. Like cinchonine, it is almost insoluble in water, but its taste is much more bitter. Its salts are in general still more bitter, and they are distinguished by a pearly silky appearance. Quinine is very soluble in ether, while cinchonine is almost insoluble in that substance, which affords a means, not only of distinguishing these bases, but also of separating them when they are found united. Quinine, when fused, becomes idio-electric, and assumes the resinous electricity with great intensity when rubbed with a piece of cloth.

MM. Dumas and Pelletier have obtained for the mean composition of quinine the following results;

Carbon	75.00
Azote	8.45
Hydrogen	6.66
Oxygen	10.40

* Journal de Pharmacie, June, 1825.

A more recent analysis of M. Liebig gives the following proportions ;

Carbon	75.76
Hydrogen	7.52
Azote	8.11
Oxygen	8.61

Whence we derive the formula $C^{20}\ H^{24}\ A_z^2\ O^2$, which gives 2055.538 for the atomic weight of quinine.

M. Liebig has investigated in another way the equivalent of this alkali, by observing the quantity of hydrochloric gas which it is capable of absorbing and saturating; and he has found that 100 parts of quinine saturate 24.1 of hydrochloric acid gas, which gives the number 1900 as the equivalent of the quinine.

Another experiment on a basic sulphate has afforded M. Liebig the cipher 4300, which, divided by two, almost corroborates the result of the elementary analysis.

MM. Dumas and Pelletier have been engaged for some years in the analysis of cinchonine, which they have found to be thus composed :

Carbon	76.97
Azote	9.02
Hydrogen	6.22
Oxygen	7.97
Cinchonine	100.19

M. Brande * has obtained from his analysis of cinchonine a very different result, viz.

Carbon	79.30
Azote	13.72
Hydrogen	7.17
Cinchonine	100.19

M. Liebig, who has of late been deeply engaged in investigating the elementary composition of the vegetable alka-

* Annals of Philosophy, April, 1824.

lies, has obtained the following as the composition of cinchonine;

Carbon	77.81
Azote	8.87
Hydrogen	7.37
Oxygen	5.93

The atom determined by the capacity of absorbing hydrochloric gas, is equal to 1005.1, a number which comes very near that presented by the formula $C^{20}\ H^{22}\ N^{2}\ O^{2}$, and which is equal to 1942.051. The formula is derived from the numbers which represent in toto the composition of cinchonine.

PREPARATION OF SULPHATE OF QUININE.

M. Henry, jun. has made known an expeditious and economical method for directly obtaining the sulphate of quinine. He treats the bark three times with hot water acidulated with sulphuric acid (in the proportion of fifty grammes to a kilogramme of the bark); filters through close linen, removes the colour by means of slaked lime, and washes the precipitate in order to separate the excess of lime. This being well drained, is dried, reduced to a fine powder, and repeatedly digested in alcohol at 36°. The alcoholic tinctures are collected in an alembic, which is placed in a water-bath; he then distils to $\frac{8}{9}$ to recover the spirit of wine, which will serve for future operations; and the residue consists of a brown, viscous, bitter substance, composed chiefly of impure quinine. This mass, exposed to heat, is treated with water impregnated with sulphuric acid even to saturation; then passed through filtering-paper, and the liquid when cool yields crystals of sulphate of quinine, which a second solution and crystallization render perfectly pure. The same method has been employed for extracting the sulphate of cinchonine from the grey bark, and with equal success. The sulphate of quinine thus obtained presents itself in the form of white crystals, quite soluble in water, little soluble

in cold, but more so in hot water, especially when somewhat acidulated.

Sulphate of quinine possesses a very remarkable property, observed for the first time by Calloud of Annecy: exposed to a temperature of 100°, it becomes luminous, especially if submitted to a slight friction. MM. Dumas and Pelletier submitted about two or three ounces of sulphate of quinine, enclosed in a glass flask, kept in a water-bath for about half an hour, to the temperature of boiling water. It then gave out by friction an intense white light. Upon introducing through the cork of the flask a metallic rod terminated in a point at the inferior extremity, and with a ball at the other, these gentlemen, on approximating the ball to the knob of Volta's electroscope, and shaking the flask before each contact, obtained all the repulsion of which the straws of the electroscope are susceptible. The electricity developed is always of the vitreous kind. The sulphate of cinchonine is possessed of the same phosphorescent and electrical properties, but in an inferior degree.

From the principle established by the experiments of MM. Pelletier and Caventou, that pure water is incapable of exhausting the cinchonas of their quinine and cinchonine, M. Guerette, apothecary in chief at the Hospital of Toulouse, and several other chemists, instituted some new experiments on the subject, and found that the barks, after being subjected to decoction, and rejected as useless, might furnish nearly two thirds of the quinine and cinchonine they contained in the virgin state. Consequently, it is advantageous to preserve these residues for the sake of obtaining febrifuge salts. According to MM. Henry and Plisson it is a sparingly soluble combination of quinine or cinchonine with the red cinchonic matter, which remains in the barks treated with water.

PREPARATION OF THE SUPER-SULPHATE OF QUININE.

M. Robiquet, by pursuing a somewhat different method, obtained a sulphate which possessed characters not exactly

the same as those we have described. It is transparent, in solid prisms, of a flattened quadrangular form, distinctly terminated, and soluble even in the cold. Anxious to know the cause of this difference, M. Robiquet submitted the two sulphates to a comparative examination, and discovered that the solution of the prismatic sulphate was acid, while the other was alkaline. He satisfied himself of the stability of these characters; for, after several crystallizations the salts remained unchanged, while the subsulphate lost each time a small portion of its acid. Besides which, M. Robiquet found, that if he constantly obtained the supersulphate, it was owing to this circumstance—that in treating the quinine with water, he only succeeded in dissolving it by means of a slight excess of acid, whereas if alcohol was employed, (quinine being easily soluble in alcohol,) no more acid need be added than was necessary for saturation.

COMPARATIVE ANALYSIS OF THE TWO SULPHATES OF QUININE.

M. Robiquet, in the work already mentioned, has given an analysis of the two sulphates; and having remarked that by each crystallization the subsulphate parts with a portion of its acid, he thought it his duty to make known the composition of this salt after the first and the third crystallization.

100 Sulphate of Quinine	Acid	63.5	82.6
	Quinine ...	19.1	
100 Sub-sulphate, 1st crystallization..	Acid	11.3	90.3
	Quinine ...	79.0	
100 Sub-sulphate, 3d crystallization ..	Acid	10.0	90.9
	Quinine ...	80.9	

It is probable, however, that M. Robiquet did not obtain the subsulphate quite pure, for we know from the experiments of Pelletier and Caventou, and from those more recently made by M. Baup *, that what he denominates

* Ann. de Phys. et de Chim. Vol. 27, November, 1824.

subsulphate of quinine always presents itself in uniform proportions, at least in its hydrated state.

M. Baup considers the common sulphate of quinine as a neutral salt. He thinks also, very justly, that for therapeutical purposes it would be better to employ the efflorescent sulphate, the composition of which is uniform. Indeed, if the neuter sulphate is kept in a damp place, it only contains 76 for 100 of quinine. If, on the contrary, it is kept in a dry place, and enclosed in a badly stopped bottle, it may contain even 86 for 100 of the base.

According to Baup, the dry supersulphate of quinine contains

Acid	18.181	100 super-sulphate.
Base	81.819	
Acid	10.000	100 neuter sulphate.
Base	90.000	
Acid	9.57	100 neutral sulphate efflorescent and invariable.
Base	86.12	
Water ...	4.31	

To obtain the efflorescent sulphate of quinine, the ordinary sulphate must be exposed to the open air at a temperature of 20°. Twenty-four hours will be sufficient for the complete efflorescence of the salt, but it will lose nothing by longer exposure.

ACETATE OF QUININE.

This is remarkable for the great facility with which it crystallizes in silky needles: it is slightly soluble in the cold, even when it contains an excess of acid; on cooling it forms an irregular mass.

CITRATE OF QUININE.

M. Caventou has lately prepared citrate of quinine. Citric acid easily dissolves quinine by the aid of heat; this solution retains its transparency, but becomes solid on cooling. This salt perhaps, of all the salts of quinine, approaches nearest in form to the sulphate of that base: it may exist in the state of supercitrate of quinine, and

then it may sometimes be advantageously employed in cases where it is desirable to combine the action of a tonic with that of an antiseptic.

The following is a formula of a syrup which I think may be substituted occasionally for the antiscorbutic syrup.

SYRUP OF SUPER-CITRATE OF QUININE.

Clarified simple syrup	1 livre.
Super-citrate of quinine	36 grains.

Dose.—From five to ten gros in twenty-four hours.

KINATE OF QUININE.

This salt, obtained by the direct combination of quinine, or by double decomposition, crystallizes in small needles, or in nipples radiating from their centre. It is very soluble in water, less so in alcohol at 36°; very bitter, and becomes dry and capable of fusion by continued heat. The quinine is precipitated by ammonia, potassa, and chalk; and the soluble salt yields kinate of potassa or of lime. It contains;

Quinine	0.82
Kinic acid.....	0.08

KINATE OF CINCHONINE.

This salt, prepared like the preceding, is more difficult to crystallize. It must be evaporated almost to dryness, and then it forms small globules, which are the centre of innumerable pearly, radiated, and silky crystals, which give the mass an undulated appearance. This salt is very bitter, very soluble in water, but less so in concentrated alcohol. Decomposed by means of the mineral alkalies, it affords cinchonine, and produces kinates with the base of the metallic oxides. Its composition is;

Cinchonine	0.59
Kinic acid	0.41

MODE OF PREPARING THE KINATES OF QUININE AND CINCHONINE.

It is better to obtain these two kinates by double decomposition. For this purpose, take a solution of sulphate

of quinine or cinchonine, and treat it with alcohol at 34° or 35°; add portions of kinate of lime dissolved in a small quantity of water until precipitation ceases; separate the deposit, and then by evaporation the salt of quinine will be obtained, which must sometimes be crystallized again by solution in water.

Since it is necessary to be acquainted with the preparation of kinate of lime before we can obtain the above, we recommend the following method:—

Take (as in preparing sulphate of quinine) a kilogramme of yellow bark: boil it three times in water acidulated each time with fifty grammes of sulphuric acid. The liquors being strained while still warm, are blanched by a sufficient quantity of *hydrate of lead*, and the whole is filtered. (The deposit treated with alcohol furnishes quinine.) We thus obtain a liquor almost colourless, which is treated with sulphuretted hydrogen or with a few drops of sulphuric acid. Decant carefully, and add to the liquid a slight excess of lime. The quinine and cinchonine of the kinates are precipitated and collected, and the calcareous kinate remaining soluble, is evaporated and crystallized. When it is in the form of a syrup it must be exposed for some days to the air, it then concretes into a mass, which is purified by several solutions and crystallizations. By this means we obtain the kinate of lime pure and perfectly white.

ACTION OF THE ALKALIES OF CINCHONA AND THEIR SALTS UPON ANIMALS.

Scarcely were these alkalies discovered, when M. Pelletier sent me a certain quantity, that I might study their effects upon animals. I soon found that the alkalies as well as their salts were not in the least degree poisonous, and indeed manifested no immediate action. Hence I had no hesitation in trying their medicinal properties.

ACTION ON MAN IN HEALTH AND IN DISEASE.

Numberless observations have led me to consider these two alkalies as possessing the medicinal properties of cin-

chona, and consequently as efficient substitutes for it in all cases. Other physicians, among whom I may mention MM. Double, Villermé, and Chomel, have made the same enquiries, and have arrived at the same conclusion.

It is always highly important for a physician to know precisely the quantity of the active substance contained in the remedy which he employs; this advantage is most conspicuous as respects the cinchonæ, whose activity varies so much with the nature and qualities of the bark. Besides, it is often very fortunate for us to be able to administer this remedy in a very small compass and under a form which is not disagreeable. We have known patients die in malignant fevers because they had not resolution to take a sufficient quantity of the bark in powder; some have been seized with vomiting after the first dose; and others have been attacked with diarrhœa, so that the medicine did no more than pass through the intestinal canal without producing any benefit. In the most favourable cases, the stomach of the patient must necessarily analyze, if we may so speak, the bark introduced, and be able to extract the febrifuge principle: but this is always a difficult and fatiguing operation even for the stomach of the most robust. Chemistry has therefore rendered essential service to medicine by discovering the means of separating before-hand the active principle.

The Académie Royale des Sciences has decreed to MM. Pelletier and Caventou a prize of 10,000 francs for their important labours respecting the cinchonæ. They have also awarded to M. Henry, jun. a sum of 2000 francs for his method, which has tended to lessen the price of sulphate of quinine and to render it an object of commercial industry.

M. Caventou has made us acquainted with the effects which he constantly found to result from the sulphate of quinine during his researches upon cinchonæ with M. Pelletier; he was frequently obliged to taste the liquids containing quinine and cinchonine, and he experienced a general excitement similar to that produced by coffee: the analogy was so striking as to induce him, as well as M.

Pelletier, to analyze coffee, which many physicians recommend in the treatment of fevers. They found in it neither quinine nor cinchonine, but an immediate principle, crystallizable in long white silky filaments resembling amianthus; but they did not prosecute their researches, having learned that one of their colleagues, M. Robiquet, was engaged on the same subject, and had even made considerable progress, designating the new substance by the name of *cafeine*. Cafeine is not an alkaline base, it does not saturate acids, it merely dissolves them and crystallizes. It is an immediate principle, like narcotine.

The employment of the sulphate of quinine is daily becoming more general, and its efficacy in all affections of an intermittent type becomes more and more confirmed. Accounts of intermittent fevers cured by it have been published in all the academical compilations and journals of medicine. Among the different authors who have written upon the subject, we shall mention Dr. Elliotson, late physician of St. Thomas's Hospital, London, who has inserted a very interesting paper in the Medico-Chirurgical Transactions* on the use of quinine and its sulphate. He has obtained the same results from pure quinine as from the sulphate in the cure of intermittent fevers. He has also administered this remedy with advantage in intermittent neuralgia and in typhus. The doses employed by this physician are larger than those we prescribe; his success, however, has been constant. He gives pure quinine in the dose of five grains every six hours; he has even prescribed ten grains at the same intervals without any bad consequences†.

Dr. F. Barker‡, of Dublin, has recorded thirty cases of intermittent fever of various types which were all cured by

* Vol. XII. Part II. for 1824.

† Dr. E. by no means recommends the employment of quinine to such an extent; his words are,—"a dose of ten grains occasioned vomiting in the three only instances in which the medicine was carried to that extent." Again, "five grains of the sulphate every six hours is the largest dose that can be necessary." [Tr.]

‡ Transactions of the Association of Fellows and Licentiates of the King and Queen's College of Physicians in Ireland, Vol. IV. 1824. Dublin.

the sulphate of quinine. The dose he employed was from one to three grains, rarely four, three times a day. Six, eight, and ten grains were often sufficient to prevent the return of the fever. But in some cases, the quantity taken by the patients was from twenty-four to thirty, and in one case even thirty-four grains. In the same work we find a memoir of Dr. O'Brien, which records six cases of typhus treated with sulphate of quinine. From three to four grains were administered daily; two of the patients were as promptly cured as if the disease had been an intermittent; in three others, success was less rapid but quite as decisive: the sixth died. I am not astonished that in England sulphate of quinine should be given in typhus, when I have seen Dr. Elliotson administer large doses with impunity in erysipelas.

M. Bally, of La Pitié has also treated a great number of intermittent fevers with the sulphate of quinine, and always successfully. The efficacy of this medicine is not less apparent in the treatment of pernicious * fevers. I have reported in my journal † the first cases of this kind cured by sulphate of quinine. M. Renauldin communicated to me the earliest instance; I soon after had an opportunity of administering successfully the same remedy, and there can now be no doubt either of the utility of this alkali or of the superior efficacy of quinine and its salts to all other preparations of cinchona. In the same journal for April and October, 1822, will be found interesting accounts of neuralgia cured by sulphate of quinine, and since that time its efficacy has been still more fully confirmed in the treatment of similar diseases.

Dr. Klokow‡ has succeeded by means of sulphate of quinine, in arresting, in a woman aged fifty, a profuse and dangerous hæmorrhoidal discharge. He gave four

* Literal.—We have no idea in this country of what aguish fevers, intermittent or remittent, are in hot climates. In Italy these are called pernicious fevers, for as soon as a person is seized, he may fall into a comatose state, from which he never recovers. (Dr. Elliotson's Lect., Med. Gaz., 1831—32, p. 96.) [Tr.]

† Journal de Physiol. Experimental, July, 1821.

‡ Journal der pracktischen Heilkande, June, 1824.

grains of the sulphate at once, and after the second dose the flux was arrested; the mineral acids, alum, ipecacuanha, and opium having been employed in vain.

Dr. Goupil, in the case of a man aged twenty-eight, affected with a severe pectoral disorder accompanied by hæmoptysis of an intermittent type, effected a cure by giving him eighteen grains of the sulphate of quinine in twenty-four hours, fifteen leeches being applied to the anus two days previously *.

M. L. Martinet † has also published a memoir on the employment of sulphate of quinine in large doses in the intermittent fevers of Italy. According to this physician, from ten to eighteen grains of quinine in quotidians and quartans had no effect, but when given to the extent of twenty and twenty-four grains, the fevers were completely subdued; that it produced no bad effects in the abdominal viscera, and the patients were fully restored to health. M. Chomel has given it to the extent of thirty-six grains in one dose with success.

We now proceed to relate some of the results obtained by the Italian physicians ‡. Professor Mathœis has given sulphate of quinine to thirty-one patients affected with tertians, simple or double, and has obtained cures; but he was obliged to raise the dose from fifteen to thirty-five grains in two or three days. He also reports two cases of pernicious fever, one of which was cured by bark, and the other by sulphate of quinine.

M. Rossi treated sixty-four persons affected with intermittents of different types and species, by means of sulphate of quinine; eight tertians, twenty-nine double tertians, two quartans, twenty-seven sub-continued, and eight pernicious fevers were cured: fifty patients had no attack after the first dose; seven experienced a slight return of the disorder. The quantity of sulphate administered varied from twelve to seventy-two grains; but in twenty-four cases it did not exceed twenty-four grains.

* Nouv. Bib. Medic. July, 1824.

† Revue Medicale, March, 1824.

‡ Giornale arcadico di Roma, November, 1822.

The results obtained by M. Tonelli are also deserving of notice. He has reported sixty-five cases of intermittents successfully treated, with the exception of one patient, who was in a desperate state when the quinine was administered. Of these, there were four quotidian, twenty-two tertian, thirty-one double tertian, three quartan, two double quartan, two sub-continued, and one pernicious. Forty-two patients had no paroxysm after the administration of the first dose. The quantity of sulphate given to each individual varied from twelve to eighteen grains.

MEDICINAL EMPLOYMENT OF QUININE AND CINCHONINE.

We have observed that the preparations most commonly employed are the sulphates of quinine and cinchonine. Of the first the ordinary dose is from one to ten grains in twenty-four hours. Those physicians who have attempted materially to exceed this dose, have been in general foiled in their expectations. Indeed some patients have experienced very unhappy effects, such as great agitation and very strong cerebral excitement. I have never administered more than ten grains in twenty-four hours, and have never known the salt fail in producing its effects. In the course of my hospital practice, which has been now of many years' continuance, I have made experiments to ascertain the exact dose in which sulphate of quinine ceases to be a powerful febrifuge. I have found that two grains in twenty-four hours are sufficient to check a tertian, quartan, or quotidian fever. Several physicians, who have become acquainted with me through the medium of the public journals, have informed me that they cannot obtain the same success as myself, and enquire the reason. Without pretending to be infallible, I imagine that the sulphate of quinine employed by my contemporaries must have been sophisticated, which is by no means uncommon. It is very essential that experiments be made with the sulphate, that its purity may be beyond suspicion.

It is also necessary to make allowance for the removal of the patient: those whom I have mentioned had quitted the

unhealthy places in which they contracted the fever in order to come to the hospital.

Dr. Alphonse Ménard, a physician of Lunel, who appears to have had ample opportunities for observation, has published a memoir * on the inconveniences resulting from large doses of sulphate of quinine in the treatment of remittent and intermittent fevers. He assures us that for the most part he has found six grains sufficient to arrest the progress of the malady in adults. As to the bad effects which this gentleman attributes to sulphate of quinine, the proofs which he adduces are by no means conclusive, since a great number of natural or accidental circumstances may influence the progress of the disease †.

An excellent thesis on the preparation and employment of these alkalies has been published by Dr. Ernest, entitled *De Medicamentis in febribus intermittentibus cortici Peruviano substitutis. D. J. M. Auctor* Frederic Adam Ernest, *Saxo-Boruss.* 1822.

PREPARATIONS OF QUININE.

M. Pelletier has prepared, according to my formula, a syrup of quinine perfectly colourless and transparent. This syrup contains two grains of quinine per *once.* I have frequently obtained the most pleasing results from it, and it appears to me to have a beneficial influence on the progress of the scrofulous affections of children.

SYRUP OF QUININE.

Simple syrup	2 livres.
Sulphate of quinine	64 grains.

* Revue Medicale, November, 1825.

† These remarks are equally applicable to two cases of gastro-intestinal phlegmasia attributed to quinine, and reported by M. E. Desportes (*Revue Med.*, December, 1823). The employment of medicines, useful as the greater part contained in this Formulary are, meets with sufficient opposition in the supineness of many practitioners, without the addition of imaginary accidents. Real accidents do undoubtedly sometimes happen, but it is unnecessary to publish any but those whose origin is confirmed. In this case the physician performs his duty and aids the progress of science.

Six doses of five *gros* each are generally sufficient to prevent the return of an intermittent. I have also known a pernicious fever yield to the same quantity.

WINE OF QUININE.

Good Madeira	1 litre.
Sulphate of quinine	12 grains.

Malaga or other wine may be substituted for Madeira.

TINCTURE OF QUININE.

Sulphate of quinine	6 grains.
Alcohol at 34°	1 once.

The sulphate of quinine is preferable to pure quinine, because a tincture made with an alkali not saturated by an acid is decomposed by watery liquids. Quinine wine may be prepared extemporaneously with this tincture by adding two ounces of it to the pint of wine.

PREPARATIONS OF CINCHONINE.

Cinchonine has also been employed as a febrifuge and a tonic, particularly by Dr. Chomel: but distinctly as these two properties have been recognised, it has been remarked that this substance possesses them in a less degree than quinine; in some cases the febrifuge effect has been altogether absent. I mentioned in one of the preceding editions of this work, that it was desirable for practitioners to make further observations on the virtues of this substance, which is present in almost all barks united with quinine, and is found almost alone in the Carthagena variety. These trials have been made, and the following are the results:—

M. P. Marianini, a physician of Mortara, has published an interesting memoir on the employment of pure cinchonine and sulphate of cinchonine in the treatment of intermittent fevers. He regards this medicine as equally certain in its effects with the sulphate of quinine, and as afford-

ing additional advantages, viz., greater solubility in water, and less bitterness.

M. Marianini is confident that by repeated washings with alcohol we may deprive cinchonine, and even quinine, of its bitterness, and that the presence of a free acid is necessary to develop this sensation, because the salt which is then formed becomes soluble.

This author reports, in the former part of his memoir, thirty-seven cases of intermittent fevers, simple and pernicious, cured by sulphate of cinchonine. Five were simple quotidians, one a pernicious quotidian, and the remainder tertians. He concludes his series of observations by eight cases of pernicious intermittents, and seven of simple quartans, which were cured by sulphate of cinchonine.

In the second part of his work, M. Marianini has made known the results which he has obtained with pure cinchonine. He mentions sixteen cases of simple tertian, eight of pernicious tertian, and fifteen of quartan fever. He usually administers cinchonine or its sulphate in some ounces of peppermint water; and the first dose is always the strongest: he gives even thirty grains of cinchonine at three doses in the course of a day, and begins sometimes with twenty grains.

To facilitate similar enquiries, I have prepared the following formulæ.

SYRUP OF CINCHONINE.

Simple syrup	1 livre.
Sulphate of cinchonine	48 grains.

This syrup may be employed in the same doses and in the same circumstances as the syrup of quinine.

WINE OF CINCHONINE.

Madeira wine	1 litre.
Sulphate of cinchonine	24 grains.

The same in its qualities as the wine of quinine. It may likewise be made with ordinary wine.

TINCTURE OF CINCHONINE.

Sulphate of cinchonine	12 grains.
Alcohol at 34°	1 once.

This tincture may be used for making cinchonine wine by adding two ounces of tincture to a pint of Madeira.

MEDICINAL EMPLOYMENT OF SULPHATE OF QUININE IN COMBINATION WITH OTHER MEDICINES.

WITH OPIUM OR MORPHINE.

Many celebrated physicians have recommended opium to be joined with bark in the treatment of obstinate intermittent fevers. Störck, Hoffman, Riviére, Sydenham, and Lind have often employed this combination with success. Sarconne strongly recommended this means when the stomach was too irritable to bear cinchona alone. Although there is less danger to be feared since the discovery of the sulphate of quinine, which is now so generally employed, yet there are circumstances in which it is useful to combine sulphate of quinine with opium, or rather with morphine. We have seen intermittent fevers, which had resisted the sulphate of quinine, cured by this means.

M. Sedillot * has published two important observations on the conjoint use of cinchona and opium in obstinate intermittent fevers: he has also often united sulphate of quinine with opium, and has found it very beneficial in subduing intermittent neuralgiæ. He has selected these two facts from a great number with which his extensive practice furnished him.

MODE OF ADMINISTRATION.

M. Sedillot formerly gave an ounce of cinchona combined with two or three grains of opium daily. He now replaces the bark with fifteen or twenty grains of sulphate

* Journal Général, tome 97, p. 9.

of quinine. He gives this *mélange* in divided doses in the interval of the paroxysms, and continues to employ it in gradually diminished doses for eight days after their cessation.

Whatever the type, the intensity, and the duration of the malady, M. Sedillot, in the whole course of his practice, has never known quinine, or the opiated sulphate of quinine, fail in their effects, unless the fevers were complicated with organic lesion.

Instead of combining the sulphate of quinine with opium, we propose to unite the sulphate of quinine with the sulphate of morphine, in the following proportions;

Sulphate of quinine ..... 2 to 6 grains *.
——— of morphine ..... ½ to 1 grain.

Of which make from two to four doses.

Sulphuric acid may also be directly combined with morphine and quinine, observing the different quantity of these two bases necessary to saturate the acid. But the crystallization of the two united sulphates would be very difficult.

SULPHATE OF QUININE COMBINED WITH TARTARIZED ANTIMONY.

Some physicians have proposed to associate an emetic with the sulphate of quinine in the treatment of intermittent fevers.

Dr. Dominique Gola † has reported four cases of intermittent fever, in which the sulphate of quinine, administered alone, had failed, but which were cured by the combination of sulphate of quinine with tartarized antimony in the following proportions;

Tartarized antimony ..... 3 grains.
Sulphate of quinine ..... 10 grains.

Mix accurately, and divide into six equal parts.

M. Gola administered one of these parts every two

* M. Sedillot prescribed from 12 to 20 grains of sulphate of quinine.

† Annali Universali di Medicina, July and August, 1825.

hours during the apyrexia. The first dose sometimes produced vomiting of a bitter substance; at other times alvine evacuations: sometimes no evacuation took place, but the fever was not less speedily subdued.

There can be no doubt that in some cases these combinations may be useful; but the sulphate of quinine alone is generally sufficient.

VERATRINE.

To the labours of MM. Pelletier and Caventou we are also indebted for our knowledge of this alkali *. These indefatigable chemists, having remarked that in the genus veratrum almost all the species, besides the common botanical characters, possessed a very acrid taste, and exerted a similar influence upon animals, thought it would be interesting to determine whether these properties were not owing to a particular substance common to all those plants. The analysis which they instituted of the seeds of the *veratrum sabadilla* tended to confirm their conjectures. They succeeded in isolating the acrid principle, which was afterwards discovered in the bulb of the common colchicum *(colchicum autumnale)*, and in the root of the white hellebore *(veratrum commune)*. This principle they named *veratrine*, from the name of the family to which these plants belong.

MODE OF PREPARING VERATRINE.

The seeds of the veratrum sabadilla are to be treated repeatedly with boiling alcohol. These tinctures, filtered

* At page 58 of the German translation of this Formulary, M. G. Kunze observes, that M. Meissner also discovered veratrine in 1819, at the same time with MM. Pelletier and Caventou, and that he made use of a different method for extracting that alkali. He infused the seeds of the sabadilla in moderately strong alcohol, evaporated and precipitated the alkali with carbonate of potass, and then washed the product with distilled water. This process, however, cannot yield very pure veratrine.

while still nearly boiling, deposit, on cooling, whitish flakes of wax. The substance in solution, reduced to the consistence of an extract, is to be taken up by cold water and filtered: there remains upon the filter a small quantity of fatty matter. The solution is then gently evaporated, and a precipitate is formed of an orange-yellow colour, which exhibits the characters of the colouring matter found in almost all ligneous vegetables. A solution of acetate of lead is to be poured upon this liquor, still highly coloured; and there is immediately formed a new and very abundant yellow precipitate, which may be separated by the filter. The liquor, now rendered almost colourless, still contains, among other substances, the acetate of lead which was added in excess. The lead is separated by means of a current of hydrosulphuric acid: the liquor is then filtered, and concentrated by evaporation; afterwards treated with magnesia, and filtered again. The magnesian precipitate is treated with boiling alcohol; and the alcoholic liquors yield by evaporation a pulverulent substance, excessively acrid, and presenting all the alkaline characters. This substance is at first of a yellow colour: by repeated solutions in alcohol, and precipitations effected by pouring water on these alcoholic solutions, we may obtain it under the form of a white and perfectly inodorous powder.

CHEMICAL PROPERTIES OF VERATRINE.

Veratrine is very sparingly soluble in cold water; boiling water dissolves $\frac{1}{1000}$ part of its weight, and acquires a sensible sharpness. It is very soluble in ether, and still more so in alcohol. It is insoluble in the alkalies, and soluble in all the vegetable acids. It saturates all the acids, and forms with them incrystallizable salts, which by evaporation assume the appearance of gum. The sulphate alone displays the rudiments of crystals when it has an excess of acid. Nitric acid combines with veratrine; but if added in excess, especially when concentrated, it produces no red colour, as is the case with morphine, brucine, and impure strych-

nine; but it very quickly alters the vegetable substance in its elements, and gives rise to the formation of a yellow detonating matter, analogous to *Welther's bitter*.

Veratrine restores the blue colour of turnsol paper reddened by acids. Exposed to heat, it liquifies at a temperature of 50° + 0, and in this state it has the appearance of wax: on cooling, it concretes into an amber-coloured translucid mass. Distilled over the open fire, it swells much, and is decomposed, producing water, a great deal of oil, &c.; a large quantity of carbonaceous matter remains, which when incinerated leaves but a very small slightly alkaline residue.

MM. Dumas and Pelletier have made three analyses of veratrine procured from the sabadilla, and with almost similar results:

Carbon	66.75
Azote	5.04
Hydrogen	8.54
Oxygen	19.60
Veratrine	99.93

Since the investigations of MM. Pelletier and Caventou were published, M. Couerbe has made new researches on veratrine, and he confidently asserts that it contains other very important principles, which he has named *sabadilline*, *veratrin*, and *resinigum* of sabadilline: there is also a black pitchy matter, which binds all these substances together, and prevents them from manifesting their properties in an isolated state.

After describing the process for the extraction of veratrine proposed by M. Couerbe, I shall say a few words respecting the preparation and properties of the new substances discovered by that able chemist.

Treat the seeds of the *veratrum sabadilla* with boiling alcohol of 36°; having exhausted the seeds by this menstruum, let the liquors be distilled, in order to obtain an extract, which is very abundant, and contains a large quantity of greenish fatty matter. Treat this extract with dilute sulphuric acid, and filter after a few minutes' ebullition. By

this means we dissolve the veratrine, the sabadilline, the veratrin, the resinigum, and the brown colouring matter; on precipitating this solution by potash, we obtain all these substances. It is sufficient to take up with alcohol, and to distil, in order to obtain the compound matter which represents the veratrine of commerce, and also that of MM. Pelletier and Caventou, but which is less white, and consequently not so pure.

This substance, which appears after the distillation of the alcohol in the form of a yellowish resin, may be still further purified by treating with sulphuric acid as before, precipitating anew by means of an alkali, and allowing it to dry. We thus obtain a tenuous, white, very acrid powder, having alkaline reaction, uniting with acids, but not yielding with them any crystallizable salts. This is the veratrine of authors, but in its greatest state of purity, and obtained by a very simple and profitable method.

In order to separate the new substances discovered by M. Couerbe, dissolve this veratrine in water acidulated with sulphuric acid, add to the solution nitric acid, drop by drop, until a viscid precipitate (the black pitchy matter) ceases to be formed. Then decant the supernatant liquor, precipitate by potass or ammonia, and wash the precipitate in cold water; afterwards take it up by means of alcohol, that certain inorganic salts contained in it may be separated; by evaporating the alcohol, we obtain a substance of a resinous aspect, containing all the principles enumerated above, except the black pitchy matter which was separated by the nitric acid.

The first stage of the process being completed, treat the matter with boiling water, which dissolves two substances, *sabadilline* and *resinigum;* the former crystallizes as the liquid cools, and the latter is obtained by evaporating the mother-waters of the *sabadilline* to dryness, in vacuo or by a gentle heat.

The water therefore leaves undissolved two other matters, pure veratrine and *veratrin*. By digesting with ether we take up the veratrine, and leave the veratrin undissolved.

PURE VERATRINE.

We have already mentioned that the veratrine of MM. Pelletier and Caventou was incrystallizable, and would not form any crystallizable salt; this is probably owing to its impurity, and especially to that dark-coloured matter which is precipitated by nitric acid. Pure veratrine is equally incrystallizable, but when united with acids, it forms solutions which are not slow in crystallizing.

Pure veratrine, therefore, forms salts which crystallize; it is white, solid, and friable. It fuses at 115° centigrade, is insoluble in water, but very soluble in ether and alcohol.

The sulphate produced by it appears under the form of long delicate needles. When heated, it fuses and parts with two atoms of water. It contains;

Veratrine	100.00
Acid	14.66

The hydrochlorate of veratrine is very soluble in water and alcohol, and is readily decomposed by heat. It is composed of;

3418.554 of base = 1 atom
455.130 of acid = 1 „

Pure veratrine has been analysed by M. Couerbe, who has obtained results quite at variance with those of MM. Pelletier and Caventou; from which we infer that he has operated upon a substance of a different character. It is composed of;

C^{34}	= 71.247
A^{2}_{z}	= 4.850
H^{43}	= 7.510
O^{6}	= 16.394

SABADILLINE.

Sabadilline presents itself in the form of small crystals or hexahedral prisms. It is white, excessively acrid, and by no means volatile. It fuses at 200° centigrade, and

loses by fusion two atoms of water. It is quite soluble in water and alcohol; but completely insoluble in ether.

Thus, we perceive that it may be distinguished from veratrine by three well defined characters:—1st, by its capability of crystallizing; 2d, by its insolubility in ether; 3d, by its great solubility in water.

Elementary analysis gives for the composition of anhydrous sabadilline;

$$C^{20} \ldots\ldots = 64.65$$
$$A^{2}_{z} \ldots\ldots = 7.50$$
$$H^{26} \ldots\ldots = 6.65$$
$$O^{5} \ldots\ldots = 21.10$$

By adding two atoms of water, we obtain the equivalent and the formula of crystallized sabadilline, which is equal to $C^{20}\ A^{2}_{z}\ H^{26}\ O^{5} + H^{4}\ O^{2}$. The equivalent deduced from its combination with sulphuric acid, has been found equal to 2637.684.

Sulphate of sabadilline crystallizes in prismatic needles; it is fusible, and contains four atoms of water, which may be dispersed by the simple fusion of the salt. It is represented by the following formula;

$$S\overset{+}{a}\ \overset{///}{S} + A^{4}_{9}\ *$$

RESINIGUM.

This substance is yellowish, incrystallizable, slightly alkaline, and when perfectly dry, very friable. It is found in the mother-water of sabadilline. Alcohol dissolves it in every proportion. Water and the acids dissolve it equally well. A temperature of 165° is required to make it fuse. Sulphuric ether dissolves merely traces of it.

* The sign $S\overset{+}{a}$ represents hydrated sabadilline, or containing its two atoms of water; for M. Couerbe has informed us, in a very extensive work on delphine and veratrine, that sabadilline holds this quantity of water in all combinations into which it enters as an alkali.

In these characters, resinigum appears to bear much analogy to sabadilline; but it differs essentially in its appearance, which is by no means crystalline. Its composition also is very little different from that of sabadilline; indeed, M. Couerbe has remarked, that it is the same as that of hydrated sabadilline minus one atom of water. Thus the formula of hydrated sabadilline being C^{20} A_z^2 H^{30} O^7, that of resinigum is equal to C^{20} A_z^2 H^{28} O^6.

VERATRIN.

I shall say but little of this substance, because its action on the animal economy is not yet known. I only introduce it here in a chemical point of view. It is composed of;

C^{14}	= 67.67
A_z^2	= 5.64
H^{18}	= 7.15
O^3	= 19.54

This substance is of a brownish colour, insoluble in ether and water, but soluble in alcohol; it fuses at 185° centigrade.

The concentrated acids decompose it, and nitric acid transforms it into oxalic.

ACTION OF VERATRINE ON ANIMALS.

A very small quantity of acetate of veratrine* injected into the nostrils of a dog, instantly excites violent sneezing, which sometimes continues nearly half an hour. One or two grains thrown into the fauces, gives rise to a very profuse salivation, which continues for some time. If the same quantity be injected into any part of the alimentary canal, and the abdomen opened in order to observe the effects, we find the intestine violently contracted, then becoming relaxed, then contracted again, and so on for some time: the portion of the mucous membrane, in contact

* The acetate being the most active of all the preparations of veratrine, has alone been employed in my experiments on animals.

with the veratrine is inflamed; the irritation extends, and excites vomiting and alvine evacuations. Given in a larger dose, the circulation and respiration are greatly accelerated, and tetanus and death rapidly supervene. The effects are still more rapid, if one or two grains be injected into the pleura or the tunica vaginalis. In less than ten minutes, the tetanic phenomena are succeeded by death. The same quantity thrown into the jugular vein, produces, in a few seconds, tetanus and death. Dissection shews that even in this case the veratrine has acted on the intestinal canal, the mucous membrane of which is found highly injected. The lungs also exhibit signs of inflammation and congestion.

From these facts we learn that veratrine must be administered in large quantities, or conveyed into parts where absorption is very active, such as the pleura or the tunica vaginalis, in order to produce those general effects which we have described as so terrible *.

ACTION OF VERATRINE ON THE HUMAN SYSTEM, IN HEALTH AND DISEASE.

The effects of veratrine in large doses, have not been observed upon man, but they would be unquestionably the same as those on animals.

The taste of veratrine is very acrid, without any perceptible bitterness; it excites abundant salivation, however small the quantity taken into the mouth. Although totally inodorous, it must not be smelt too closely; the small quantity carried by the air into the nasal cavities being often sufficient to produce violent and dangerous sneezing.

A quarter of a grain conveyed into the intestinal canal, speedily produces copious alvine evacuations: in doses a little beyond this it excites vomitings more or less violent. I have recently however given it to the amount of two grains in twenty-four hours, without those profuse evacuations ensuing. The patient was an old man, who had been at-

* See the first number of Majendie's *Journal de Physiologie*, for a paper by M. Andral, Jun., on the action of veratrine.

tacked with apoplexy some time before. This is an additional proof that the state of the nervous system has great influence on the action of medicines. Having tasted, though cautiously, the mixture which contained these two grains of veratrine, I experienced for several hours an insupportable acrimony in the mouth and pharynx, and the impression had not entirely disappeared the next day: the patient was sensible of nothing of the kind.

CASES IN WHICH VERATRINE MAY BE EMPLOYED.

This substance producing the same effects as the plants from which it is derived, may be substituted for them, with great advantage, because we know in this case, what we are ignorant of in the other, the quantity of the active principle which is employed.

Veratrine is especially suitable in cases where it is necessary to excite prompt and copious alvine evacuations: given with this view, it has succeeded remarkably well with some old persons, in whose large intestine there was an enormous accumulation of indurated fæces. In the pharmaceutical preparations of which hellebore and colchicum form the base, these substances should be superseded by veratrine; they would thus be rendered powerful therapeutic agents, and at the same time more convenient and certain. Bacher's pills, tincture of colchicum, eau medicinale, and some others, of whose uncertain effects practitioners have so often complained, would then cease to be employed.

The following formulæ may be substituted for those of which we have spoken;

PILLS OF VERATRINE.

Veratrine..... 1—2 grains.
Gum arabic and syrup, sufficient to make six pills of each grain.

One of these pills may be administered at first, and if no purgative effects are obtained, three may be given in the course of a day.

TINCTURE OF VERATRINE.

Veratrine..... 4 grains.
Alcohol..... 1 once.

Dose.—From ten to twenty-five drops in a cup of water. It may be administered internally, instead of the tincture of colchicum, in dropsy and anasarca; and externally by friction in the same maladies, and also in gout.

SOLUTION OF VERATRINE.

Sulphate of Veratrine..... 1 grain.
Distilled water..... 2 onces.

This solution may be substituted for the eau medicinale of Husson; it is given in the dose of five *grammes* combined with one or two ounces of eau sucrée.

I have often completely subdued tic douloureux of the face, by sprinkling small vesicatories made along the course of the diseased nerves with one or two grains of veratrine, repeating the process every four or five days. I have employed the same means with similar success, in cases of paralysis of the face. I need scarcely add, that the application must in this case be made over the course of the facial nerve.

OINTMENT OF VERATRINE.

Veratrine..... 4 grains.
Lard..... 1 once.

To be employed externally in cases of chronic rheumatism, anasarca, and gout.

ACTION OF SABADILLINE ON THE ANIMAL SYSTEM.

I have made some experiments with sabadilline, but I have met with no results of sufficient importance to warrant my employing it for veratrine under any circumstances; I nevertheless intend to continue my researches upon this new substance, which is certainly possessed of great activity.

PRUSSIC OR HYDROCYANIC ACID.

In a memoir presented to the Académie des Sciences, in November, 1817, I communicated the successful results which had attended the employment of prussic acid in pulmonary complaints. The medicine has since been used by a great number of physicians, both in Europe and the United States. Success has every where attended its employment, and although so redoubtable in itself, this substance may now be regarded as one of the most important of remedial agents.

Prussic acid was discovered in 1780 by Scheele, but this chemist obtained it mixed with a variable proportion of water. M. Gay-Lussac first made us acquainted with it in a pure state *.

PHYSICAL PROPERTIES.

This acid, at the ordinary temperature, is liquid, transparent, and colourless; its taste is at first agreeably cool, but soon becomes acrid and irritating; it slightly reddens the tincture of turnsol. Its odour is very strong, and may prove mortal; it is only supportable when mixed with a certain proportion of air, and is then very similar to that of bitter almonds.

CHEMICAL PROPERTIES.

Prussic acid is extremely volatile. In fact, it boils at 26°.5, under a pressure of $0^{m}.76$, and at 10° sustains a column of mercury of $0^{m}.38$: its congelation, however, is easily effected, and takes place at 15° of cold: when also a few drops of this acid are poured upon paper, the portion which evaporates almost instantly produces a degree of cold sufficient to crystallize the remainder. This is the only liquid which has such a property. Prussic acid is but slightly soluble in water; hence when agitated with ten or

* Annales de Chimie, Tom. LXVII., p. 128; and Tom. XCV., p. 136.

twelve times its volume of this liquid, it collects on the surface, like oils and ethers. Alcohol readily dissolves it. Left to itself in a closed vessel, it is sometimes decomposed in less than an hour; it can rarely be preserved longer than a fortnight.

According to Gay-Lussac, hydrocyanic acid is composed of 44.27 carbon, 52.08 azote, and 3.65 hydrogen; or of

1 volume of vapour of carbon,
1 volume of azote,
1 volume of hydrogen,

condensed into two volumes; or rather of a volume of cynanogen, and one of uncondensed hydrogen.

PREPARATION OF PRUSSIC ACID.

It is obtained by treating the deuto-cyanuret of mercury in crystals, but reduced to powder, with two thirds of its weight of fuming hydrochloric acid. The apparatus to be used for this purpose consists of a small tubulated retort, to which is adapted a tube of sufficient length, bent to a right angle at one extremity, which is placed in a very narrow flask, or what is better, in a test tube surrounded with ice and salt. The horizontal part of the tube, which is adapted to the retort, should contain fragments of carbonate of lime, followed by others of chloruret of calcium. The apparatus being thus adjusted, and the retort placed upon a small furnace, the deuto-chloruret of mercury and the hydrochloric acid are to be introduced into it through the tube. A gentle heat being applied, the decomposition of the deuto-cyanuret of mercury commences; the hydrocyanic acid which results from the action of the hydrochloric acid upon the deuto-cyanuret of mercury passes through the tube and is condensed in the test tube, having been deprived, by its contact with the carbonate of lime and chloruret of calcium, of all the water and hydrochloric acid which by the effect of the heat, may have been volatilized with it.

Vauquelin has proposed to obtain the hydrocyanic acid by decomposing the cyanuret of mercury by means of sulphuretted hydrogen. The apparatus differs little from the

last: for the retort we substitute a globe containing a mixture of sulphuret of iron and diluted sulphuric acid: the cyanuret of mercury is placed in the horizontal tube already described, and near the extremity attached to the globe. Beyond the deuto-cyanuret, fragments of carbonate of lead and of chloruret of calcium are placed, the former to absorb the small quantity of sulphuretted hydrogen which may not have been decomposed by the cyanuret of mercury, the latter to absorb the water that may be contained in the hydrocyanic acid.

This preparation is generally impure and impregnated with sulphuretted hydrogen, because a portion of the gas eludes the carbonate of lead intended to absorb it.

When we prepare this acid after the method proposed by M. Gay-Lussac, care must be taken lest too much hydrochloric acid be employed, for M. Pelouse has observed, such is the formula of the acid, that by adding three atoms of water we represent exactly that of formiate of ammonia, and then this salt will be generated during the process, and but very little hydrocyanic acid.

The formula sufficiently accounts for this reaction: $A_z^2\ C^2\ H^2$ = hydrocyanic acid, $H^6\ O^3$ = 3 atoms of water; by reuniting these elements, we have $A_z^2\ H^6 + C^2\ H^2\ O^3$ = 1 atom formiate of ammonia.

ACTION ON ANIMALS.

One drop of pure prussic acid being introduced into the fauces of a remarkably strong dog, he fell dead after two or three convulsive respirations. A few particles applied to the eye produce effects almost as sudden, and in other respects similar. A drop of acid diluted with a few drops of alcohol, injected into the jugular vein, kills the animal instantly, as if it had been struck with lightning. In animals thus destroyed by prussic acid, scarcely any traces of irritability can be discovered in the muscles a few moments after death.

In the Transactions of the Medical Society of Copenhagen *, there is a memoir by Dr. Viborg, in which that

* Acta nova regiæ Societatis Medicæ Harniensis, 11th vol. Hafniæ, 1821.

learned physician states that he has given prussic acid in very large doses to animals without causing death. The acid he employed was evidently prepared according to Scheele's method, or some other which yields an impure product. To obtain uniform results which will admit of comparison, we must adhere to one mode of procedure: we recommend the method of M. Gay-Lussac, or that of Vauquelin.

ACTION ON THE HUMAN SYSTEM.

Pure prussic acid produces the same effects on man as on animals. Even its vapour should be cautiously avoided, since, if respired, it occasions acute pain in the chest, and a feeling of oppression which does not subside for some hours. Properly diluted, its effect in disease is to allay morbid irritability in certain organs.

Given in proper doses, but too frequently, we have seen it produce head-ache, and a kind of vertigo which disappears in the course of a few minutes.

CASES IN WHICH PRUSSIC ACID MAY BE EMPLOYED.

Prussic acid, diluted in the way we are about to describe, is employed with success in all cases of morbid irritability of the pulmonary organs. It may be advantageously used in the treatment of nervous and chronic coughs, asthma, and hooping-cough, and in the palliative treatment of phthisis; indeed a great number of observations induce the belief that it may effect a cure in the early stage of the latter disease. In England it has been administered with success in hectic cough, sympathetic of some other affection, and also in dyspepsia. Dr. Elliotson, both in hospital and private practice, has frequently employed medicinal prussic acid prepared after the method of Vauquelin *. He has recorded more than forty cases of dyspepsia, with or without vomiting, and accompanied with considerable pain in the epigastric region and with pyrosis, which were cured by this acid. The same physician quotes a case of colica

* We mention the particular acid made use of, because in England Scheele's method is almost exclusively used.

pictonum *, in which Dr. Prout gave the acid, and procured instantaneous relief. Dr. Elliotson has also administered hydrocyanic acid in a great number of pectoral affections, and has almost invariably succeeded in allaying the troublesome cough. Applied externally in lotions, in different diseases of the skin, it has not, in Dr. Elliotson's practice, produced any decided effects; Dr. Thomson †, however, asserts, that he has employed it in lotions, with constant success, in diminishing the itching and the heat so annoying in cutaneous diseases, and has cured several species of herpes, particularly the *acné rosacea*.

M. J. Bouchenel ‡ has published an interesting memoir on the employment of prussic acid in the treatment of chronic pulmonary catarrh; he mentions four cases in which this remedy proved effectual. He concludes by saying, that prussic acid, when given in a small dose, is not more inconvenient than an ordinary linctus; that it is not proper in the acute stage of catarrh, and that success is more certain when antiphlogistic measures are previously adopted. M. Bouchenel has also employed prussic acid in a case of phthisis, but he only succeeded in allaying the cough for a time, which leads him to doubt the fact of its having really effected the cure of confirmed phthisis. I do, however, assert and maintain that I have cured individuals having all the symptoms of incipient phthisis, and even those in a more advanced stage.

In Italy, the medicinal hydrocyanic acid has been used to allay excessive irritability of the uterus, even in cases of cancer, and to moderate the action of the heart in almost all sthenic diseases.

Professor Brera extols its happy effects in pneumonia §; he recommends it also in rheumatic cases, and as an anthelmintic. Since the professor has employed it in dis-

* More accurately "gastrodynia," which followed colica pictonum. [Tr.]

† Lond. Med. and Physical Journal, Feb. 1822.

‡ Bulletin de l'Athénée de Médecine.—Nouvelle Bibliothèque Med., Août, 1824.

§ Prospetti de' resultamenti nella Clinica medica, p. 29. Padova, 1816.

eases of the heart, Dr. Macleod has administered it in the same diseases; he has found it allay nervous palpitations, especially those which seemed to depend on derangement of the digestive organs: he has also employed it as a palliative in some cases of aneurism of the heart. He never raised the dose beyond 28 drops in the twenty-four hours, and has never witnessed any untoward consequences.

Dr. Frisch, of Nyborg, in Denmark, has allayed the intolerable pain caused by cancer of the breast, which had resisted all the antispasmodics, by washing the ulcerated surface with diluted prussic acid. He has also successfully employed this remedy in several cases of phthisis *. Dr. Guerin, of Mamers, has obtained beneficial results from its employment in two cases of brain fever.

MEDICINAL EMPLOYMENT.

The medicinal properties of prussic acid, prepared according to Scheele's process, are not sufficiently uniform, on account of the arbitrary mode of preparing it. The acid obtained by Vauquelin's method, has the inconvenience of retaining a certain quantity of sulphuretted hydrogen. That which is prepared according to the directions of Guy-Lussac is much preferable, if it be properly diluted. I mix it with six times its volume, or 8.5 times its weight of distilled water. This is the preparation which I denominate *medicinal prussic acid.*

The medicinal acid may also be prepared by adding to hydrocyanic acid, six times its volume of alcohol: it then retains its active properties better, and evaporates less quickly than when mixed with water. It has been recently proposed to employ an acid more concentrated; for example, three fourths of water to one of acid; but this method appears to me to have no advantage over the preceding, which is now generally adopted.

The following are the formulæ most frequently employed by me.

* Bibliotek forlæger et Nyc Hyœga.

PECTORAL MIXTURE.

Medicinal prussic acid	1 gros.
Distilled water	1 livre.
Purified sugar	1½ once.

Let five *gros* of this mixture be taken night and morning. The dose may be increased to six or even eight times this quantity in twenty-four hours. Care must be taken to shake the mixture each time before using it, or the acid will accumulate on the surface, and may give rise to serious consequences.

PECTORAL POTION.

Infusion of ground ivy	2 onces.
Prussic acid	15 drops.
Syrup of marsh mallows	1 once.

Five *gros* to be taken every three hours, shaking the phial.

CYANIC SYRUP.

Clarified syrup	1 livre.
Medicinal prussic acid	1 gros.

This may be added to common pectoral mixtures as a substitute for other syrups.

MIXTURE FOR LOTIONS.

Med. hydrocyanic acid	1 to 2 gros.
Lettuce water	1 pinte.

The quantity of the acid may be augmented from two to four gros.

This mixture may be used externally in cases of herpes and cancerous ulcerations, and as an injection in cancer of the uterus.

REMARKS ON PRUSSIC ACID.

It is not without reason that we have censured the use of the *prussic acid of Scheele*; in truth, that acid is never constant in the proportion of the real acid to the water it contains: this is owing to the difficulty of combining the same circumstances in every operation. If, in order to

avoid this inconvenience, we wished to prepare the acid called Scheele's with the pure acid of Gay-Lussac, by diluting the latter with water, what quantity should be added? M. Robiquet * has proposed to add two parts of water to one of the pure acid. Scheele's acid thus prepared is twice as strong as that we recommend, and is more inconvenient to use. This inconvenience is rendered still greater by the inexact manner in which M. Robiquet's method is described in the Parisian codex. The formula there given, directs the prussic acid to be diluted with an equal quantity of water: and afterwards a receipt is given for the preparation of a syrup, into which the prussic acid, thus mixed, enters in the proportion of one part in nine of simple syrup. This syrup can only be given by drops; if unfortunately an ounce of it were blended with a mixture, the consequences would be fatal †.

In writing these lines it has been my especial aim to prevent those accidents which would infallibly result from the inconsiderate use of a preparation so eminently poisonous; my advice has succeeded in banishing the article complained of from private practice, and my cyanic syrup is universally employed in its stead; but in the hospitals of Paris, the codex must be implicitly followed, in conformity with the regulations laid down.

A deplorable event took place in one of the hospitals of the capital from the strict observance of this rule. Seven epileptic individuals had taken, about the same time, two *gros* six *grains* of the hydrocyanic syrup of the codex. Three quarters of an hour after, they were no more. The frightful rapidity of their death forbade their receiving any help, and this is still more affecting, for it might not have been impossible to save them from so tragical a fate.

I have once had occasion to attend a person poisoned by a very strong dose of prussic acid, and I had the pleasure of saving her life.

* Journal de Pharmacie, 1818.

† Many serious accidents have followed the employment of this syrup of the new codex.

A young lady of eighteen years of age had been two or three years previously, cured, under my advice, of an old and obstinate cough, by means of prussic acid given in the form of my pectoral mixture (see p. 93); the cough having returned, the physician who attended the patient exhausted the whole list of ordinary remedies without any advantage. Having consulted with me on the subject, I remembered treating the same disorder with prussic acid, and proposed to resort to the same means again. It was agreed that the pectoral mixture already mentioned should be given the next day. The physician was desirous of assisting in the administration of the remedy for the first time; but I know not by what inadvertence, instead of administering *five gros*, he made an extemporaneous mixture, and gave the patient one half, which he poured into a large cup. The effects, as may be supposed, were soon apparent; the patient lost all consciousness, and was seized with extreme agitation, accompanied with sanguineous congestion of the brain. The physician, being very justly terrified, and not accustomed to the use of the medicine, hastened to my house. Fortunately I was able to set out with him immediately, and arrived a very few minutes after the accident took place. I observed a sort of drowsiness, with convulsive movements, and especially a cerebral congestion of the most intense nature. I instantly abstracted a large quantity of blood from the jugular vein, and compelled the patient to swallow several drops of ammonia, diluted with water; these measures were followed by a sensible amelioration; consciousness returned, and with it tranquillity. Only head-ache remained, which lasted until the next day.

We are now convinced, from a number of experiments made on animals, that in a similar event the respiration of chlorine would be very useful, as also the employment of chlorine externally, diluted with water; but it is necessary to act promptly, for the activity of the poison admits of no delay.

Notwithstanding all we have said concerning the strength of Scheele's *prussic acid*, prepared according to the codex

and the method of M. Robiquet, many physicians consider it much weaker than our *medicinal prussic acid*, and sometimes prescribe it to the amount of a *gros* in a mixture of 4 *onces*, to be taken by spoonsful. The apothecaries of Paris are, for the most part, so accustomed to see the *prussic acid of Scheele* enter in large quantities into medical prescriptions, that to avoid accidents, they prepare this acid by mixing that of Gay-Lussac with forty parts of water. This quantity of water, which is entirely arbitrary, allows them at least to make up the prescriptions they receive without danger, when they see by the largeness of the dose it is not my medicinal acid that the physician means to prescribe.

SOLUTION OF CYANURET OF PURE POTASSIUM

AS A SUBSTITUTE FOR PRUSSIC ACID.

The different results obtained from prussic acid may be attributed to the fact of that medicine not being always identical, on account of its great volatility and the facility with which its elements disunite. We have pointed out a slight modification in the preparation of medicinal prussic acid, which in part obviates this inconvenience, but MM. Robiquet and Villermé have thought that the cyanuret of potassium, its action on the animal system being the same, might be substituted with advantage.

MODE OF PREPARATION.

The process recommended by M. Robiquet consists in exposing ferruginous prussiate of potass to long-continued heat in a stone crucible, taking care to lute the opening during the period of its cooling. By this means, the cyanuret of iron is completely decomposed, while that of the potassium remains unaltered. The residue of this intense calcination is a blackish lamellated mass, which is no other than the cyanuret of potassium soiled by the iron and charcoal belonging to the cyanuret of iron. This mass

is to be washed in water; the iron and the charcoal will then be deposited, while the cyanuret of potassium dissolves, and is transformed into hydrocyanate of potass.

When the operation has been well conducted, the solution is perfectly colourless, and retains no portion of iron. The cyanuret of potassium, well prepared, and quite pure, is white and transparent; it may be fused by heat without undergoing any change; the action of the air, however, and of carbonic acid especially, in part decompose it. It may be preserved for an indefinite length of time, provided it be kept from humidity.

ACTION OF THE CYANURET OF POTASSIUM AND HYDROCYANATE OF POTASS ON ANIMALS.

MM. Robiquet and Villermé have made experiments with this substance on animals in my presence. The tenth part of a grain of cyanuret of potassium destroyed a linnet in the space of one minute; a little less than a grain killed a guinea-pig in two or three minutes.

A small drop of the hydrocyanate of potass, containing only a hundredth part of a grain of the cyanuret in solution, killed a linnet in half a minute. Half a gros, containing five grains of cyanuret, destroyed a large dog in a quarter of an hour. The symptoms were similar to those produced by hydrocyanic acid. We have not yet had an opportunity of observing its poisonous effects on man.

MEDICINAL EMPLOYMENT.

Cyanuret of potassium dissolved in eight times its weight of distilled water, is transformed into hydrocyanate of potass. Cyanuret, mixed with water in this proportion, may be called "medicinal hydrocyanate of potass." This solution should always be extemporaneous, as the hydrocyanate is liable to be soon decomposed into carbonate of ammonia.

It may be administered in the same doses as the medicinal prussic acid, without danger: and may also enter into the same preparations. It is possible to render it perfectly independent of the action of the small portion of alkali

contained in the cyanuret, by adding a few drops of any vegetable acid, or by prescribing it with some acid syrup; great advantage would moreover result by setting the prussic acid more at liberty.

If the cyanuret of potassium, instead of the hydrocyanate of potass, be introduced into a draught, we must commence with a quarter of a grain, and gradually augment the dose to a grain, though the latter dose has been exceeded by some practitioners. The following are a few formulæ.

PECTORAL MIXTURE.

Medicinal hydrocyanate of potass.....	1 gros.
Distilled water	1 livre.
Refined sugar	1½ once.

Five *gros* to be taken night and morning, and the dose may be divided so as to give six or eight such quantities in the twenty-four hours.

PECTORAL POTION.

Infusion of ground ivy.....	2 onces.
Med. hydrocyanate of potass	15 drops.
Syrup of marsh mallows.....	1 once.

Five *grammes* to be taken every three hours.

MIXTURE OF CYANURET OF POTASSIUM.

Lettuce water.....	2 onces.
Cyanuret of potassium.....	½ grain to 2 grains.
Syrup of marsh mallows.....	1 once.

Five *gros* to be taken every two hours.

SYRUP OF HYDROCYANATE OF POTASS.

Clarified syrup	1 livre
Med. hydrocyanate of potass.	1 gros.

This syrup may be added to ordinary pectoral draughts, and may be substituted for other syrups.

CYANURET OF ZINC.

The cyanuret of zinc, as a substitute for hydrocyanic acid, has lately been employed in Germany, and is reported to possess decided vermifuge properties.

We shall only point out the mode of preparing it, in order that some experiments may be made of its efficacy.

MODE OF PREPARATION.

M. Pelletier has made several researches for the purpose of obtaining cyanuret of zinc. He precipitates sulphate of zinc by hydrocyanate of potass; thereby forming a triple hydrocyanate of zinc, which being well dried, and calcined at a dull red heat, is converted into cyanuret of zinc, mixed, however, with some cyanuret of potassium. According to the investigations of M. Berzelius respecting the triple prussiates, that learned chemist appears not to admit such results, for he asserts, that none but alkaligenous metals retain their cyanogen after calcination: all others are decomposed, and often produce quadri or bicarburets of the metals.

The following method, which yields pure cyanuret of zinc, has been proposed by M. Henry. Take a solution of sulphate of zinc, and pour on it cautiously, until precipitation ceases, a filtered and recently prepared solution of cyanuret of potassium. The deposit carefully washed and dried is the white cyanuret of zinc. Should the solution of cyanuret of potassium be alkaline, it must be proportionately saturated with a little acetic acid.

MODE OF EMPLOYMENT.

Cyanuret of zinc may be employed in the same quantities as cyanuret of potassium. It is proper to commence with a quarter of a grain, which may be gradually increased to a grain and a half, and taken in any mixture by spoonsful: but great caution is necessary.

Dr. Henning* has derived great advantages from cyanuret of zinc in cases where hydrocyanic acid is ordinarily used. He has found it remarkably successful as a vermifuge in the disorders of children. He gives in such cases a grain combined with powdered jalap. He has also em-

* See Journal de Médicine Pratique, 1823, by Dr. Hufeland.

ployed it in diseases consequent on dentition. In nervous affections of the stomach, especially in spasm of that organ, it has proved very beneficial. In these disorders he prescribes the following mixture;

Cyanuret of zinc	6 grains.
Calcined magnesia	4 „
Cinnamon powder	3 „

He orders this dose to be taken every four hours. Sometimes the cyanuret of zinc is mixed with sugar, and its action is promoted by giving at the same time a warm infusion of aromatic plants. He has employed the same remedy in cases of dyspepsia and colic attendant on difficult menstruation. Dr. Henning has published twelve cases which were cured by this mode of treatment, and he thinks the cyanuret of zinc preferable to prussic acid.

CYANURET OF IODINE.

This new compound of iodine, azote, and carbon was discovered by Serullas *, while repeating some of the beautiful experiments of MM. Davy and Faraday on the liquefaction of gases; but he soon ascertained that the combination of iodine and cyanogen might be effected without the aid of pressure.

CHEMICAL AND PHYSICAL PROPERTIES.

Cyanuret of iodine, purified by gentle sublimation, is perfectly white, and presents itself in the form of very long needles, excessively slender: its odour is very pungent, it irritates the eyes greatly and provokes tears; and its taste is exceedingly caustic. Its specific gravity is greater than that of sulphuric acid, through which it readily precipitates. It volatilizes without being decomposed, at a temperature far above that of boiling water. Thrown upon burning charcoal, it gives off abundant violet-coloured vapours. It is more soluble in alcohol than in water, and

* Annales de Chimie et de Physique, Oct. 1824, p. 184.

the colourless solutions have the odour and taste of the cyanuret itself; they do not redden the tinctures of turnsol or turmeric. By itself it does not decompose water, and affords no precipitate with nitrate of silver.

A concentrated solution of potass decomposes the cyanuret of iodine, and iodate and cyanuret of potassium are formed. Nitric acid appears to have no action upon it, nor does sulphuric acid attack it until after some time. Hydrochloric acid decomposes it; but the liquid sulphurous acid has the most remarkable effect upon it, speedily decomposing it, while the acid is set at liberty. Neither sulphurous acid gas when very dry, nor chlorine, has any action on cyanuret of iodine.

PROCESS FOR OBTAINING CYANURET OF IODINE.

In order to effect the combination of the acid with the cyanogen, Serullas triturates carefully and promptly, in a glass mortar, two parts of cyanuret of mercury quite dry and one part of iodine in the same state. He introduces this mixture into a phial with rather a wide neck, and gradually applies heat until the cyanuret of mercury begins to be decomposed, which is pointed out by the crepitation, the disappearance of violet-coloured vapours, and the commencing condensation of a white substance about the orifice of the phial. It is then conveyed by means of bent tongs, near to a large glass bell placed on a sheet of paper, or rather on a large square of glass. One side of the bell is to be raised, to admit the neck of the phial, which is inclined on one side as if to be emptied of a liquid. At this instant, white vapours rise very rapidly from the phial, and are condensed on the surface of the glass in the form of light cottony flakes. When no more are formed, heat is again to be applied, and the fumes collected as before. The operation may be also performed equally well by heating the mixture in a small glass retort, which is attached to a small receiver of the same material; but there is some difficulty in obtaining the product, and we are longer exposed to its deleterious emanations.

When iodine and cyanuret of mercury in the pro-

portions described, are employed in the preparation of the cyanuret of iodine, we avoid the inconvenience of a superabundance of iodine; but it is not less indispensable to effect a sublimation in order to separate a portion of ioduret of mercury that is mixed with it. This sublimation should be made at a very uniform heat. Serullas, to ensure this effect, preferred making use of a water-bath, notwithstanding the tediousness of the process.

With this view, introduce impure cyanuret of iodine into the bottom of a glass tube of moderate size, in such a manner that none of it adheres to the sides; keep it plunged in the water of the bath, the ebullition of which is to be kept up until nothing remains in the inferior part of the tube but the red ioduret of mercury, which is not volatile at this temperature. The tube should be inclined a little out of the bath, that the volatilized cyanuret of iodine may condense upon that part which, from its position, is the coldest.

COMPOSITION OF CYANURET OF IODINE.

To determine the proportion of the constituent principles of this substance, various quantities have been decomposed by means of red-hot iron. The ioduret of iron which results, being treated with pure potass, affords ioduret of potassium, which, according to its known composition, taking the mean of five experiments, gives for each gramme of cyanuret, 0.8066 of iodine; whence it may be calculated that a gramme of cyanuret of iodine contains;

Iodine	0.828	1 atom.
Cyanogen.....	0.172	1 atom.

It must however be remarked, says Serullas, that in each experiment the quantity of iodine was rather less than it should have been, on the supposition that the cyanuret contained an atom of iodine and an atom of cyanogen. But the difference is not sufficiently great to establish the conclusion that this body is formed of one atom of iodine and two of cynanogen; for in that case the proportions would be;

Iodine	0.7062	1 atom.
Cynanogen	0.2938	2 atoms.

ACTION OF CYANURET OF IODINE ON MAN.

From its composition, Serullas is of opinion that the cyanuret of iodine should have a very energetic action on the animal economy; and he thinks it likely to prove serviceable in medicine. It does not appear, however, to be so deleterious as the nature of its elements might at first lead us to suppose. This distinguished chemist, to whom we are indebted for an excellent work on the cyanuret, from which we have extracted these details, tasted it, as well as several persons in his laboratory, who like him were exposed to the inhalation of its vapours in considerable quantities, while preparing and enclosing it in vessels; the only effects were, a sense of weakness, and in every individual violent irritation of the eyes, which disappeared however in a short time.

M. Thenard has furnished me with a large quantity of cyanuret of iodine; but I have not been able to make sufficient experiments to determine its modus operandi. I have described it thus fully, in hope that some one may be induced to investigate its medical properties.

HYDROCYANIC ETHER.

M. Pelouze, a young chemist of great promise, has discovered a compound, which, in its physiological properties, approaches very near to prussic acid, and not possessing the frightful activity of the latter, is likely to become a useful medicine.

CHEMICAL PROPERTIES OF HYDROCYANIC ETHER.

It is a colourless liquid, of a very penetrating alliaceous odour, of the density of 0.78, boiling at about 82°, very sparingly soluble in water, but soluble in every proportion in alcohol and sulphuric ether.

When pure, it is not disturbed by a solution of nitrate of silver. It is very inflammable, and burns with a blue

flame. Caustic potass acts upon it with the greatest difficulty, and only when very much concentrated.

PREPARATION OF HYDROCYANIC ETHER.

To prepare hydrocyanic ether, mix intimately equal parts of sulpho-vinate of baryta and cyanuret of potassium, and raise the mixture to a moderate temperature in a glass retort, to which are adapted a basin and a tubulated matrass. We obtain by distillation a colourless or slightly yellow liquor, which separates into two distinct strata. The lighter of the two consists principally of hydrocyanic ether; but this ether is not pure, it is mixed with water, alcohol, sulphuric ether, and hydrocyanic acid. In order to purify it, let it be agitated quickly with four or five times its volume of water, and keep it for some time at a temperature of 50° to 60°. Agitate it again with a small quantity of water; then decant; leave it for twenty-four hours in contact with fused chloride of calcium, and distil. The ether thus obtained is pure. It is composed of;

Carbon	64.23
Hydrogen	8.96
Azote	26.81
	100.00

Its formula is $C^4\ H^8 + A^2\ H^2$.

It corresponds with equal volumes of olefiant gas and prussic vapour condensed into one volume.

PHYSIOLOGICAL PROPERTIES OF HYDROCYANIC ETHER.

Six drops thrown into the fauces of a dog, speedily produced deep inspirations, falling on the side, and subsequently cerebral congestion, and a remarkable agitation of the paws. He continued in this state for four minutes, after which the symptoms gradually abated, and in half an hour had almost disappeared. Six drops more introduced into the jugular vein, soon caused death, with phenomena very similar to those produced by prussic acid.

These experiments having been repeated and varied in

different ways, have enabled me to apply this ether with confidence to the treatment of disease.

MEDICINAL EMPLOYMENT OF PRUSSIC ETHER.

Six drops of prussic ether being added to a gummy linctus, a patient attacked with convulsive cough tried it for several days successively with very beneficial effects, without complaining of its disagreeable and penetrating odour. It was not so with some other patients to whom I administered the prussic ether at the Hotel Dieu: for although it produced satisfactory results, analogous to those obtained from prussic acid, I was obliged to discontinue its employment, on account of the insurmountable aversion of the patients to its nauseous odour.

Prussic ether may be administered in all those cases in which hydrocyanic acid is ordinarily employed.

IODINE.

Iodine is a simple body, discovered in 1813 by M. Courtois, in the mother-waters of the soda obtained from *sea-weed;* but we are indebted to M. Gay-Lussac for the greater part of our knowledge respecting its properties. It may be obtained from most of the *fuci* which grow on the sea-coast, and according to M. Fife, from sponge*. M. Gaultier, of Claubry†, has detected iodine in the mother-waters of soda from sea-weed in the state of hydriodate of potass. Several mineral waters appear to owe their properties to this substance. M. Laur. Angelini, of Voghera, has discovered the presence of iodine by means of starch in the saline waters of Voghera; but he has not made known the details of his process. The same chemist has found iodine in the waters of Salles, in the Voraghese, which are esteemed efficacious in cases of goître and obstructions of

* Annales de Chim. et de Phys., Tom. XII. p. 405.

† Ibid. Tom. XCIII. p. 75.

the lymphatics. Dr. Cantu, professor of chemistry at Turin *, astonished at the effects of the sulphureous waters of Castel-Nuovo d'Asti in these diseases, endeavoured to detect iodine in them, but without success. Encouraged, however, by the researches of M. Angelini, he has at length prevailed, and is even inclined to think that iodine exists in all the sulphureous waters which contain chlorurets. Several mineral waters not sulphureous, and particularly those of Echaillon in Savoy, which yield one twelfth their weight of sea-salt, and whose efficacy in goître is much celebrated, have afforded no trace of iodine.

M. Balard †, of Montpellier, in modifying the employment of starch as a re-agent for iodine, has proved the existence of this body in different marine molusca, both naked and testaceous, such as the *doris*, *venus*, *ostrea*, &c.; in several polypi and marine vegetables, as the *gorgonia*, the *zostera marina*, and especially in the mother-water of the salts afforded by the Mediterranean ‡. He has not been able to discover in what state iodine exists in sea-water, on account of the minute quantity, but supposes it to be in the form of hydriodate. In this form it has also been detected in the waters of Pandour and Raggozi.

Vauquelin, a short time before his death, found iodine in combination with silver, in a specimen of that metal obtained from a mine in the neighbourhood of Mexico, whose locality is not exactly known.

* Memorie della reale Acad. delle Science di Torino, tom. XXIX. p. 221.

† Annales de Phys. et de Chim. Feb. 1825.

‡ As M. Balard's method is simple and ingenious, it seems deserving of mention in this place. Having mixed the liquor containing the iodine with starch and sulphuric acid, a small quantity of the aqueous solution of chlorine is poured gently upon it; this liquid, on account of its less specific gravity, does not mix with the other; but at the point of contact a blue zone appears, which, although faint, cannot be mistaken. If the vessel be slightly agitated, so as to mix a portion of the inferior liquid with the supernatant solution of chlorine, the blue tint is developed in the part with which the chlorine is in contact; but if it be agitated sufficiently to cause a complete mixture of the two liquors, the blue colour instantly disappears, if there be an excess of chlorine.

PHYSICAL AND CHEMICAL PROPERTIES OF IODINE.

The name is derived from the Greek word ἰωδὴς, on account of the violet colour of its vapour. At the ordinary temperature iodine is solid, in the form of small greyish lamellæ, of feeble tenacity, and having the aspect of plumbago. It fuses at a temperature of 170° (cent.), and volatilizes at 175° (cent.), giving off beautiful violet-coloured vapours. These vapours, collected in a receiver, condense anew into crystalline lamellæ.

Iodine is soluble in ether and in spirits of wine, the latter dissolving a larger or smaller proportion, according to its degree of rectification; at 35°, and at a temperature of 13° (cent.), it dissolves about $\frac{1}{9}$th of its weight. At 40°, the temperature being the same, it dissolves $\frac{1}{6}$th of it. Water dissolves no more than $\frac{1}{7\,0\,0}$ of its weight of iodine.

Iodine has the property of forming an acid with hydrogen, and another with oxygen. It cannot be combined with oxygen in the gaseous state; but it unites with it in the nascent gaseous form, producing iodic acid. Its affinity for hydrogen is very great, abstracting it from a great number of bodies, and absorbing it in the gaseous state, when the temperature is elevated; it forms with this gas hydriodic acid, composed of iodine and hydrogen alone. This acid presents itself in the form of a colourless gas, which has a pungent taste and a penetrating odour; it reddens strongly the tincture of turnsol, and extinguishes bodies in a state of combustion.

This gas is very rapidly absorbed by water, which dissolves a very large quantity of it; hence it gives off white fumes in the atmosphere, by uniting with the aqueous vapours therein contained.

Hydriodic acid may be obtained by pouring water on ioduret of phosphorus made with eight parts of iodine and one of phosphorus, and distilling the liquor. The first portion which comes over is merely water, but the last, if separately collected, is highly concentrated, and impregnates the air with dense fumes: this is hydriodic acid. Phosphoric acid, which is likewise formed, remains

at the bottom of the retort. Another method of obtaining it is, by treating iodine diluted with an excess of hydrosulphuric acid, filtering, and then concentrating out of the reach of atmospheric air; or by decomposing ioduret of antimony by means of a large quantity of water, precipitating the last portions of metal by hydrosulphuric acid, and filtering and evaporating in vacuo.

Hydriodic acid will unite with a great number of bases; forming with some of them neutral salts, of which the most frequently employed in medicine hitherto is the hydriodate of potass: hydriodate of soda has also been sometimes used, and apparently with equal success.

PREPARATION OF IODINE.

Iodine is extracted, as we have already mentioned, from the mother-waters of soda prepared from sea-weed, where it exists in the state of hydriodate of potass. These waters are obtained by burning the different fuci which grow on the coast of Normandy, lixiviating the ashes, and concentrating the liquor.

To obtain the iodine, pour an excess of concentrated sulphuric acid on these waters, and let the liquor be gradually raised to ebullition in a glass retort furnished with a receiver. The acid seizes on the base of the hydriodate and on the hydrogen of the hydriodic acid, so that the result is sulphate of potass, water, sulphurous acid, and iodine, which last rises in violet-coloured vapours, passes into the receiver with a small quantity of acid, and in that state is condensed. In order to purify it, it must be washed, mixed with water containing a little potass, and again distilled.

PREPARATION OF THE HYDRIODATES OF POTASS AND SODA, SIMPLE AND IODURETTED.

If a solution of soda or of potass be poured upon iodine in the metallic state, an iodate and an hydriodate are formed, which may be separated from each other by means of alcohol, which dissolves only the latter of these salts, and the hydriodate is obtained by evaporation. The

iodate, by extreme calcination, may be transformed into an ioduret.

The hydriodates of soda and of potass may also be obtained in the same manner as other neutral hydriodates, viz., by directly combining the acid with the oxide. They are deliquescent salts, and consequently very soluble in water. Their solution is capable of dissolving more iodine, and thus an ioduretted hydriodate is formed.

MM. Baup * of Vevay, and Caillot † of Paris, have discovered, each separately, the same process for obtaining hydriodate of potass by means of hydriodate of iron. It is thus performed: one part of iodine and from three to four parts of water are introduced into a phial or matrass: to these are added, gradually, and at intervals, an excess of pure iron filings—one-half, for instance. A combination immediately takes place; much heat is disengaged, the iodine disappears, and the liquid assumes a deep red colour. During this powerful reaction, an ioduretted hydriodate is formed; by applying a gentle heat, and agitating for a moment while it is still warm, it is converted into simple hydriodate of iron. The absence of colour in the liquid indicates the cessation of the action; but a surer test is, that it no longer imparts a red tinge to white paper. The liquor is then filtered, diluted with several parts of water, and placed in a sand bath, in a capsule or matrass, until ebullition nearly takes place; and the iron is precipitated by means of carbonate or sub-carbonate of pure potass. This part of the operation demands some care, lest the potass be added in excess, which might indeed be separated by repeated crystallizations, or saturation with hydriodic acid. After filtering, in order to separate the ferruginous deposit, and washing thoroughly, we proceed to evaporate the filtered liquor, commencing with the waters used in the washing. The salt may be crystallized by cooling or by evaporation: in the latter case, the concentrated solution of hydriodate of potass is to be placed—not on a stove, because the salt would rise

* Naturwiss. Anzeiger, 1821.

† Journal de Pharmacie, Oct. 1822.

upon the sides of the vessel, and finish by taking up all the liquid, but over a very gentle fire, where the sides of the vessel being less heated than the bottom, will condense a little of the vapour which rises, and thus prevent the ascent of the salt. By degrees, the crystals are deposited; when they fill all the space occupied by the liquid, it is allowed to cool, and the mother-waters are then to be drawn off, which should afterwards be evaporated to procure more of the salt; finally the crystals are to be thoroughly dried on a stove, or over the fire, where they undergo a slight decrepitation.

To obtain the salt in a state of complete purity, it must undergo repeated crystallizations, especially if potass has been added in excess. If the iron employed was somewhat cupriferous, a few bubbles of sulphuretted hydrogen should be passed through the mother-waters, and the liquor filtered before we proceed to further crystallizations.

The hydriodate of potass (ioduret of potassium) generally crystallizes in cubes; but by careful evaporation it may be obtained in pyramids more or less broad. The crystals are almost always opaque or milky white. By slowly cooling a moderately concentrated solution, M. Baup has obtained it crystallized in long quadrangular prisms, and also in short prisms, terminated by a four-sided pyramid.

The solubility of the ioduret of potassium at 18° (Therm. centigr.) has been determined by M. Gay-Lussac: 100 parts of water at this temperature dissolve 143 of the ioduret. M. Baup has found that the same quantity of water at 12°.5 dissolves 136, and at 16°, 141 parts.

Five parts and a half of alcohol of the specific gravity = 0.85 at 12°.5, and from 39 to 40 parts of pure alcohol at the same temperature, are required to dissolve one part of ioduret of potassium: in both cases it dissolves better if heat be applied.

IODURETTED HYDRIODATE OF POTASS.

M. Baup has found that the ioduretted hydriodates are combined in fixed and determinate proportions, so that

the solution of hydriodate of soda or potass that is known to be capable of still further dissolving iodine, may, under any circumstances, combine with a quantity of iodine equal to that which it already contains (nearly $\frac{3}{4}$ of its weight, or :: 76.5 : 100).

Hitherto none but the iodureted hydriodate of potass, generally in solution with water, has been employed; but I prefer the simple hydriodate.

ACTION OF IODINE ON THE ANIMAL SYSTEM.

A short time after the publication of his valuable researches on iodine, M. Gay-Lussac sent me a quantity, that I might ascertain its effects upon animals. I soon instituted some experiments, in which I introduced the tincture of iodine into the veins, to the extent of a *gros*, without any apparent effect. Several dogs were also made to swallow it, but the only effect produced was that of vomiting.

Perceiving its harmlessness, I took a tea-spoonful of the tincture myself, and experienced no other effect than a disagreeable taste, which continued for some hours, but went off by degrees. I have seen a child, four years old, to whom the same quantity of tincture of iodine prepared by M. Pelletier, was given by mistake: the lips and tongue were stained yellow, but no injurious consequences ensued.

Among the properties of iodine, one of the most remarkable, when its employment has been continued for some time, is the diminution of the mammæ, and of the testicles. I have not myself witnessed this effect, but I am assured it is frequent in Switzerland.

CASES IN WHICH THE PREPARATIONS OF IODINE MAY BE EMPLOYED.

Dr. Coindet, of Geneva, was the first who employed iodine as a medicine; he used it in the treatment of goître with very decided success. It has since been tried both in France and Switzerland, by many physicians, who are unanimously agreed that iodine is an efficacious remedy in a disease that is sometimes most intractable.

Although we are more sanguine of obtaining success in cases of recent goître, and when the individual is young, we have known instances in which goîtres of long standing, indurated and very large, have disappeared before this remedy; but the treatment in such cases being necessarily protracted, the continual use of the iodine may have an injurious effect upon the stomach: to obviate this inconvenience, I have recommended iodine to be used in another way, viz., by means of friction.

If new examples were requisite to prove the advantages of simple remedies over the old formulæ, we might cite the facts collected by Mr. W. Rickwood *, of the cure of goître by means of iodine, when he had before employed burnt sponge with but transient success. Among the cases mentioned, is one of the cure, or at least of a considerable diminution in size of goître, in a woman seventy years of age.

The employment of iodine has been equally successful in the treatment of scrofula. M. Baup has cured old scrofulous ulcers. I have myself subdued by its means very considerable glandular enlargements.

In the report of the Polyclinical Institute of Berlin for the years 1820, 1821, and 1822, MM. Hufeland and Osann, after enumerating several cases of goître which were cured by tincture of iodine and hydriodate of potass, add, that they have also obtained beneficial results from the same preparations in scirrhus and carcinoma of the uterus. Dr. Wagner has observed good effects from iodine, in the treatment of a tumour of the lower jaw which he considered cancerous. Dr. Hennemann † has also reported a case in which iodine exerted a remarkable influence on a cancer of the uterus, in the most advanced stage; there was a communication between the vagina and the abdominal cavity, so that a cure was impossible; but the condition of the patient was greatly ameliorated.

M. Zinck read, in 1823, to the Société cantonale of Lausanne, a memoir, in which he records two cases of

* Lond. Med. and Phys. Journal, August, 1823.

† Journal der Practischen Heilkunde.

white swelling that were cured by the preparations of iodine.

In Dr. Gairdner's monograph on iodine, a similar case is mentioned, which was communicated by Professor Maunoir, of Geneva. A child laboured under a white swelling of the knee, and was unable to walk without crutches. Blisters, leeches, and deobstruents of all kinds had been used in vain, when the tumour was ordered to be rubbed with a piece of iodine ointment about the size of a nut, and the tincture of iodine to be administered internally in small doses. In the course of a few weeks the cure was completed.

M. Zinck * has likewise published two memoirs on the abuse of iodine taken internally; from which it appears, that if persisted in for too long a time, it may produce gastric inflammation; but this can only happen from the indiscretion of the patients, who, in the hope of obtaining more speedy relief, or even to prevent the disease altogether, make use of this remedy in immensely large doses.

M. Zinck proceeds in these words:—"As soon as the efficacy of the tincture of iodine, in the cure of goître, was made public, that article was employed to an inconceivable extent at Lausanne; it was pushed so far, that I may say, without exaggeration, the tincture of iodine bottle occupied the place of the sweetmeat box. With a few exceptions, every one used it, even those who dreaded the possibility of an attack of goître, and it was procured from the shops without physicians' prescriptions. I have calculated with M. Bischoff, an apothecary of this city, that by the most moderate computation, he has used ten pounds of iodine to prepare the tincture required for one year's consumption; and other apothecaries have sold a like quantity. Many persons sent to Geneva for it, believing very erroneously that it would be better when procured from thence. This mania for iodine had some victims; but few in comparison with the great number of persons who made use of the tincture without any kind of

* Journal Complimentaire, 1824.

precaution, and the ill effects produced were undoubtedly owing to the abuse of the dose."

The use of iodine has been lately much extended in England, where it was formerly employed by very few practitioners. Dr. Gairdner has published an interesting memoir on the effects of iodine on the animal economy, and on the advantages derivable from it in the treatment of goître, and scrofulous and tuberculous affections of the chest and abdomen. We may observe, that iodine very rarely causes the serious accidents attributed to it by M. Gairdner; to produce such mischief, it must be administered with as little restriction as it was by the young student of whom the author speaks, who wished to cure his sister of goître. Dr. Baron, of London, has employed iodine with considerable success, in the treatment of scrofulous phthisis and some other tuberculous affections. These first attempts require corroboration by additional facts, that we may know more precisely the efficacy of iodine when phthisis has made but little progress.

The late Mr. Haden, in the English translation of this Formulary, has reported a case of phthisis, presumed to have been cured by iodine.

M. Defermon employed the following mixture with success, in the case of a young phthisical female, giving her five grammes every hour.

Lettuce water	4 onces.
Solution of hydriodate of potass	15 drops.
Medicinal prussic acid	10 to 12 drops.
Syrup of marsh-mallows	1 once.

The prussic acid, and the syrup of marsh-mallows, may be replaced by one ounce of cyanic syrup.

Dr. Baron, in his Treatise on Tuberculous Diseases, reports a case of encysted ovarian dropsy, in which the employment of iodine was followed by the most prompt and decided success. Dr. Gairdner, who quotes this fact in his work, and says that he recommended the remedy with great advantage in a similar instance, gave it in several cases of ascites, without success.

Dr. Coindet extols iodine as a powerful emmenagogue, which property has been confirmed by the observations of Professor Brera * and other physicians. I have also had opportunities of verifying this assertion.

When using it in a suppression of the menses of a young lady, whose virtue I had no reason to suspect, an abortion suddenly took place at the end of three weeks!

M. Brera has administered the preparations of iodine still more extensively than Coindet. Besides goître and suppression of the menses, which have been cured by iodine, he mentions several cases of indurated glands, tabes mesenterica, chronic dysentery, hæmoptysis supervening to suppressed catamenia, laryngeal phthisis, leucorrhœa, syphilitic enlargements, &c., the cure of which he attributes to this remedy. Probably M. Brera often associates other substances with the preparations of iodine, to which he ascribes all the efficacy; it ought therefore to be cautiously employed in similar cases. This gentleman, however, is not the only one who has given iodine in tabes mesenterica. Mr. Callaway, a distinguished English surgeon, has obtained very successful results from its employment in scrofulous cases and in enlarged mesenteric glands.

Iodine has also been recently employed in the treatment of syphilitic buboes, and in blennorhagia. M. Richon †, physician to the military hospital of Strasbourg, has used it with advantage in these two complaints. He generally gives 15 drops of the tincture the first day, in the morning, 20 to 25 the second, and 30 the third day. He then begins to administer 15 drops in the evening, and proceeds in this way till 30 drops are taken morning and evening. This dose is continued for three or four days, and at last it is increased to 50 or 55 drops, morning and evening. If no irritation of the stomach is occasioned, the patients sometimes experience a sensation of heat in the pharynx, which soon disappears; there is occasionally slight colic, headache, dryness and redness of the tongue; the medicine is then

* Saggio clinico sull' Iodio, &c. Padua, 1822.

† Archives Gén. de Med., March, 1824.

suspended, but resumed again. The most suitable dose is 30 drops, morning and evening. M. Richon's patients were all soldiers, for the most part robust and not easily excited.

MM. Gimelle * and Sablairolles † have detailed instances which establish the virtues attributed by Coindet and Brera to this remedy in leucorrhœa. M. Gimelle has cured herpes by means of the preparations of iodine; I have also treated very obstinate cases of it with speedy and complete success. M. Eusèbe de Salle has employed the ointment of hydriodate of potass by friction, and iodine in pills, in the chronic obstructions of the liver to which Europeans are subject from their residence in equatorial regions.

M. Roupp, the veterinary surgeon attached to the depôt at Abbeville, has made use of the hydriodate of potass in the treatment of the acute stage of glanders: during a whole month he gave from 9 to 14 grains to a horse, rubbing in, at the same time, an ointment of the same salt. This first attempt was unsuccessful; indeed the fever seemed to be augmented by the action of the medicine: perhaps the dose was too feeble, or the disorganization too considerable to afford a hope of cure.

At the close of the year 1822, the Genevese and Swiss physicians quite changed their opinion respecting the advantages which they formerly considered attributable to the preparations of iodine; they imagined that serious accidents had followed its employment, such as chronic inflammations of the stomach, rapid emaciation of the whole body, and particularly of the mammæ, &c. I have never seen these ill effects, even from doses which might be deemed extraordinary ‡.

* Revue Medicale, tom. VII. p. 249.

† Journ. Univ. des Sciences Medicales, Oct. 1825, et Bulletin des Sciences Med., Feb. 1824.

‡ Perhaps these discrepancies are to be attributed in some measure to the difference in weights of different countries. In Geneva and France, 48 grains of iodine are used to the ounce of alcohol; but these grains are of the marco weight, whereas in other parts of Switzerland and in Germany, the Nuremburg medicinal weight is used, and in England the troy weight. In both

MEDICINAL EMPLOYMENT OF IODINE.

TINCTURE OF IODINE.

Alcohol at 35°	1 once.
Iodine	48 grains.

This tincture should not be prepared a long time beforehand, because it soon deposits crystals of iodine; moreover, it is not unlikely that the iodine may attract a portion of the hydrogen of the alcohol, and be thus converted into an ioduretted hydriodic acid.

Tincture of iodine has been employed with much success in the treatment of goître, also of scrofula, but less frequently than the two following preparations. It is given to adults in the dose of from 4 to 10 drops, three times a day, in a small glass of sugared water; the quantity may be progressively increased to 20 drops, thrice a day: 20 drops contain about one grain of iodine *; but the dose may be carried to a much greater extent without inconvenie ce.

IODATED WATERS.

These are employed in the treatment of scrofula in the hospital Saint-Louis, and very decided success has been obtained.

M. Lugol prepares these iodated waters in the proportion of one-half, two-thirds, and one grain of iodine to a *livre* of salt water. These iodated waters are distinguished from each other by the numbers 1, 2, and 3.

these, 20 grains are contained in the scruple, while in the marco there are 24 grains. So that in the last mentioned countries, a tincture of iodine is used stronger, by one-fifth, than that which is employed in France and Geneva. (See Journal de Pharmacie, Jan. 1823.)

* A drop of the tincture of iodine weighs but $\frac{2}{3}$ds of a grain, while a drop of the solution of hydriodate of potass weighs more than a grain. If the hydriodate is ioduretted, the weight of the drop may be from one grain and a half to two grains. This difference must be taken in to account when the doses are regulated by the number of drops.

Iodated Water. No. I.

(Half a grain of iodine to one livre.)

Purified sea salt ..... 66 grammes.
Tincture of iodine (containing one grain of iodine per gramme)..... 50 grammes.
Pure water ..... 50 litres or 100 livres.

Iodated Water. No. II.

($\frac{1}{3}$d of a grain of Iodine per livre.)

Sea salt ..... 66 grammes.
Tincture of iodine..... 75 grammes.
Pure water..... 100 livres.

Iodated Water. No. III.

(One grain per livre.)

Sea salt ..... 66 grammes.
Tincture of iodine..... 100 grammes.
Pure water..... 100 livres.

I have long employed these iodated and ioduretted waters, but without the addition of sea-salt. I have frequently made use of the following formulæ;

IODURETTED WATER.

Ioduret of potassium..... 6 grains.
Iodine ..... 1 grain.
Pure water ..... 2 livres.

This may be substituted for ordinary beverage at meals.

IODURETTED SULPHURIC ETHER.

Sulphuric ether ..... 1 gros.
Pure iodine..... 6 grains.

Thirty drops contain one grain of iodine. Patients can scarcely bear more than ten drops at a time.

SOLUTION OF IODURET OF POTASSIUM.

Ioduret of potassium ..... 36 grains.
Distilled water..... 1 once.

This solution is capable of dissolving still more iodine, and thus forming an ioduretted hydriodate of potass.

If we wish to employ the solution called Coindet's, we have only to add ten grains of pure iodine to the foregoing solution of ioduret of potassium.

These two preparations, whose mode of exhibition is the same as that of the tincture of iodine, are likewise employed in the treatment of goître and scrofula; if in the latter some tonic is usually added.

I have for a considerable period made use of the solution of ioduret of potassium, both in the hospitals and in private practice, and I have obtained results of a very interesting nature. I am satisfied that the dose of this solution may be raised, without any fear of accident, to one, two, and even three *onces* per diem.

Delicate, emaciated, and very nervous women, as well as young females, have taken this quantity for several weeks, without the least appreciable derangement of their health. Far from this, their embonpoint has increased in an extraordinary manner; and the mammæ of some young girls have been obviously developed during the use of this medicine. From the same dose, I have witnessed two cancers of the tongue in the incurable wards of the Hospice de la Salpétrière disappear, as if by enchantment, in less than fifteen days. The women who were afflicted with this loathsome disease, had been many years before admitted into the hospital as incurables; one of them is there still, and her cure, which takes its date nearly five years since, is perfectly established*. In the same hospital, a woman who had for a long time suffered under ulcerations of the tongue, has been completely cured by the use of the hydriodate of potass.

I have in a few days reduced scorbutic swellings of the gums by half a *gros* of the solution daily. In these cases, the solution probably acts in a manner analogous to its operation in goître, viz., by constricting the ultimate ramifications of the vascular system. With this view, I have employed large doses of the solution in hypertrophy of the ventricles of the heart. If the analogy in this case be

* See Magendie's Journal de Physiologie, &c., 1828.

not delusive, as it so often is, I have arrived at some important results, which I shall not fail to make public.

The researches thus adverted to in 1827, I have continued and prosecuted hitherto with all the zeal of which I am capable; but the nature of this work only permits me to announce the general results.

The infirmary of the Hospice de la Salpétrière invariably contains a great number of cases of hypertrophied ventricles; this place therefore was favourable to my first endeavours. Unfortunately, the effects did not answer my expectations; I observed only a slight amelioration in consequence of the treatment I had adopted. The cause of this want of success was doubtless owing to the organic lesions, and especially to the ossifications of the arteries and valves, which almost always accompany these hypertrophies. I have, however, gained the knowledge of an important fact, viz., the extent to which the simple and ioduretted hydriodates may be administered. At first I gave the solution by drops; I now give it by *gros*, and I have often exceeded two *onces* in twenty hours, which is equal to a *gros* of hydriodate of potass. I have never seen the least accident, nor even the slightest inconvenience from this dose, which leads me to infer that it may be safely administered to a still greater amount.

If I have not succeeded in the Hospice de la Salpétrière with old men, it has not been the same with the young persons whom I have attended, both in the metropolis and at the Hotel Dieu. On the contrary, I have obtained surprising effects from large doses of ioduret of potassium; surprising, I say, not only because the distinctive symptoms of the hypertrophy have disappeared, but rather because they have disappeared in a very short time, frequently in less than a month. I have generally used the following formulæ;

ATROPHIC SOLUTION.

Distilled lettuce water	8 onces.
Peppermint water	2 gros.
Ioduret of potassium	4 gros.
Syrup of marsh-mallows	1 once.

Five *gros* to be taken morning and evening in a little water. The dose may be increased to twice this quantity at the same intervals.

It sometimes happens that hypertrophy of the ventricles, which is characterized by a strong impulsion, and by a dull though intense beating sound, is accompanied by acceleration of the movements of the heart; in this case, I add to the solution tincture of digitalis in the following proportion;

ATROPHIC SOLUTION.

Distilled lettuce water	8 onces.
Orange-flower water	1 gros.
Ioduret of potassium	4 gros.
Alcoholic tincture of digitalis	1 to 2 gros.
Syrup of marsh-mallows	1½ once.

Half an ounce or five *gros* night and morning in a little water.

OINTMENT OF HYDRIODATE OF POTASS.

Hydriodate of potass	1 gros.
Lard	1½ once.

Frictions may be made with this ointment night and morning on goître or enlarged scrofulous glands, in the quantity of half a gros each time. At the end of a week, the quantity may be increased to a gros, or even more, according to the age of the patient and the extent of the tumour.

The complete resolution of tumours, is sometimes effected by this means which could not be entirely removed by saline solutions. This ointment has been successfully employed in various cases of enlargement of the testicle which had resisted all other remedies. Sometimes, however, friction is not sufficient of itself, and the internal administration of the remedy is necessary to effect a perfect cure. In general, the employment of the saline solutions appears to be most efficacious in scrofula.

When friction is resorted to in the treatment of goître, it is sometimes expedient to promote the action of the

iodine by emollient fomentations or leeches. Occasionally, after the first frictions, the goître instead of becoming softer, increases in hardness, and is slightly painful; the application of a few leeches will generally remove this local irritation, and the effects of the iodine will be displayed in a very remarkable manner.

The activity of this ointment may be increased by adding from ten to fifteen grains of pure iodine, to form what is called "Ointment of ioduretted hydriodate of potass."

M. Lugol has prepared for the patients of the hospital Saint-Louis, three kinds of ioduretted hydriodated ointment, distinguished by the numbers 1, 2, and 3, according to the following formulæ.

IODURETTED HYDRIODATED OINTMENTS.

Ointment. No. I.

Ioduret of potassium	64 grains.
Iodine	8
Lard	1000

Ointment. No. II.

Ioduret of potassium	160 grains.
Iodine	22.4
Lard	1000

Ointment. No. III.

Ioduret of potassium	160 grains.
Iodine	25.6
Lard	1000

M. Lugol has particularly employed the ioduretted ointments, and the iodated waters before mentioned, in the treatment of scrofulous diseases. For many years, he has observed the efficacy of these preparations in tubercles, ophthalmiæ, ozæna, ulcers, dysmenorrhæa, white scrofulous swellings, &c.

I have commenced a series of experiments on the employment of ioduret of potassium in epilepsy, and have already observed, in several cases, most advantageous effects; but I have found it necessary to employ half a gros and even a gros daily.

I constantly make use of this formula:

ANTI-EPILEPTIC SOLUTION.

Ioduret of potassium	4 gros.
Iodine	2 grains.
Peppermint water	3 onces.
Orange-flower water	3 onces.

Dose.—Five *gros* three times a day.

EMPLOYMENT OF THE IODURET OF POTASSIUM IN CHRONIC RHEUMATISM AND OLD SYPHILITIC AFFECTIONS.

I have for some years employed with advantage, especially at the Hôtel Dieu, the ioduret of potassium, either alone or combined with vegetable decoctions, such as sarsaparilla or dog's-grass *.

I add from half a gros to two gros of the ioduret to a pint of the decoction, and one to two grains of iodine. These drinks are called at the hospital *ioduretted dog's grass* and *ioduretted sarsaparilla*. These are the formulæ;

IODURETTED SARSAPARILLA.

Decoction of sarsaparilla	2 livres.
Ioduret of potassium	1 gros.
Syrup of orange-peel	2 onces.

The whole may be taken in twenty-four hours, a glassful † at a time.

IODURETTED DOG'S-GRASS.

Decoction of dog's-grass	2 livres.
Ioduret of potassium	½ gros.
Peppermint syrup	2 onces.

This may be given in the same quantities as the last.

EMPLOYMENT OF IODINE IN SCROFULOUS OPHTHALMIÆ.

I am happy to be able to acquaint my fellow practitioners with a means of curing, in a short time, scrofulous ophthalmia, a disease which often baffles the most active therapeutic agents.

* Triticum repens and Panica stolonifera. [Tr.]

† Verre,—the sixth-part of a *pinte*. [Tr.]

IODURETTED COLLYRIUM.

Rose water	6 onces
Ioduret of potassium	24 grains.
Iodine	1 or 2 grains.

To be used four times a day.

I have rarely seen scrofulous ophthalmia, attended even by ulceration of the conjunctiva and the cornea, resist this means longer than a month, combined always with suitable internal treatment and an appropriate regimen. I sometimes add morphine to the solution.

IODURETS OF CALCIUM, BARIUM, IRON, AND ARSENIC.

IODURET OF CALCIUM.

Precipitate hydriodate of iron by an excess of slaked lime, and evaporate to dryness; then redissolve in water, and the filtered liquor yields by evaporation ioduret of calcium.

This salt is white, very deliquescent, of a bitter and hot taste, and susceptible of crystallization.

IODURET OF BARIUM.

Expose to heat the hydriodate of iron, with an excess of carbonate of baryta; evaporate to dryness, and by redissolving in water, and concentrating, we obtain the ioduret in silky or prismatic needles, which are very deliquescent, and of a nauseous disagreeable taste.

This ioduret has only been employed by M. Biett in a few cases of scrofulous congestions.

OINTMENT OF IODURET OF BARIUM.

Ioduret of Barium	4 grains.
Lard	1 once.

PER-IODURET OF IRON.

Place one part of iodine in contact with half the quantity of iron filings, taking care that it be performed under water. On applying heat, the iodine combines with the iron: when the liquor becomes green, let it be filtered, evaporated to dryness, afterwards taken up again by water, and by filtering and evaporation the ioduret is obtained. It crystallizes with difficulty, and is very deliquescent, styptic, &c.

IODURET OF ARSENIC.

This substance has been used medicinally by M. Biett, of the hospital Saint-Louis.

It is obtained *either*—by heating in a glass retort a mixture of sixteen parts of arsenic, and 100 of iodine; the iodine is sublimed under the form of needles, of an orange red colour. It is easily decomposed by large quantities of water.

Or—by boiling thirty *grammes* of arsenic in powder, and 100 grammes of iodine in 1000 grammes of water, filtering as soon as the liquor becomes colourless, and evaporating to dryness. It may be sublimed, if that be thought desirable.

OINTMENT OF IODURET OF ARSENIC.

Ioduret of arsenic.....	3 grains.
Lard.....	1 once.

M. Biett has frequently employed this ointment in cases of tuberculous herpes-exedens.

IODATE OF STRYCHNINE.

The preparation of this salt is very easy; we have only to reduce the strychnine to powder, and to saturate it with a concentrated solution of iodic acid: at the moment of combination, the mass increases in volume, absorbs the water, becomes thick, and often of considerable consistence; it is then taken up by boiling alcohol, filtered, and

ultimately left to spontaneous evaporation. We obtain, by this means, a beautiful crystallization of iodate of strychnine.

It may also be obtained by double decomposition, either by pouring iodic acid into a solution of a salt of strychnine, or by pouring a soluble iodate, like that of soda, on a solution of sulphate or hydrochlorate of strychnine. In both cases the iodine is precipitated; on taking it up by boiling alcohol, we may procure it in crystals like the preceding.

CHEMICAL PROPERTIES OF IODATE OF STRYCHNINE.

Thus obtained, it is white, crystallized in beautiful prismatic needles, scarcely soluble in cold water, but soluble in boiling water and in alcohol; thrown upon hot coals, it crepitates and disengages iodine. Heated in a tube, it is decomposed with a slight detonation, deposits charcoal, and disengages carbonic acid and iodine.

ACTION OF IODATE OF STRYCHNINE UPON ANIMALS.

This salt is one of the most powerful with which I am acquainted; one grain is sufficient to cause the speedy death of a vigorous dog, with tetanic symptoms.

CASES IN WHICH IT MAY BE EMPLOYED.

Iodate of strychnine has also the most energetic action on the human system.

I have given it, with success which surpassed all my hopes, in many cases of paraplegia of long standing which having exhausted all the known therapeutical agents were pronounced incurable.

I have only administered this remedy in pills of $\frac{1}{8}$th of a grain each. I commence with one, morning and evening, gradually augmenting the dose, until eight are taken in twenty-four hours; but it is necessary here, as in all the preparations of strychnine, to observe the greatest caution.

IODURET OF MERCURY.

The iodurets of mercury have recently been employed in syphilis, and I have abundantly verified their sanative properties in numerous syphilitic affections.

MODE OF PREPARING THE PROTO-IODURET OF MERCURY.

Take 100 parts of proto-nitrate of mercury in crystals, and dissolve them in 400 parts of water. On the filtered solution pour a solution of hydriodate of potass, until precipitation ceases. We thus obtain a greenish yellow pulverulent precipitate, which being thrown upon a filter, is carefully washed with distilled water, until the water no longer yields a black precipitate with potass; it is then to be dried and preserved in a close vessel defended from the rays of the sun. This proto-ioduret is yellow, insoluble in water, and without action upon that fluid; it is also volatile. According to Dr. Thomson, 162 parts of the proto-ioduret contain 62 parts of iodine and 100 of mercury, or 250 of mercury and 156 of iodine.

MODE OF PREPARING THE DEUTO-IODURET.

Take of the deuto-chloruret of mercury (corrosive sublimate) seventy parts, and of the hydriodate of potass 100 parts. Dissolve each separately in a sufficient quantity of distilled water; filter the two liquors, and unite them by small quantities: a red powder will be instantly precipitated, which must be collected on a filter, and washed with distilled water in the most careful manner, until the water comes off without taste.

The precipitate is then dried, reduced to powder, and kept in a bottle excluded from the light. The deuto-ioduret is very soluble in hydriodate of potass and in mercurial salts, so that neither of them must be added in excess: the acids, and even alcohol, likewise dissolve this precipitate. It is very volatile, and contains 250 parts of mercury and 312 of iodine.

Hydriodic acid may be substituted for hydriodate of potass, in these ioduretted preparations.

MODE OF EMPLOYING THE IODURET OF MERCURY.

OINTMENT OF THE PROTO-IODURET OF MERCURY.

Proto-ioduret of mercury..... 20 grains.
Lard..... 1½ once.

This ointment has been extolled in the treatment of inveterate venereal ulcers, whose cicatrization it certainly promotes.

OINTMENT OF THE DEUTO-IODURET OF MERCURY.

Deuto-ioduret of mercury..... 20 grains.
Lard..... 1½ once.

This preparation, is more active than the preceding, but is used in the same circumstances: a very small quantity should be placed on the pledgets of lint applied to the ulcers.

TINCTURE OF DEUTO-IODURET OF MERCURY.

Alcohol at 36°..... 1½ once.
Deuto-ioduret of mercury..... 20 grains.

Twenty-six drops of this tincture are nearly equivalent to $\frac{1}{8}$th of a grain of the deuto-ioduret itself; it may be given to the extent of ten, fifteen, or twenty drops in a glass of distilled water, as it is quickly decomposed by common water.

We are assured that it has succeeded in scrofulous affections complicated with syphilis.

SULPHURIC ETHER WITH DEUTO-IODURET OF MERCURY.

Sulphuric ether..... 1½ once.
Proto or deuto-ioduret of mercury.. 20 grains.

This preparation is more active than the preceding, and must therefore be given in smaller quantities.

PILLS OF DEUTO-IODURET OF MERCURY.

Deuto-ioduret of mercury..... 1 grain.
Extract of juniper..... 12 grains.
Liquorice powder, q. s.

To be made into eight pills, two to be taken at first morning and evening. The dose may be afterwards increased to four at the same periods.

PILLS OF PROTO-IODURET OF MERCURY.

Proto-ioduret of mercury..... 1 grain.
Extract of juniper..... 12 grains.
Liquorice powder, q. s.

Divide into eight pills, which are to be administered as in the preceding formula.

IODURET OF SULPHUR.

Take of iodine four parts, sublimed sulphur one part; introduce the mixture into a medicine-phial, and apply a gentle heat; the excess of iodine is separated, and the ioduretted compound remains as a greyish, needle-pointed mass, absorbing moisture with avidity and easily decomposed.

OINTMENT OF IODURET OF SULPHUR.

Ioduret of sulphur..... 5 parts.
Lard..... 96 „

Idem.

Ioduret of sulphur ..... 8 parts.
Lard..... 144 „

The ioduret of sulphur has been employed by M. Biett for many years, in tubercular affections of the skin.

IODURET OF ZINC.

Some persons have obtained benefit from the substitution of ioduret of zinc for ioduret of potassium.

It is prepared either by decomposing carefully a solution of sulphate of zinc, by the ioduret of barium in solution, then filtering, crystallizing, and evaporating to dryness; or, by heating in a matrass a mixture of zinc (20 parts) and of iodine (170 parts), and subliming in a phial.

The ioduret of zinc is obtained in white needles, very deliquescent, and very soluble in water; its taste is disagreeable and styptic.

OINTMENT OF IODURET OF ZINC.

Dr. Ure * recommends friction, with the following ointment, as a substitute for that of hydriodate of potass.

Ioduret of zinc	1 gros.
Lard	1 once.

A *gros* of which may be rubbed on the tumour once or twice a day.

BROMINE.

Bromine, discovered by M. Balard, has been found in saline mother-waters, in sea water, and in numerous springs, in animals and vegetables which inhabit the sea, and in a great number of marine substances.

MODE OF PREPARATION.

Several methods have been proposed for the extraction of this substance. That of M. Balard consists in passing a current of chlorine into the saline mother-waters, and pouring a quantity of sulphuric ether on the surface of the liquid, which becomes impregnated with the bromine.

* Dict. of Chemistry, 2d edition.

This ether being well agitated with potass, yields a bromuret, which, collected, dried, and mixed with peroxide of manganese, and treated with dilute sulphuric acid, emits by distillation ruddy vapours; these condensed, are bromine.

PHYSICAL AND CHEMICAL PROPERTIES.

Bromine is a liquid, of a fine hyacinthine red, when viewed in a thin layer by refracted light; blackish red when viewed by reflected light: it is extremely volatile, giving off ruddy vapours, and has a suffocating odour, analogous to that of oxide of chlorine; it tinges the skin of a yellow colour; it is very heavy, even more so than sulphuric acid; its density is 2.966; it congeals at 18° or 20° of cold. It is not decomposed by heat, electricity, &c.

This substance has much analogy with chlorine and iodine, between which its station is assigned, being driven from its combinations by the former, while it displaces iodine from its compounds.

It affords also with oxygen and hydrogen two acids, the one bromic, the other hydrobromic. The latter, combined with a base, yields various salts, which may be designated as hydro-bromates, or bromurets. M. Henry * has made us acquainted with the preparation of several of these salts.

MODE OF PREPARING THE BROMURETS.

It is with the bromuret of iron in solution that most of these have been obtained.

Per-bromuret of Iron.—This salt is procured by heating under water a mixture of equal parts of bromine and iron filings; when the liquid presents a greenish hue, filter, evaporate to dryness, and the sienna-coloured residue taken up by water and evaporated afresh, yields the per-bromuret. It is of a brick-red colour, very soluble, deliquescent, and excessively styptic to the taste.

Bromuret of Calcium is obtained in the same manner as ioduret of calcium, substituting bromuret of iron in solution for ioduret of iron. It appears in small silky

* Journal de Pharmacie. Feb. 1829.

needles, white, very deliquescent, and of a hot taste, like the chloride of calcium.

Bromuret of Magnesium.—By heating the solution of bromuret of iron with an excess of caustic magnesia, filtering, and evaporating, we obtain this salt. It is very deliquescent, in the form of prismatic needles, and of a bitter taste.

Bromuret of Barium.—Proceed in the same way as for ioduret of barium. This bromuret is in rhomboidal prisms, less deliquescent than the preceding, and of a very nauseous taste.

Deuto-Bromuret of Mercury.—It is obtained by the direct combination of bromine with mercury, and by sublimation; or by subliming a mixture containing equal parts of deuto-sulphate of mercury, and bromuret of potassium.

The *Proto-Bromuret of Mercury*—is obtained by carefully pouring a very weak solution of proto-nitrate of mercury on the bromurets of potassium, calcium, or sodium. The yellowish white deposit, washed and dried, constitutes this salt, which may be easily sublimed. When it is more decidedly yellow, it is hot and insoluble in water.

This salt is very volatile, and very soluble; it crystallizes in silky needles of a pearly lustre.

The *Bromurets of Potassium and Sodium* are obtained by decomposing the bromuret of iron by the carbonates of potass and soda, filtering and evaporating.

The first is scarcely deliquescent, a little brackish, and crystallizes in cubes. The second has an alkaline taste, and crystallizes in needles; they are very soluble.

EMPLOYMENT OF BROMINE.

The analogy between the properties of iodine and bromine has induced several physicians to make trial of the latter substance. I have myself prosecuted researches of this kind, and up to the present time I have had no cause to regret my exertions.

I administer bromine in those cases where iodine does

not appear to have sufficient activity, or more frequently, where the patients are accustomed to the action of the latter substance. In the hospitals, I use the preparations of bromine, in scrofula, amenorrhœa, and hypertrophy of the ventricles.

I make use of the following formulæ:

MIXTURE OF HYDROBROMATE OF POTASS.

Distilled lettuce-water.	3 onces.
Hydrobromate of potass	12 grains.
Syrup of marsh-mallows	1 once.

To be taken in twenty-four hours, in doses of five *gros*.

PILLS OF BROMURET OF IRON.

Bromuret of iron pulverized.....	12 grains.
Conserve of roses	18 grains.
Gum arabic	12 grains.

Mix carefully, and make into twenty pills, of which two may be taken morning and evening.

OINTMENT OF BROMINE.

Lard	1 once.
Hydrobromate of potass or soda.....	34 grains.

Mix well, and use it in friction on scrofulous swellings, to the extent of half a *gros* or a *gros*.

OINTMENT OF BROMURETTED HYDROBROMATE OF POTASS.

Refined lard	1 once.
Hydrobromate of potass	24 grains.
Liquid bromine.....	6 to 12 drops *.

To be used in friction.

There is great scope for inquiry, as to the preparation and employment of bromine, but we may safely affirm that this substance will become a valuable therapeutical agent.

* *Gros*, in the French text, which must be a misprint for gouttes. [Tr.]

CHLORINE.

Chlorine, discovered in 1774 by Scheele, was regarded as a compound body, and received the name of *dephlogisticated marine* acid; when the new nomenclature was established, it was called *oxygenated muriatic acid.* Kirwan gave it the name of *oxymuriatic gas*, because, according to the old theory, this body was regarded as a compound of oxygen and *muriatic acid;* it was supposed that the latter acid, which is composed of hydrogen and chlorine, had the same radical as the *super-ozygenated muriatic acid*, and only differed in having a smaller proportion of oxygen.

Chlorine has been the object of numerous researches. Berthollet made it a particular study, and invented the method of bleaching by chlorine; Guyton-Morveau applied it to the purposes of disinfection. This important discovery presented some inconveniences in the application, because of the difficulty of graduating the quantity of gas we may wish to disengage. The chlorurets are now most frequently employed as disinfectants. M. Chenevix was the first who sought to determine the principles of oxygenated muriatic acid; but the beautiful experiments of MM. Gay-Lussac and Thenard, soon established this important fact;—that oxygenated muriatic acid, regarded until then as a compound body, was a simple body, and that all the phenomena it presents may be satisfactorily explained by this hypothesis. Sir Humphrey Davy also made numerous experiments on muriatic acid, which led him to adopt the opinion of the French chemists, eighteen months after the publication of their researches *. This theory is now generally received, especially since the discovery of iodine and bromine.

PHYSICAL PROPERTIES.

Chlorine, so named because of its colour, is a greenish yellow gas, of a strong and pungent taste and odour, by

* For a proof of Sir H. Davy's claim to the honour of this discovery, see Ure's Chemical Dict.; article *Chlorine.* [Tr.]

which it is easily distinguished from other bodies. Its specific gravity is 2.4216. The flame of a candle plunged into this gas grows pale at first, afterwards becomes red, and is finally extinguished. It is in this state that the chlorine is disengaged in the fumigations of Guyton Morveau; but pure chlorine is not employed in medicine, except in asphyxia produced by sulphuretted hydrogen gas. At the present day, chlorine combined with aqueous vapour, is employed in the treatment of pulmonary phthisis and other affections of the chest. At the temperature of 20°, and under the pressure of 0.75^{m}, water dissolves one and a half times its volume of chlorine.

MODE OF PREPARING THE AQUEOUS SOLUTION OF CHLORINE.

Mix one part of peroxide of manganese well pulverised with five or six parts of a solution of hydrochloric acid in water; place them in a matrass, whose capacity is nearly double, to the neck of which a bent tube is affixed, passing into Woolfe's apparatus of three or four flasks; the saturated water of the third and fourth flask is alone to be used. Sixty *grammes* of oxide of manganese will produce nearly twenty *litres* of chlorine.

This solution may also be prepared by means of sulphuric acid, making use of the same apparatus.

Introduce into a retort, a mixture of one part and a half of sea salt, one part of peroxide of manganese, two parts of concentrated sulphuric acid, and two parts of water. Let the flasks be nearly filled with water; and to avoid being incommoded by the portion of chlorine which reaches the extremity of the apparatus, take care to introduce into the last flask a quantity of slaked lime, or attach to it a tube which leads out of the laboratory: then place some burning coals in the furnace, so that the gas may be slowly disengaged; otherwise, as it is sparingly soluble, much of it will be lost.

A hectogramme of the salt is more than sufficient to saturate from ten to twelve litres of water with chlorine.

The operation lasts for several hours, and is terminated when, notwithstanding the elevation of temperature, no more chlorine is disengaged.

PHYSICAL AND CHEMICAL PROPERTIES.

The solution of chlorine in water has the odour, the taste, and the colour of gaseous chlorine; it acts in the same way on tincture of turnsol, and upon all animal and vegetable colours.

Exposed to a temperature of from two to three degrees above zero, and in a greater ratio at a less heat, it produces lamellated crystals, of a deep yellow colour, which contain much more chlorine than the solution itself. This is the reason that when we pass chlorine through water at this temperature, much more of it is absorbed than at a more elevated temperature, to such a degree that the liquor finally runs into a mass, and this mass, when it begins to liquefy, exhibits considerable effervescence, owing to the excess of gas which is disengaged. Indeed, the great affinity of chlorine for hydrogen, causes it, when dissolved in water, to decompose all hydrogenous bodies, exactly the same as if it were gaseous. It decomposes even water, either by the influence of the solar rays, or by the aid of a red heat, and occasions in both these cases the production of a certain quantity of hydrochloric acid, and the evolution of oxygen gas.

In order to preserve liquid chlorine, it is requisite to keep it in bottles well stopped, and covered with black paper. These bottles should only contain an ounce or two at the most; if they hold more, the last portions of the fluid give out all the gas, and the physician will be disappointed in his expectations.

OF THE SOLUTION OF CHLORINE AS A DISINFECTING AGENT.

We may disinfect the most insalubrious places, such as hospitals, prisons, dissecting-rooms, &c., at a smaller expense, and more easily and efficaciously, than by *eau de*

javelle * or any solution of a chloruret. For this purpose we have merely to saturate, by the aid of a very simple apparatus, a certain quantity of water with gaseous chlorine, which is easily prepared, and by no means expensive.

M. Gannal proposes that every inspector of a ward should be provided with a bottle of solution of chlorine, and sprinkle it from time to time between the patients' beds; that it should be distributed to the attendants to be made use of in performing their respective duties, &c. It would be equally proper that the walls of all places susceptible of being impregnated with infectious miasmata should be whitened with oil paint instead of lime, to allow of their being washed once a month with the solution of chlorine. The expense would not exceed three francs per diem, for a hospital of the most extensive description (the Hotel Dieu for instance).

I have made the following calculation of the expense:

The oxide of manganese costs 60 francs per 100 kilogrammes. Common hydrochloric acid, 17 fr. 50 cent. per 100 kilogrammes. Two kilogrammes of oxide, and two of acid, yield at least 400 litres of chlorine gas, which saturate 200 litres of water, a quantity more than sufficient for the daily use of the Hotel Dieu. By adding together 1 fr. 55 cent. for the oxide and acid, 20 cent. for fuel, and 1 fr. 25 cent. for two hours' labour, we shall have the 3 fr. at which M. Gannal calculates the expense.

CASES IN WHICH THE SOLUTION OF CHLORINE AND GASEOUS CHLORINE MAY BE USED MEDICINALLY.

Chlorine has only been employed as a medicine within these few years, that and the chloruret being considered merely as disinfecting agents. There are, however, some exceptions. Thus, it was used by M. Braithwate and Dr. Kapp in the treatment of scarlatina, and some cutaneous diseases; by M. Clozel (in 1810) in cases of inveterate scabies; by Nysten in diarrhœa and chronic

* Solution of chlorate of potass. [Tr.]

dysentery. The respiration of chlorine in asphyxia from sulphuretted hydrogen gas has been strongly recommended, also mixed with the vapour of water in pulmonary phthisis, and in different diseases of the chest, such as asthma, and chronic pulmonary catarrh. Baths of gaseous chlorine and hydrochloric acid have been recently employed in the treatment of chronic diseases of the liver; finally, some physicians imagine that lotions made with chlorine, or the chlorurets dissolved in water, would be useful to prevent the development of syphilis, and even of madness.

Whatever may be its efficacy in the treatment of the different maladies we have enumerated, it is especially as disinfecting agents that chlorine and the chlorurets are indisputably efficacious. If new proofs were needed of the utility of chlorine as a means of disinfection, a remarkable instance might be found in its employment concurrently with ventilation, in the cleansing of the sewers of Roquette, Amelot, St. Claude, &c.; an undertaking as difficult as it was tedious and dangerous.

INHALATION OF CHLORINE IN PULMONARY AFFECTIONS.

M. Gannal has recommended the employment of the following method :—Procure a flask with three tubulures, of the capacity of half a litre; the first closed with a glass stopple; the second furnished with a straight tube of five lines diameter, which must reach to the bottom of the flask; and the third having a curved tube also five lines in diameter, and slightly flattened at its extremity. About four ounces of water, at a temperature of 28° to 30°, are introduced into the flask, to which are added five drops of liquid chlorine, and the flask closed. The patient applies his mouth to the extremity of the curved tube, respires the gas, and afterwards expires it by the nose.

Each inhalation should continue four or five minutes, and should be repeated eight times in the course of the day, leaving an interval of an hour between each, so that there may be an hour between the inhalation which pre-

cedes and follows each meal. It is very essential that the water of the flask be renewed at each inhalation. The quantity of water requisite is, five drops the first day, six drops the second day, increasing by a drop every day, until it reaches 25 drops, which may be persisted in for at least a month. But if in the interval, irritation of the trachea, spitting of blood, or any other accident should occur, the five drops must be returned to, and the dose gradually augmented as before.

If after a month and more the disease remains stationary, the inhalations are not to be discontinued, but the dose of gas must be varied at each inhalation. The first, for instance, may be 25 drops, the second 10 drops, the third 20 drops, the fourth 5 drops, the fifth 30 drops, and so on.

The good effects of this treatment are for the most part manifested slowly, unless the catarrh be simple and recent, when a few days suffice for a cure, but in chronic catarrh and phthisis, at least three months are necessary.

Dr. Cotterau has also employed chlorine in phthisis and pulmonary catarrh. He has invented a new apparatus, which consists of a flask capable of holding half a litre, with three tubulures, into which about two or three ounces of water are introduced. The middle tubulure is accurately closed with a flint-glass tube (tube en cristal) of six lines interior diameter, reaching to within two or three lines of the bottom of the vessel, and containing a spirit of wine centigrade thermometer, which rests on the lower part of the flask, and may be withdrawn at pleasure.

To one of the lateral tubulures is adapted a conical flask, capable of holding about two ounces, furnished with a stop-cock, and terminating in a tube, which is compressed like the mouth-piece of a flageolet. This flask, which contains the liquid chlorine, should be made of dark coloured glass, or covered with black paper. The other tubulure supports a curved tube, slightly flattened towards the extremity, in order to suit the form of the lips, between which it is to be placed.

Finally, the large flask is placed in a kind of hollow pedestal (socle creux) made of tin or copper, at the bottom of which is fixed a small spirit of wine lamp, constantly alight, and its flame so disposed that the water contained in the flask above may be kept at 30° or 32° centigrade.

When the apparatus is to be used, turn the cock of the coloured flask, and let fall the prescribed number of drops of chlorine; at the same time introducing between the lips the flattened extremity of the curved or *inspiratory tube*, and making the inspirations until the peculiar odour and taste of the gas are no longer perceived. If the patient be fatigued before the chlorine is entirely disengaged, shut the cock of the tube, and when sufficient rest has been taken, the operation may be resumed.

The water of the large flask should be renewed every day, otherwise it contracts a very disagreeable taste and smell. When the heat of the lamp unduly increases the temperature, one or more layers of felt may be interposed.

All the parts of the apparatus that are fitted together should be covered with wax, to obviate all the defects of contact that may exist.

The small flask should be replenished with chlorine before it is entirely empty; if not, and there remain but a few drops of liquid, the patient is liable to respire all at once, a very large quantity of vapour of chlorine not mixed with a sufficient proportion of aqueous vapour, and violent fits of coughing may thus be produced. It is necessary here to observe, that the stop-cock of the second flask is pierced with an aperture, which should be closed with a ground stopple whereon a capillary groove is made, otherwise the chlorine escapes in too great quantity. By means of the greater or less depth that is given to the groove, there is a fall of one, two, three or more drops in a minute.

The patient may make from six to twelve inspirations in the course of a day.

CHLORINE BATHS.

During the petechial epidemic which prevailed in Italy in 1817, and in putrid fevers, Dr. Palloni employed warm baths, into which a certain quantity of hydrochloric acid was introduced. Dr. Estribant has also made use of chlorine in the treatment of adynamic fevers, which were rife among the Spanish prisoners. But it is more especially in the treatment of chronic diseases of the liver that most benefit has been obtained from these baths. Drs. Wallace*, Julius†, and Bernhard‡, have published several cases in demonstration of their utility, and MM. Wallace, and H. Zeise of Altona, have invented apparatus to facilitate their employment.

MODE OF EMPLOYMENT.

The apparatus employed for administering the baths of chlorine, is only a modification of that which is employed in ordinary vapour-baths, and is so disposed that the patient may not respire the gaseous chlorine, and that a current of gas may be directed towards any particular point; the region of the liver for instance.

The following are the proportions in which the substances intended to disengage chlorine may at first be employed:

Per-oxide of manganese	½ to 1 once.
Common salt	1½ once.
Sulphuric acid	1 „

The temperature may be from 32° to 36° (Reaumur).

The quantity of the articles may be gradually trebled.

These baths produce considerable itching of the skin and perspiration; sometimes the skin becomes red, and is covered with small pustules; it is also rendered softer and

* Researches respecting the medical powers of Chlorine Gas, particularly in diseases of the liver. 1825.

† Magazin der austandichen Litteratur. March—April, 1826, p. 181; and Bulletin des Sciences Medicales, tom. XI. p. 83.

‡ De utilitate acidi nitrici et muriatici interses miatorum non nullis in morbis eximia. Anat. G. L. Bernhard. Leipsic, 1825.

more sensitive. Sometimes the itching is excessive, and the patient feels a prickling sensation which he compares to the stinging of insects. After the bath, he is sensible of an acid taste; the saliva colours turnsol-paper red, and the teeth and gums are not unfrequently irritated.

The baths of chlorine may be replaced with advantage by the nitro-muriatic baths, as recommended by Dr. Bernhard, whose dissertation we have quoted. He restricts the quantity of nitro-muriatic acid to one ounce and a half in an ordinary bath. This distinguished physician speaks of the efficacy of these baths, not only in hepatic complaints, but in ascites, dropsy of the chest, herpetic affections, secondary syphilis, and various menstrual derangements.

CHLORURETS OF LIME AND SODA.

The utility of the chlorurets of lime and soda, as disinfecting agents, and the advantage derived from them in supplying some therapeutical indications, have induced us to point out, with considerable detail, the mode of employing these substances, and the cases in which real benefit has been derived from them. We are indebted to Guyton Morveau for the important discovery of the properties of chlorine in destroying putrid miasmata; he shewed by a number of delicate and well-conducted experiments, that chlorine entirely destroys miasmata, while the aromatic fumigations employed from time immemorial served only to mask them, and to add still further to the impurity of the air. But the employment of gaseous chlorine presented many practical inconveniences, especially in wards filled with patients. If the disengagement of the gas was restricted, the deleterious cause still remained; if too abundant, the respiration of it became troublesome, occasionally suffocating, and in some cases dangerous. In extensive hospitals where it was possible to evacuate the wards, this method was of easy application, but there were numerous obstacles to its employment in private houses. Recourse was had to the disinfecting flasks of Guyton

Morveau, but experience has often proved their inefficiency.

In the year 1812, M. Mazuyer, professor to the Medical Faculty of Strasbourgh, made known the advantages of chloruret of lime over chlorine. He successfully employed a solution of this chloruret in purifying the wards of hospitals where typhus prevailed, and in the disinfection of anatomical dissecting-rooms. So remarkable and so useful a discovery ought thenceforward to have fixed the attention of men of science; nevertheless, the means proposed by M. Mazuyer made little sensation, and remained almost in oblivion.

Nine years subsequently, the Society for the Encouragement of National Industry proposed as a subject, the best means of purifying cat-gut manufactories. M. Labarraque satisfactorily answered the question, and his essay gained the prize. This skilful pharmacien demonstrated by a great number of experiments, that the chloruret of soda was one of the most powerful agents, for the instantaneous annihilation of that disgusting odour which is produced by the maceration of intestines in water.

M. Labarraque extended the use of the chloruret to all animal matters in a state of putrefaction, and many distinguished physicians have since applied it in medicine.

The efficacy of chloruret of lime as a disinfectant, having been confirmed by the experience of many years, the Académie des Sciences, in 1825, decreed to M. Labarraque, a prize of 3000 francs, left by Baron Monthyon to the author of the best means of rendering a useful art less injurious to health; but the Academy having ascertained that ten years previously M. Mazuyer had employed the chloruret of lime in disinfecting the wards of hospitals, they awarded to that gentleman the sum of 2000 francs.

For all that relates to the history of the different chemical researches made upon the chlorurets, and their application in the arts, we refer to an excellent work recently published by M. Chevalier*.

* L'art de préparer les Chlorures de chaux, de soude, et de potasse; par A. Chevalier. Paris, 1829.

MODE OF PREPARING THE CHLORURETS OF SODA AND LIME.

Although the preparation of these chlorurets has been known for a long time, it may be useful in this place to describe the manner in which M. Labarraque prepares them, that the same compounds may be invariably obtained.

Chloruret of Soda.—Dissolve five *livres* of pure carbonate of soda, in twenty *livres* of distilled water, so that the fluid marks 12° of Baumé's areometer. Pour the liquor into a vessel which is sufficiently large to contain four times the quantity. Place upon a sand-bath a glass balloon, of the capacity of four *pintes*, with a long neck and a large aperture, into which introduce 576 *grammes* of hydrochlorate of soda and 448 of peroxide of manganese; lute to the mouth of the balloon a large curved tube, and a tube in the form *S*, for the introduction of dilute acid; place the first tube in a vessel containing a small quantity of water, for the purpose of washing the gas, and from this a large bent tube should proceed communicating with the vessel which contains the saline solution.

The apparatus being properly disposed, and the luting quite dry, pour into the tube *S* the cold dilute acid which has been mixed with water some hours previously, in the following proportions; concentrated sulphuric acid 576 *grammes*, water 448 *grammes*. Then apply fire under the sand-bath, and continue the heat until the chlorine ceases to be disengaged. The operation being finished, examine the strength of the product, thus; take a portion of chloruret, introduce it into the bertholimeter*, and pour on it a solution of sulphate of indigo, prepared as follows:—Bengal indigo powdered, one part; sulphuric acid six parts; unite them by means of heat, and afterwards dilute with 993 parts of distilled water. The chloruret ought to decompose eighteen parts of this sulphate, and in case the liquor should not be sufficiently saturated with chlorine, a current of this gas must be passed through it, until it produce the above effect.

* Chlorometer. [Tr.]

Chloruret of Lime.—Take quick-lime, slake it thoroughly with a small quantity of water; mix the powder with a twentieth part of its weight of hydrochlorate of soda, and place the whole in a stone vessel of an elongated form, into which the chlorine passes. The gas is disengaged from a mixture similar to that employed for the preparation of chloruret of soda. As many sets of apparatus may be placed side by side as are desired, taking care, however, that the chlorine passes slowly into each of them, in order that the combination may be effected successively; this circumstance is essential to the success of the operation. The hydrated lime being sufficiently charged with chlorine, becomes moist, by which we may judge that the operation is nearly terminated. To try its point of saturation, take one part of the chloruret, and dilute it with 130 parts of water; this solution ought to decolorize four and a half parts of sulphate of indigo. The addition of the hydrochlorate of soda to the lime, is for the purpose of facilitating the absorption of chlorine.

In large establishments, such as hospitals, barracks, prisons, &c., where the daily use of these disinfecting agents is necessary, the chloruret of lime may be prepared more economically, in the manner following: take 40 *litres* of water, one *livre* of sea-salt, and five *livres* of fresh slaked lime; place in this liquid (which must be constantly stirred with a piece of wood) a tube which will reach within a few inches of the bottom of the vessel, and which conducts the chlorine disengaged from a mixture less by half than that described in the process for obtaining the chloruret of soda. This chloruret will still have more strength than is necessary for the purpose of disinfecting wards, and animal substances in a state of putrefaction; it must therefore be mixed with a sufficient quantity of water.

MODE OF EMPLOYING THE CHLORURET OF LIME.

M. Labarraque has published several interesting remarks on the employment of the chlorurets in an hygienal point of view. We shall extract the most important particulars.

When it is requisite, for instance, to exhume and to

inspect a body in a putrifying state, it will be necessary to procure a bucket, into which put 24 *litres* of water, and a *demi-kilogramme* of chloruret of lime, and mix them well together.

Let a sheet be thoroughly soaked with this solution, and wrapped over the whole surface of the corpse, so that no part of it may be uncovered—the putrid odour will soon cease. If blood, or any other fluid should escape from the body upon the ground, pour upon it one or two glasses of chlorureted water, and the fœtor will disappear.

If the infection extends to adjacent places, corridors, staircases, &c., let them be sprinkled with the same quantity.

The sheet which is wrapped round the corpse should also be frequently moistened with the liquid contained in the bucket: we shall thus prevent the reproduction of the noxious effluvia.

A very striking example of the powerful disinfecting property of the chloruret of lime was exhibited a few years since. On the first of August, 1823, at the request of the attorney-general, we proceeded to exhume a corpse which had been interred a month previously; it remained out of the coffin for nearly three hours, exposed to a temperature of 18° centigrade. This corpse, which swelled in a very obvious manner after disinterment, exhaled an insupportable and infectious odour. Scarcely were some aspersions made with chloruret of lime dissolved in water, when the effluvia was destroyed, and the examination of the body was rendered practicable and safe.

This chloruret may also be used with advantage for the disinfection of privies, water-closets, ships, stables, manufactories, hospital-wards, &c., &c., for which purpose it will be sufficient to dilute it with sixty times its weight of water, and to sprinkle the clear solution over the surfaces of the objects intended to be purified; a broom or a watering-pot may be used, and at the end of a few minutes the disinfection will be accomplished.

In wards containing patients, this solution must be poured into deep plates, and placed under the beds. The

infectious odour cannot spread, because in proportion to its formation, it is destroyed by the progressive evolution of chlorine.

It must be admitted, however, that the odour of chlorine, when long continued, becomes insupportable, as was abundantly proved at the Hotel Dieu during the prevalence of cholera. Dread of the contagion had, at the commencement of the epidemic, induced us to disperse the vapours of chlorine every where profusely, but it was almost impossible to remain in this atmosphere; moreover, experience having shewn that the disease was in nowise contagious, we abandoned the use of chlorine, even in autopsy.

CASES IN WHICH THE CHLORURET OF SODA MAY BE EMPLOYED.

The employment of the chloruret of soda has been crowned with success in all cases where general or partial infection has existed. Carbuncle, hospital gangrene, degenerated venereal ulcers, and gangrenous sores of the worst description, have speedily begun to cicatrize after the application of this chloruret diluted with from eight to ten parts of water. For the numerous patients affected with ulcerated cancer of the breast and uterus, at the hospital of Salpétrière, we have prescribed lotions of chloruret of soda in solution, which are applied every day when the sores are dressed. By this means not only has the fetid smell of the pus and other discharges been removed, but the sufferings of the unfortunate females have been greatly alleviated, and their sleep rendered more tranquil. M. Alibert has also employed these lotions with advantage in herpes exedens; MM. Roche and Cloquet have found it useful in the treatment of gangrenous ulcers, and in many other offensive and dangerous maladies. M. J. Cloquet orders the sphacelated limb to be bathed in a solution of the chloruret in 10 or 15 parts of water, and from 25 to 30 drops of it to be given in a pint of barley-water.

M. Roche cured porrigo favosa with lotions of chloruret

of soda in solution. He has also employed this solution as a gargle with great success in *angine couenneuse*, (angina diphtheritica?) and I have found it equally beneficial.

M. Sanson has disinfected ulcerations of the mouth attended with caries of the palatine bones, and has suspended for some time the ravages of this disease.

M. Lagneau has used the chloruret as a wash in ulcerations of the gums which exhaled an intolerable fœtor.

M. Lisfranc has found it extremely useful in the treatment of burns and ordinary ulcers; he employs for this purpose a solution of chloruret of lime which marks three degrees by the chlorometer of Gay-Lussac.

M. Bouley has employed the chloruret with success in veterinary surgery, in the treatment of the carbuncular affections to which horses are so liable.

ANTIPSORIC SOLUTION OF CHLORURET OF LIME.

M. Derheims proposes the following solution for the cure of itch;

Chloruret of lime.....	3 onces.
Distilled water.....	1 livre.

Dissolve and filter.

Apply lotions upon the thighs, legs, and arms twice or thrice a day. From six to eight days are sufficient to effect a cure.

PREPARATIONS OF THE CHLORURETS TO SWEETEN THE BREATH.

M. Chevalier, in the work we have quoted, recommends the following formulæ as well adapted for purifying the breath;

SPIRITUOUS SOLUTION OF CHLORURET OF LIME.

Dry chloruret of lime	12 grammes = 3 gros.
Distilled water	64 grammes = 2 onces.
Alcohol at 36°	64 grammes = 2 onces.

Mode of preparation.—Triturate well the chloruret in a glass mortar, and add a portion of the distilled water; leave it to settle, decant the clear liquor, and add a fresh

quantity of water to the residue; triturate, and allow it to settle again; repeat the washing a third time, making use of the remaining portions of distilled water; then decant and unite the decanted liquors; afterwards filter, and add the prescribed quantity of alcohol and a few drops of some essential oil.

Put two grammes and a half of this mixture into a glass of water, and wash the gums, using for this purpose a brush made of sponge. This preparation may likewise serve to destroy any unpleasant odour—that of tobacco for instance.

DR. ANGELOT'S FORMULA.

Chloruret of lime.....16 to 30 grains.
Solution of gum..... 1 once.
Syrup of orange-peel..... 4 gros.

Dr. Angelot, physician at Briançon, has employed this mixture as a lotion in ulcerations of the gums, very frequent among soldiers.

CHLORURET OF LIME LOZENGES TO SWEETEN THE BREATH.

Chloruret of lime.....28 grammes (7 gros).
Vanilla sugar.....12 grammes (3 gros).
Gum arabic .....20 grammes (5 gros).

Make into lozenges of 15 to 18 grains each.

Two or three of these are sufficient to produce the desired effect. They are of a grey colour; to obtain them white this formula may be used;

Dry chloruret of lime.....24 grains.
Powdered sugar..... 1 once.
Gum tragacanth..... 2 grains.

Triturate the chloruret in a glass mortar, pour water upon it in small quantities at a time, and leave it to settle. Decant and filter, and add water sufficient to dissolve the chloruret. This solution of the chloruret is used to reduce the mixture to the consistence of a paste, which is then to be divided into lozenges of 18 or 20 *grammes* each. They are rendered aromatic by some essential oil.

One or two of these lozenges may be taken.

M. Deschamps has recommended the following formula, with the same design as the preceding;

Dry chloruret of lime	2 gros.
Sugar	8 onces.
Starch	1 once.
Gum tragacanth	1 gros.
Carmine	3 grains.

The addition of the starch prevents the lozenges from acquiring a yellow tinge. They should contain 3 grains each; and five or six may be taken in two hours.

MANNITE.

By this name we designate a saccharine substance derived from manna, crystallizing in small elongated prisms. It has been called by some *sugar of manna*, but it only resembles sugar in its taste, for by no process can it be made to ferment. Mannite is found not only in manna, it appears to exist, though in small quantity, in the juice of onions, beet-root, celery, and many other plants.

To obtain it, the manna of commerce (manna in tears) is treated with boiling alcohol, filtered, and left to crystallize: on cooling, the mannite is precipitated in small and beautifully white needles.

Manna in tears is composed almost entirely of mannite combined with a small quantity of yellowish extractive matter, and some traces of cane-sugar. Common manna contains but little mannite and a great deal of extractive matter; indeed, it is composed almost entirely of the latter substance. The superiority of the former, then, needs not to be insisted on.

Mannite is white, soluble in water in almost every proportion, and is capable of forming a syrup with that liquid; it fuses between 105° and 110° into a colourless liquid, which becomes a gelatinous mass and crystallizes on cooling; exposed to a more intense heat, it burns and is decomposed like sugar.

Mannite has been analyzed by MM. Gay-Lussac,

Thenard, Proust, de Saussure, Henry, Oppermann, and Liebig. The latter chemist has found it to be composed of;

Atom.			
6	Carbon..... =	458.622	.....40.0228
14	Hydrogen.... =	87.357	..... 7.6234
6	Oxygen..... =	600.000	.....52.3537

As to the extractive fatty matter of manna, it is easily obtained from the manna of commerce, by depriving it of all the crystallizable principles by means of alcohol, dissolving it in water to separate the vegetable *debris* which it always contains; and finally, having filtered, to dry it carefully. The substance thus obtained is the extractive matter of manna, which has a considerable purgative property.

EMPLOYMENT OF MANNITE.

This substance is a useful substitute for manna, as it possesses its laxative properties without its disagreeable smell. The dose for children is two *gros:* I have sometimes given it to the extent of half an ounce, but have always found the purgative effects too violent; such a dose appears only suitable for adults.

SYRUP OF MANNITE.

By attending to the observations already made, a syrup of mannite may be formed, which is very useful as a gentle purgative for children at the breast, and as an adjunct to pectoral infusions in pulmonary catarrhs which threaten to become chronic.

EMPLOYMENT OF THE FATTY MATTER OF MANNA.

I have endeavoured to render serviceable the fatty matter which results from the process for obtaining mannite, but I have not been very successful. This substance, which has the appearance and the flavour of an extract, is almost inert, and does not appear to me at all to justify the powerful laxative properties which were once attributed to it. An ounce, mixed in herb-broth, produced scarcely any effect after repeated trials at the Hotel Dieu.

SOLANINE.

This alkali was discovered by M. Desfosses, of Besançon, in two plants of the family Solaneæ,—the solanum nigrum and the solanum dulcamara. It exists in both these plants, but while the leaves of the solanum dulcamara afford a large quantity of it, none has been detected in the leaves of the solanum nigrum.

Several able chemists have treated these plants according to the process recommended by M. Desfosses, and have obtained nothing but a little phosphate of lime and vegetable matter, without any trace of the alkali. It is therefore highly expedient that M. Desfosses should repeat his experiments, and corroborate the fact which he has advanced, or point out the reason why solanine could not be obtained at Paris.

PREPARATION OF SOLANINE.

Solanine is found in the greatest abundance in the berries of the solanum nigrum, where it exists in the state of a malate. In order to obtain it, the filtered juice of these berries is to be treated with ammonia, whereby a greyish precipitate is formed. This deposit, collected upon a filter, washed and treated with boiling alcohol, yields by evaporation a salifiable base, which is of itself sufficiently pure if the berries made use of were perfectly ripe.

If the juice of green berries is employed, the solanine remains in combination with a certain quantity of chlorophylle, which is not easily separated.

PROPERTIES OF SOLANINE.

When quite pure, solanine presents itself in the form of a white powder, opaque, and sometimes of a pearly lustre. It has no smell, its taste is slightly bitter and nauseous, and its bitterness is developed by solution in acids, especially the acetic. Its salts are incrystallizable, and a

solution of them is transformed by evaporation into a gummy, transparent, and easily pulverized mass.

Solanine is insoluble in cold water, and even hot water dissolves but $\frac{1}{8000}$ of it. In alcohol it is sparingly soluble.

Its alkaline properties are faintly manifested on turmeric; it restores, however, the blue colour to turnsol paper reddened by acids; it unites even when cold with acids, and if the operation be carefully managed, will form perfectly neutral solutions. Like all vegetable alkalies, it requires but a small portion of acid for the purpose of saturation.

ACTION OF SOLANINE UPON ANIMALS.

Introduced into the stomach of a dog or a cat, to the extent of 2 to 4 grains, it produces violent vomiting, speedily followed by drowsiness which lasts for several hours.

Eight grains were given to a kitten without causing death; but after violent vomiting it fell into a profound sleep, which lasted nearly thirty-six hours. Solanine extracted from the *solanum ferox**, was sent me by M. Pelletier; I tried it upon two young dogs, and soon perceived that it was very acrid, for it caused profuse salivation in one of the animals, but no drowsiness.

ACTION OF SOLANINE ON THE HUMAN SYSTEM.

If a very small quantity be swallowed, a strong feeling of irritation is perceived in the throat. Taken into the mouth, solanine imparts a nauseous and slightly bitter taste, which becomes very intense if the substance be dissolved in a little acetic acid.

The acetate of solanine is the only salt that has been tried upon the human species. In the dose of a quarter of a grain it produces nausea, but no tendency to sleep is manifested.

From what has been said, it appears that solanine, like opium, may produce vomiting and sleep; but its emetic properties seem to be more developed than those of opium, while its narcotic properties are much less so.

* Atropa Belladonna. L.

CASES IN WHICH IT MAY BE EMPLOYED.

Solanine has not yet been administered in disease, but it may be employed whenever the extract of solanum nigrum or that of the dulcamara is admissible.

DELPHINE.

This alkali was discovered in 1819, in the seeds of the stavesacre, *delphinium staphisagria*, by MM. Feneulle and Lassaigne, who thus named it with the idea that all the plants of this family owed their acrid properties to this principle,—an opinion which has not been confirmed by the analysis of other *delphinia*.

MODE OF PREPARATION.

A quantity of the seeds deprived of their integuments and reduced to a fine paste are to be boiled in a little distilled water. The decoction is first to be passed through linen and then filtered. Very pure magnesia is to be added, and the ebullition continued for some minutes. At the end of this time it is to be filtered again, and the residue, well washed, submitted to the action of highly rectified alcohol. The alcoholic tincture being then evaporated, the delphine is obtained under the form of a white powder, presenting a few crystalline points.

This is the simplest means of procuring it; but if a large quantity be required, as the operation of denuding the grains demands much time and patience, the following method is preferable.

The grains not cleared of the husk are to be well bruised and treated with sulphuric acid. The liquor is precipitated by means of ammonia, and the delphine, which still contains a little colouring matter, is taken up by alcohol. In order to purify it, get rid of the alcohol by distillation; dissolve the residue in hydrochloric acid, and

boil with magnesia. The deposit being again taken up by alcohol, yields perfectly pure delphine.

M. Couerbe has proposed another method for obtaining pure delphine; this process is very similar to that which he has described for the preparation of veratrine. It consists in making an alcoholic extract of the seeds of the staphisagria, —treating this extract with water acidulated with sulphuric acid,—filtering and treating the solution with ammonia,— and finally, straining the whole through a piece of linen cloth, when the precipitate of delphine will remain upon the linen. Let it drain, take it up by alcohol, in order to separate the small portion of phosphate of lime which it sometimes contains, and treat it with dilute sulphuric acid a second time. Precipitate once more by means of ammonia or potass, having added a sufficient quantity of nitric acid to disperse the viscous fatty matter.

The substance thus obtained and properly dried is delphine, nearly pure, but containing a little neutral matter; this matter may be separated by ether, which dissolves the pure delphine and does not affect the neutral substance denominated by M. Couerbe, *staphisaire*.

PROPERTIES OF DELPHINE.

When pure, delphine has the aspect of a white powder, crystalline when moist, but becoming opaque by exposure to the air. It has no smell; its taste is at first very bitter, and afterwards acrid. Water dissolves but a very small quantity, which is only perceptible by the slight bitterness it occasions. Alcohol and ether readily dissolve it: the alcoholic tincture imparts a strong green colour to the syrup of violets, and restores the blue of turnsol paper reddened by acids.

With the sulphuric, nitric, hydrochloric, oxalic, and acetic acids, delphine forms very soluble neutral salts, whose taste is extremely bitter and acrid. It is precipitated by alkalies in the form of a white jelly.

Delphine has been analysed by M. Couerbe, who finds it to be composed of;

Carbon	76.69
Azote	5.93
Hydrogen	8.89
Oxygen	7.49

$= C^{27} A_z^2 H^{38} O^8$.

The weight of the atom of this substance has been obtained by means of hydrochloric gas, and we find that 100 of delphine absorb 17.52 of this gas, which gives 2597 for the atomic weight.

CASES IN WHICH IT MAY BE EMPLOYED.

I have not yet tried the medicinal virtues of delphine, but if the stavesacre has any efficacy, it may be presumed that it resides in this alkali. It may, therefore, be employed whenever the plant itself is indicated; and its salts will then be preferable on account of their solubility.

GENTIANINE*.

The discovery of this immediate principle was so singular as to merit recital.

M. Henry and M. Caventou were occupied at the same time, without being aware of it, in the analysis of gentian. They arrived at results so perfectly identical, that having communicated with each other, they found the appearance of their having acted in concert so striking, that they determined to publish their researches in one memoir†.

* M. Caventou has procured from the root of the cassia fistula a bitter principle, which may be found very useful in the treatment of intermittent fevers; it has the singular property of forming combinations with the nitric, muriatic, and sulphuric acids, that are very slightly soluble in water; on the other hand, its combinations with potash, soda, ammonia, and even magnesia, lime, baryta, &c., are very soluble.

† This fact is remarkable in two ways:—first, as evincing the degree of perfection which vegetable analysis has attained within these few years; and secondly, as exhibiting the change which the progress of science has wrought upon the minds of its votaries. A similar coincidence, a hundred years ago, would have caused most bitter hostility; in the present day, it has produced unfeigned satisfaction.

PREPARATION OF GENTIANINE.

Treat powdered gentian with cold ether, which in forty-eight hours furnishes a greenish yellow tincture; this being filtered, poured into an open vessel, and exposed to heat, passes on cooling, (if the liquor be sufficiently concentrated,) into a yellow crystalline mass, with the odour and taste of gentian very powerfully developed. This mass is to be treated with alcohol, until it ceases to yield a citron colour. The washings are then to be united and exposed to a strong heat, when the crystalline substance reappears and concretes towards the close of the evaporation into a mass which is exceedingly bitter. This, taken up again by weak alcohol, is dissolved, with the exception of a certain quantity of oily matter. The last spirituous solution, besides the bitter principle of gentian, contains an acid substance and the odorous matter also.

By evaporating this liquid to dryness, washing the residue in water, adding a little calcined and well washed magnesia, boiling, and evaporating in a water-bath, the greater part of the odorous matter of the gentian is dispersed, the acidity is removed by the magnesia, and the bitter principle remains partly free and partly combined with the magnesia, to which it imparts a fine yellow colour. On boiling this magnesia with ether, the greater part of the bitter principle is obtained, which may be isolated and rendered pure by evaporation. If it be desired to separate the greater part of the bitter principle that remains in the magnesia in a fixed state, and which could not be taken up by the ether, we may treat it with oxalic acid in sufficient quantity to produce slight acidity. The acid seizes upon the magnesia, and sets the bitter principle at liberty, which may be recovered in the manner already described.

PROPERTIES OF GENTIANINE.

Gentianine is yellow, inodorous, possessing in a power-

ful degree the aromatic bitter taste of gentian, which is very much increased by solution in an acid. It is very soluble in ether and alcohol, and separates by spontaneous evaporation under the form of delicate crystalline needles of a yellow colour. It is much less soluble in cold water, which it renders notwithstanding very bitter; boiling water more readily dissolves it. Diluted alkalies heighten its colour very much, and dissolve a little more of it than water.

Acids diminish its yellow colour in a very remarkable manner. With sulphuric and phosphoric acids the solution is almost colourless, but with the weaker acids, such as acetic, it is still yellowish. Concentrated sulphuric acid carbonizes it and destroys its bitterness.

Exposed in a glass tube to the heat of boiling mercury, gentianine sublimes in the form of small yellow crystalline needles, and is partially decomposed.

It has no sensible effect on turnsol, either when blue or reddened by acids. It is apparently neutral.

ACTION OF GENTIANINE ON THE ANIMAL SYSTEM.

Several experiments have convinced me that gentianine is by no means poisonous; several grains injected into the veins produced no apparent effects. I have swallowed two grains dissolved in alcohol, and was only sensible of an extreme bitter taste and a slight sensation of heat in the stomach.

MEDICINAL EMPLOYMENT.

The tincture seems to be the most eligible form for administration. It may be made in the following manner;

TINCTURE OF GENTIANINE.

Alcohol at 24°	1 once.
Gentianine	5 grains.

This may be substituted for the tincture of gentian, and employed in the same circumstances.

SYRUP OF GENTIANINE.

Simple syrup ..... 1 livre.
Gentianine..... 16 grains.

This is one of the best bitters that can be employed in scrofulous affections. I constantly obtain from it the best effects.

LUPULINE.

This substance was discovered in the Humulus Lupulus, by Dr. Ives, of New York. It has since been described in France by M. Planche, and more recently by MM. Chevalier and Payen, under the name of *yellow matter of the hop*.

It presents itself in the form of small, shining, yellowish grains, which cover the base of the scales of the hop; it is of a golden yellow colour, pulverulent, and of an aromatic odour.

By analysis, it is found to be composed principally of resin, a small quantity of volatile oil, and of a bitter principle; to which last the term *lupuline* seems more exclusively to belong. It has a very bitter taste, and is soluble in water, alcohol, and ether, to all which it communicates its bitterness.

ACTION ON THE ANIMAL SYSTEM.

Dr. Ives considers it at once aromatic, tonic, and narcotic. I have not fully ascertained whether all these properties belong to it, but I have often tried lupuline in substance and various preparations of it upon animals, and have never observed narcotic effects, although such effects are more easily distinguished than any other.

MEDICINAL EMPLOYMENT.

POWDER OF LUPULINE.

Lupuline..... 1 part.
Powdered white sugar ..... 2 parts.

Bruise the lupuline in a porcelain mortar and gradually add the sugar. Mix them accurately.

PILLS OF LUPULINE.

Beat any quantity of lupuline into a mass, and form pills.

This substance needs no adjuvant for the purpose of forming a mass.

TINCTURE OF LUPULINE.

Lupuline bruised..... 1 once.
Alcohol at 36°..... 2 onces.

Digest for six days in a close vessel, strain, squeeze it thoroughly, filter, and add a sufficient quantity of alcohol at 36° to obtain three *onces* of the tincture.

EXTRACT OF LUPULINE.

This may be prepared either from the aqueous infusion, when it is bitter and aromatic; or from the decoction, in which case it is equally bitter, less aromatic, and contains resin.

SYRUP OF LUPULINE.

Tincture of lupuline..... 1 part.
Simple syrup..... 7 parts.

When the tincture of lupuline is mixed with the syrup, the latter separates in a state of minute division, and gives the mixture the appearance of orgeat; it is therefore necessary that the bottle should be shaken immediately before each dose.

The doses of these preparations are not precisely fixed; but as lupuline has no poisonous qualities, they may be easily determined by the practitioner.

OIL OF CROTON TIGLIUM.

This oil is extracted from the seeds of the croton tiglium, a shrub of the family euphorbiæ, which grows in the

East Indies. M. Caventou seems confident from his recent investigations that the croton tiglium is the same shrub which produces the seeds known in commerce by the name of purging nut (*pignon d'Inde*), and analysed by MM. Pelletier and Caventou, under the name of *jatropha curcas*. M. Caventou has supported this opinion from chemical experiments which have convinced him that the oil obtained from the purging-nut differs in nothing from the croton oil procured directly from London. They have in fact the same odour, the same colour, and the same taste, the same mode of affecting chemical re-agents, and finally the same violent therapeutical action, according to experiments made in the hospitals by MM. Recamier, Bally, and Kapeler.

It is cultivated at Malabar, Ceylon, and the Moluccas, on account of its medicinal properties. Croton oil was introduced into Europe in 1630, and was employed in the interior of the continent by some physicians with success. In 1632, Artus Gyselius extolled its efficacy in dropsies. In the *Herbarium Amboinense* of Rumphius, published at Amsterdam, in 1750, by Burmann, we find a description of the croton; whose seeds, says the author, furnish by expression an oil which, taken in the dose of one drop in canary wine, was at that time a common purgative. This medicine had, however, fallen into neglect in Europe, until Mr. Conwell, of the East India Company's service at Madras, brought it again into repute. It is now generally employed in India, and has been introduced from thence into British practice.

MODE OF PREPARATION.

The method pursued in India for obtaining the croton oil is not known; but judging from the recent experiments of M. Caventou, it is most likely by expression or by boiling. By digesting in sulphuric ether, 100 parts of the bruised kernels, placing the whole on a filter carefully covered the whole time, and washing the residue with a sufficient quantity of ether, Dr. Nimmo, of Glasgow, found that forty parts remained, and that sixty had been

dissolved. By this process, from 300 grains of the seeds (deducting 108 grains for the integuments, which leaves 192 grains for the kernels) he obtained two drachms of an oil which had the taste and medicinal properties of ordinary croton oil.

An alcoholic solution may also be prepared by pouring alcohol either upon the seeds or upon the oil itself; but Mr. Conwell does not state in his thesis the proportions to be used; that which he prepared, however, must have been less active than the oil, for he gave it to the extent of half a *gros*. According to Dr. Nimmo, the activity of croton oil depends on an acrid resinous principle, soluble in ether, alcohol, and the fixed and volatile oils. From the experiments of this physician, 100 parts of the kernels of croton tiglium contain;

Acrid principle	27
Fixed oil	33
Farinaceous matter	40
	100

One hundred parts of the croton oil contain;

Acrid principle	45
Fixed oil	55
	100

Vauquelin and Pelletier have made experiments for the purpose of isolating the active principle of croton oil, but they have not succeeded.

M. Caventou has extracted the oil of croton tiglium by the action of alcohol at 38° upon the kernels of the purging-nut reduced to a paste. He allows it to macerate forty-eight hours, and filters: he adds a second and a third quantity of alcohol to this paste, and submits it to strong pressure. He collects the alcoholic macerations in an alembic and draws off the alcohol by distillation, which will serve for another operation. The oil remaining in the alembic is filtered through paper and preserved in a glass-stopped bottle.

The quantity of oil afforded by the seeds is fifty per cent.

From the researches of M. Caventou it appears, that jatrophic acid is not the principle in which the drastic virtue of the croton oil resides.

ACTION ON THE ANIMAL SYSTEM.

Croton oil is of an orange yellow colour; it has a strongly marked odour, *sui generis;* its taste is very acrid and penetrating like that of cinnamon, and somewhat resembles that of castor oil. When a drop of it is placed upon the tongue, a disagreeable sensation of heat is soon experienced, which extends even to the fauces and continues for some minutes; one or two spoonsful of water will remove this: nevertheless it must be considered an obstacle to the administration of croton oil by itself. Mr. Conwell having sent me a small quantity, I proceeded to try its effects upon animals. I was soon convinced that this oil is purgative in a very small dose, such as a drop, or even half a drop. In a larger quantity, it proves powerfully drastic, and occasions violent inflammation of the intestinal canal, attended by repeated vomiting and continual dejections.

Injected into the veins it produces, according to the dose, either simple purgation, inflammation of the intestinal canal, or death.

Acquainted thus far with its mode of action, I did not hesitate to employ it as a medicine: I have given it to many patients, both male and female, at the Hotel-Dieu, and the results have been most satisfactory. One or two drops mixed with half an ounce of syrup, purged gently but copiously about fifteen patients labouring under various affections. The effects were so highly satisfactory, that several pupils of the hospital tried its purgative property on themselves and expressed their entire satisfaction. I frequently use it in the hospice de la Salpétrière, as well as in my private practice, and have never known it fail.

Mr. Conwell states, that in some persons the oil produces nausea and vomiting;—I have not observed this.

When vomiting takes place, the purgative effect is not at all diminished. The same gentleman observes that the odour of croton oil inhaled several times from a bottle containing sixteen ounces was sufficient to purge a young girl; and that an adult having made the same experiment, was only affected with nausea.

Croton oil operates very rapidly, frequently in half an hour. Besides the alvine evacuations, the secretion of the urine seems to be considerably augmented.

Doctors Recamier, Kapeler, and Bally, have made numerous experiments with croton oil, prepared by M. Caventou from the purging-nut, and have invariably found one or two drops sufficient to produce twelve, fifteen, or even twenty motions. They have likewise observed that it is apt to excite vomiting, like that procured from England.

CASES FOR THE ADMINISTRATION OF CROTON OIL.

Croton oil may be employed as an ordinary purgative, when there are no signs of gastric or enteric irritation; in old persons, in the same circumstances as veratrine; but it is more especially suitable when the common purgatives have been successfully used in apoplexy and dropsy, and when mechanical or other obstacles prevent the employment of a less energetic purgative, and when a rapid effect is indispensable.

Dr. Ainslie, of Madras, in his Materia Medica, published there in 1813, recommends the external application of croton oil in rheumatic affections. I have frequently used it in similar cases, especially when acute rheumatism has begun to assume a chronic character.

Dr. Kinglake quotes several cases of obstinate constipation, which he cured by means of a single drop of croton oil, given in the form of a pill. He cured, in this way, an individual attacked with painter's colic. I have myself employed it successfully in the latter disease, in the dose of one or two drops in twenty-four hours *.

* Bulletin des Sciences Medicales, Feb. 1824.

MODE OF EMPLOYMENT.

One, two, or three drops are generally given in half an ounce of mucilage, or some syrup.

Mr. Conwell recommends this formula;

Alcoholic solution	½ gros.
Simple syrup.....	3 drachms.
Mucilage.....	3 ,,

We have already mentioned, that Mr. Conwell has not stated in what proportions the active principle enters into the alcoholic solution, so that it will be advisable, until something positive is known, to confine ourselves to the use of the oil. The solution is, however, most likely obtained by saturation.

This oil is also used in friction around the umbilicus. According to Mr. Conwell, four drops employed in this manner have proved purgative: a slight eruption is consequent on the friction.

CROTON OIL SOAP.

As the therapeutical administration of croton oil presents some inconveniences in determining the exact number of drops, M. Caventou has prepared a soap with a sodaic base, which has been successfully employed by Dr. Bally.

MODE OF PREPARATION.

Triturate in the cold, two parts of oil and one part of caustic soda. When the mixture has acquired consistence, it is run into pasteboard moulds, and after a few days, the soap is taken out in slices and kept in a bottle with a large opening and well stopped.

MODE OF EMPLOYMENT.

Dr. Bally gives the croton oil soap to the extent of two or three grains, mixed in a little water or sugar, or made

into pills; the purgative effect is identical with that of the oil.

Dr. Gondret has also used this soap with considerable success.

PIPERINE.

This substance was discovered in black pepper* by M. Œrstaedt, who regarded it as a vegetable alkali.

M. Pelletier has since analyzed this grain, and proved that piperine, the crystalline matter of pepper, is not a vegetable alkali; that it exhibits much resemblance to the resins †, and is of a distinct nature.

Piperine has been employed in Italy as a febrifuge. I have not been able to confirm, by experience, the properties attributed to it by M. Dominique Meli ‡, I shall therefore confine myself to the description of his method for obtaining piperine, and the doses in which it is exhibited.

PREPARATION OF PIPERINE.

Digest at a gentle heat two pounds of bruised pepper-seeds in three pounds of alcohol at 36°. The heat must subsequently be raised to ebullition, after which the liquid is to be allowed to cool and settle, and the operation repeated with fresh alcohol. The two liquors are then to be united, and two pounds of distilled water, and three ounces of hydrochloric acid poured upon them; by which they are rendered turbid, and a dark grey precipitate chiefly composed of fatty matter, is formed. This being separated, fine crystals of piperine are collected on the filter and on the sides of the vessel. By adding water until the liquid becomes clear, a fresh portion of crystals is obtained.

* Journal de Physique, 1820.

† Examen Chimique du Poivre, in 8vo.

‡ Annali univ. di Medicina, tom. XXVII. et XXVIII.

M. Pelletier approves of this, but prefers the following method.

After exhausting the pepper by alcohol, and evaporating the tinctures, a fatty or resinous matter is obtained, which is acted on by successive portions of boiling water, until the water comes away colourless; then by dissolving in hot alcohol the fatty matter thus purified, and leaving the solution to itself for some days, a multitude of crystals are obtained, which may be purified by solutions in alcohol, and repeated crystallizations. The alcoholic mother-waters, left to themselves, will afford additional crystals. The crystalline matter is piperine.

Piperine presents itself in the form of four-sided prisms, the two parallel sides of which are evidently larger; the prism itself is terminated by an inclined surface. This substance is totally insoluble in cold water; boiling water dissolves a small quantity of it, which precipitates on cooling. It is very soluble in alcohol, less so in ether, and more soluble in hot than in cold.

M. Pelletier finds that piperine has considerable analogy with the resin of cubebs, which Vauquelin compared to the balsam of copaiba; the piperine of cubebs, however, has no crystalline property.

MM. Gobel and Henry made the first analysis of piperine, but they make no mention of azote, which it certainly contains in the proportion of four per cent.

M. Pelletier analysed it in 1830, and found it to contain in 100 parts;

Carbon	70.41
Hydrogen	6.80
Azote	4.51
Oxygen	18.45

results which correspond with the formula C^{20} H^{24} A^{1}_{2} O^{4}.

M. Liebig, the celebrated German chemist, has lately investigated the composition of piperine, and his results corroborate those of M. Pelletier.

CASES IN WHICH PIPERINE MAY BE ADMINISTERED.

According to Dr. Dominique Meli, piperine has the same febrifuge properties as the cinchonic alkalies. At the hospital of Ravenna, he has treated a great number of fevers with this medicine, and even goes so far as to assert that its action is more prompt and certain than that of sulphate of quinine. It should be given in smaller doses than sulphate of quinine. Intermittent fevers are the only diseases in which piperine has been hitherto employed. It might be used in gonorrhœa instead of cubebs.

Dr. Meli also states that the acrid oil of pepper possesses the same febrifuge properties as piperine, but in a less degree. This is doubtless owing to that substance always retaining a certain portion of the crystalline matter.

UREA.

Urea, the immediate principle of the urine of mammalia was discovered by Rouelle Cadet, and studied in most of its properties by Fourcroy and Vauquelin.

PHYSICAL AND CHEMICAL PROPERTIES.

Urea in its purest state is exhibited in the form of elongated lamellæ, of a pearly lustre; it is colourless, transparent, of a fresh and poignant taste, and its odour analogous to that of urine*. Exposed to a heat of 120°, it fuses without being decomposed; at a few degrees higher it melts, is decomposed, and carbonate of ammonia without any mixture of hydrocyanate is sublimed. By suitably increasing the heat, we obtain for a residue a greyish substance, which is no other than cyanuric acid: this at a still higher temperature is resolved into its elements.

Thrown upon burning charcoal, it immediately rises into white vapours, which emit a strong ammoniacal odour.

* Dr. Prout says its odour is not urinous. (Tr.)

Exposed to the atmosphere it attracts no moisture; nevertheless it is very soluble in water and alcohol.

A concentrated aqueous solution of urea is not decomposed by heat or cold, but a weak solution boiled or left to itself, is decomposed by degrees and converted into carbonate of ammonia; this transformation is admirably explained by means of the formula of an atom of urea which it suffices to place in contact with an atom of water. In fact, A_z^2 C^1 H^8 O^1 = urea + H^2 O = water = A_z^2 H^6 + C^1 O^2 = carbonate of ammonia. Nitric and nitrous acids and chlorine are the only substances that affect the solution of urea at an ordinary temperature.

Infusion of galls and the alkalies produce no precipitate with it, but if it be heated ever so little with alkaline substances, the urea is converted into ammonia and carbonic acid.

Urea has been the subject of several analyses, but that of Prout appears the most accurate.

	atoms.
Azote	46.66 = 2
Carbon	19.99 = 1
Hydrogen	6.66 = 4
Oxygen	26.66 = 1

PROCESS FOR OBTAINING UREA.

M. Thenard considers the following as the best mode of obtaining urea.

Urine evaporated to the consistence of a syrup is to be treated with its own volume of nitric acid, at 24°. Agitate the mixture, and place it in an ice-bath to solidify the crystals of super-nitrate of urea: wash them in water at 0, then drain and compress them between sheets of blotting paper: when they are thus separated from foreign matters, dissolve them in water, and add to the solution subcarbonate of potass, which takes up the nitric acid and sets the urea at liberty. Evaporate this new liquor by a gentle heat, almost to dryness; treat the residue with pure alcohol, which only dissolves the urea; concentrate the solution, and the urea will crystallize.

ACTION OF UREA ON THE ANIMAL SYSTEM.

Urea not having been detected in any fluid of the body except the urine, and in the blood of animals deprived of their kidneys, M. Segalas was desirous of ascertaining whether nephrotomized animals would die from the accumulation of urea or of the other elements of the urine. He therefore injected into the veins of several dogs, gradually increased quantities of urea; all the animals survived, and their blood presented not a trace of urea. But it was observed that the urea thus injected into the veins stimulated the urinary function in a remarkable manner. The diuretic action of urea on man has since been confirmed by M. Segalas himself, and by M. Fouquier. We must remark, however, that in some individuals, urea has not exhibited that degree of activity ascribed to it by M. Segalas.

M. Segalas has given urea in diabetes, but without success. The composition of the morbid urine was not changed by it, but advantage may perhaps be derived from it as a substitute for other diuretics when the patient has become habituated to their action.

MODE OF ADMINISTRATION.

Urea has been administered internally in solution in sugared water. It has been given to the extent of a gros or more, but it will be better to commence with twenty-five or thirty grains.

OIL OF EUPHORBIA LATHYRIS *.

Euphorbia Lathyris, or spurge, is an indigenous annual

* *Giornale di Farmacia chimica*, 1824. Dr. Carlo Calderini has obtained an oil from the seeds of this plant, (casaputia minor,) which may be used as a substitute for that of *croton tiglium*. Its purgative properties have been long known, for Gilbert mentions it as a violent drastic, and Perylhius assures us that an oven heated with this plant, renders the bread baked in it purgative. Further than this: Sangiorgio in his *Histoire des Plantes medicamenteuses*, thus characterizes it: *Purgante vi infamis quod ad abigendum fœtum adhibeatur. Præstat autem et hâc, et totâ gente abstinuisse cum causticæ sint et nimio indomabiles.* Haller Helv. p. 189.

of the natural family Euphorbiaceæ, and like all the plants of that family, contains an irritating and caustic juice. Its seeds have lately been proposed as a substitute for ipecacuanha.

PROCESS FOR OBTAINING THE OIL.

When the seeds are quite ripe, they are to be dried, and the black ones, which would become rancid, separated; the oil is then obtained by simple pressure: fourteen ounces of the seeds yield six ounces of very pure oil.

PHYSICAL PROPERTIES OF THE OIL OF EUPHORBIA LATHYRIS.

It very much resembles castor oil; it has the same colour, but is not quite so dense; it has no smell, has neither an acrid nor an unpleasant taste, and is perfectly limpid.

By keeping, and especially in warm weather, it becomes turbid and rancid, and has then a pungent taste. It burns with a beautiful white flame, without smoke. It is insoluble in alcohol, even when highly rectified. It forms a soap with the alkalies.

ACTION ON THE ANIMAL SYSTEM.

This oil is purgative in its action, and its effect prompt and certain. It may be considered, says the Italian author, as a very mild purgative; it causes no vomiting, colic, or tenesmus; it may be administered even in dysenteries, where there is intestinal irritation, with as much benefit as the pulp of tamarinds.

Dr. Bally asserts that this oil provokes vomiting like that of croton, but in a less degree.

CASES IN WHICH IT HAS BEEN ADMINISTERED.

It has been used as a purgative in quotidian gastric fever; in dysentery, even when there were evident signs of abdominal irritation and embarrassment of the prima via; in the slight anasarca consequent on intermittent fevers, and in all cases when it is desirable to purge gently and with a small dose.

MODE OF ADMINISTRATION.

The proper dose for adults varies from four to eight drops.

For children of two or three years old, a dose of three drops in chocolate paste is sufficient. In very excitable persons an excellent effect is produced by an emulsion with eight drops of the oil, rendered palatable by a little aromatic water and syrup of orange-peel.

The same quantity may also be given in a glass of sugared water.

THRIDACE*, OR LACTUCARIUM.

The *lactucarium* of Dr. Duncan and the thridace of Dr. François, are nothing more than the white viscid juice of the garden lettuce (lactuca sativa hortensis) procured without the aid of heat, while the plant is in flower. For several years it has been employed in England, and its properties are fully described in the London Pharmacopœia, and by Dr. Paris in his Pharmacologia.

PHYSICAL AND CHEMICAL PROPERTIES.

The white viscid juice obtained from the lettuce by incision, is bitter; it soon concretes and turns brown; it becomes hard and brittle like gum, but quickly resumes a pasty consistence if exposed to the open air. Preserved in a well stopped vessel, it diffuses a slight ammoniacal odour, which is very fugacious. Evaporated at a gentle heat, it has the peculiar odour of the plant, and a decided flavour.

When dried, it attracts the humidity of the air, by which it is distinguished from the extract of lettuce, prepared in the ordinary way by means of heat,—the latter remaining dry when exposed to the open air. Dissolved in distilled water, the filtered solution is clear and of a brownish yellow. This solution strongly reddens turnsol

* Θρίδαξ, lettuce.

paper; with ammonia it yields a white flocculent precipitate, which appears to be composed chiefly of phosphate of lime; infusion of gall-nuts also produces with it an abundant precipitate. It is the same with oxalate of ammonia, nitrate of baryta, and of silver, and with alcohol in large quantity; chloruret of platina does not affect it.

MM. Caventou and Boulay endeavoured to ascertain whether there did not exist in thridace a peculiar principle analogous to morphine, but failed to discover any.

MODE OF PREPARATION.

In the memoirs of the Caledonian Horticultural Society, Dr. Duncan has pointed out various modes of obtaining the juice of the lettuce, which he calls *lactucarium:* he recommends it to be collected on cotton, sponge, or brushes, as it flows from the stem of the plant; but Mr. Probart of London has made experiments on a large scale; he thus describes his method. "I have the cos lettuce planted about eight inches asunder in rows, between which there is sufficient space to enable persons to pass up and down without injuring the plants. I commence my operations just before the plant is about to flower, by cutting off an inch of the stem; the milky juice immediately exudes and is collected on pieces of wove cotton, about half a yard square. As soon as this becomes charged, it is thrown from time to time into a vessel containing a small quantity of water, which when sufficiently impregnated, is evaporated at the common temperature of the atmosphere, by exposure in a number of shallow dishes. The *lactucarium* in a few hours is found adhering to the vessels in the form of an extract, but differing from every other in all its sensible properties: this method enables me to collect *lactucarium* with great facility and dispatch, but it is still attended with considerable expense, as the proportion of milky product is necessarily very small, and the price of the medicine consequently high. This consideration led me to make further experiments for the purpose of ascertaining whether an *extract* might not be obtained from the plant, possessing all the properties of lactucarium, when

administered in large doses, and which could be introduced at a comparatively trifling cost. In prosecuting this enquiry, I found that the plants contain most of the milky juice when they have flowered and the leaves are beginning to assume a yellow hue, and I observed that when cut down, the milky juice assumes for the most part a concrete form, having subsided in the bark of the stalk and in the old leaves, a circumstance which accounts for the extreme bitterness of these parts. I was naturally led from these circumstances to choose the above period for my operations, and to select those parts only of the plant for my extract, rejecting the substance of the stalk and the young sprouts. My method of procuring the extract is as follows: I first macerate the parts in water for twenty-four hours, and then boil them for two, after which I allow the clear decoction to drain through a sieve without using any pressure; this is then evaporated, as far as it can be done with safety, and the process is finished in shallow dishes, in the manner above described for obtaining lactucarium. This extract, which I have called 'extractum lactucæ concentratum,' is of course less powerful than lactucarium, but it possesses all the properties in larger doses, and it has been found equally useful in a number and variety of cases, and is not more than a sixth part of the price."

A concentrated tincture of the juice of lettuce may also be prepared.

M. Caventou obtains thridace in the following manner; he gathers the plant just before it flowers, and strips off the leaves; he then slightly bruises the stalks in order to express the juice, which is evaporated to the proper consistence, at a temperature not exceeding 30 or 35 degrees.

ACTION ON THE ANIMAL SYSTEM.

From the observations made by Dr. François, it appears, that the action of thridace is sedative; it diminishes the rapidity of the circulation, and consequently the natural heat; widely differing, in this respect, from opium.

Dr. François states that the first dose of this substance

occasions a strange sensation in the stomach, resembling cold, but not unpleasant. This viscus soon becomes habituated to its action; it is therefore necessary to increase the dose rapidly, to abandon its use a day or two, and to return to the original dose, which is generally two grains for an adult. If this quantity is not sufficient to cause sleep, the patient is at least exempt from agitation and pain during the night; and this repose is neither accompanied nor followed by narcotism, stupor, constipation, suspension of any function, itching, or other inconvenience consequent on the use of opium.

This physician counted the pulse of twelve patients under the influence of thridace, and remarked the temperature of the body by placing a thermometer in the axilla: he found that the pulse, on an average, was reduced from 67 to 60 beats in the minute. In some, the reduction was 10 or 12 beats, and in one individual still more considerable. The diminution of temperature he estimated by the centigrade thermometer, at one degree, and in one or two instances, a degree and a half.

CASES IN WHICH THRIDACE HAS BEEN ADMINISTERED.

In August, 1824, eleven patients were selected from different wards of the Hôpital de la Pitié. Dr. François ordered them Caventou's thridace: some of them were affected with rheumatism, some with phthisis, and some were convalescent from acute diseases, and all were unable to sleep; in ten cases it proved an excellent narcotic. From the 26th of September to the 24th of October, thirty-six patients, from the same wards, made use of this remedy; they were all watched with the greatest care: three were affected with acute rheumatism; eight with the same disease in a chronic form; one with quotidian fever; and one with gastro-enteritis; three had organic affections of the stomach: two chronic peritonitis; two chronic irritation of the bladder; three were labouring under phthisis pulmonaris; two hypertrophy of the heart; one an abscess in the arm; the rest were convalescent, but exhausted for want of sleep, and distressed with pain in the limbs. They

all experienced decided and permanent relief from the use of thridace; their pains were assuaged; and they obtained that refreshing sleep which they so much needed. In none of these patients was that contraction of the pupil observed, so evident in those who have taken opium.

Dr. François also mentions that he has cured individuals suffering from nocturnal emissions, by means of thridace, given for six weeks or two months. The dose was from two to eight grains in twenty-four hours, divided into two, three, or four doses. But I have often exceeded this quantity without the slightest bad effect.

SALTS OF GOLD.

About the year 1810, M. Chrestien, of Montpellier, called the attention of physicians to the preparations of gold, and published in his *Méthode Iatraleptic*, the formulæ of the salts he employed. Since that time many physicians have made trial of its virtues, and though not so fortunate as M. Chrestien, they have met with considerable success; so that the salts of gold may now be regarded as efficacious medicines in syphilitic complaints. I cannot conceive how the estimable author of the *Méthode Iatraleptic* could so misunderstand me, as to suppose that I wished to restrain the employment of these preparations, and to dispute their efficacy, while the very contrary was my intention, as is evident from the space devoted to them in this formulary.

With regard to the letter addressed to me by M. Chrestien*, I shall think it a duty, and even a pleasure, to derive benefit from the observations it contains. I must also mention that Dr. Legrand† has published a long series of observations,

* Lettre à M. Majendie, sur les preparations d'or et les differentes manières de les administrer; par J. A. Chrestien. Paris, 1828.

† De l'or, de son emploi dans le traitment de la siphilis recente et invéterée, et dans celui des dartres siphilitiques, &c.; par A. Legrand d'Amiens. Paris, 1828.

which confirm the efficacy of auriferous salts in syphilitic and scrofulous disorders.

Four preparations of gold are now principally employed in medicine. 1st. The chloruret or muriate of gold. 2d. The chloruret or muriate of gold and soda. 3d. The oxide of gold. 4th. The oxide of gold by tin or *purple powder of Cassius*. Finely divided gold has also been employed.

MODE OF PREPARING THE CHLORURET OR MURIATE OF GOLD.

Take one part of fine beaten gold, cut it into small pieces, and introduce it into a white glass phial, pour upon it three parts of aqua regia, (composed of one part of nitric and two parts of hydrochloric acid,) and heat the whole in a very small sand-bath, so disposed that the liquor may be collected if the phial should break. The solution of the gold is soon effected. Evaporate the liquor until the odour of the chlorine is perceived, which is easily ascertained, for after a certain time nothing but nitric acid is disengaged; immediately after this the disengagement of chlorine takes place, which indicates the commencement of the decomposition of a small portion of the chloruret that is formed. Then take the vessel from the fire and leave it to cool. The chloruret will speedily assume a crystalline mass of beautiful yellow needles. In this state the chloruret of gold is as pure as is requisite. It does not contain an excess of hydrochloric acid, which prevents it from being deliquescent; hence, it may be kept in a phial merely stopped with paper, without fear of its undergoing any change.

PHYSICAL AND CHEMICAL PROPERTIES.

Chloruret of gold is always very acid, but it owes this property to no foreign acid. Its flavour is styptic and disagreeable; it has a powerful attraction for atmospheric humidity only when it contains an excess of hydrochloric acid. It dissolves easily in water, to which it imparts a beautiful yellow colour. With vegetable and animal substances it

produces a purple-violet colour, and stains the epidermis. Exposed to a moderate heat it passes to the state of protochloruret; heated more intensely in a close vessel, it disengages chlorine without water, and leaves metallic gold for a residue. Its composition in the state we have described is such, that two parts of gold should furnish three parts of chloruret.

MODE OF PREPARING THE CHLORURET OF GOLD AND SODIUM, OR MURIATE OF GOLD AND SODA.

Dr. Chrestien seldom uses the pure chloruret of gold in medicine, he combines it with chloruret of sodium so as to form a double salt or muriate of gold and soda. We are indebted to MM. Figuier and Javal for more decided information respecting this double salt, whether with soda for a base or potass.

M. Figuier prepares the chloruret of gold and sodium by dissolving four parts of gold in aqua regia. Then by evaporating the solution to dryness, pouring 32 parts of water upon this product with one part of chloruret of sodium, and concentrating the fluid to half its weight, viz. 16 parts; on cooling, he obtains crystals composed of 69.3 chloruret of gold, 14.1 chloruret of sodium, and 16.6 water. M. Javal has made analogous observations on the chloruret of gold and potassium.

PHYSICAL PROPERTIES OF GOLD AND SODIUM.

These double salts are of a fine yellow colour, and appear in the form of elongated quadrangular prisms. They attract moisture, but not like the acid chloruret.

MODE OF PREPARING THE OXIDE OF GOLD.

The oxide of gold employed by Dr. Chrestien is prepared by means of carbonate of potass. We might therefore dispense with pointing out the mode recommended by the Parisian Codex; but we wish to omit nothing that will render the success of the operation more certain. We

shall afterwards describe a method at once more exact and economical.

Method of the Codex.—Take any quantity of chloruret of gold, prepared as before described; dissolve it in seven or eight times its weight of cold distilled water, and introduce the whole into a white glass phial, or a matrass, if a large quantity be to be operated upon. Then add gradually to the liquor carbonate of potass, either in crystals or dissolved in a little water, until effervescence ceases, and raise it nearly to the boiling point. A very abundant precipitate of a gelatinous appearance will be formed; let the liquor become cool and then filter. Wash the precipitate with tepid water, until the washings yield no sensible precipitate with nitrate of silver. Remove the oxide from the filter, dry it at a temperature of 60° or 70° Reaumur, and preserve it in a well stopped bottle in a cool and dark locality.

The liquor in which the precipitate is formed, and the washings, still contain much gold, which is entirely lost in the operation; this metal may be precipitated by pouring a sufficient quantity of proto-sulphate of iron into the liquor.

It will be observed, that in the above process we have avoided making use of a porcelain capsule, which is always coloured at the expense of a portion of gold; that we recommend the liquor to be heated in order to facilitate the precipitation of the oxide; that we point out a sure mode of proving the absence of chloruret of potassium; and lastly, that we fix the temperature at which the oxide should be dried, a matter of importance, which will prevent divided gold being given for the oxide of that metal.

Another method.—Introduce any quantity of chloruret of gold into a white glass phial, pour on it six or seven times its weight of boiling water, in order to dissolve the chloruret, and add by degrees *crystallized baryta*, until the liquid loses its acidity, which may be easily known by dipping into it a slip of blue turnsol paper; boil the liquor for a very short time, and when it is cool, filter; wash the precipitate several times with warm water; unite all the

washings and evaporate them almost to dryness, leave them to cool, and dissolve the saline mass in water: by this means a fresh quantity of oxide of gold is separated, which may be added to the preceding. The evaporation may be repeated if it be thought requisite. These liquors contain only very small quantities of gold, which may be separated by well known means; but they are so trifling, if the operation have been well conducted, as not to repay the trouble.

The oxide of gold remaining on the filter is then to be washed with boiling water until the washings cease to form a precipitate with nitrate of silver; then washed once or twice with water acidulated with nitric acid; by this means the small quantity of sub-carbonate of baryta which may have been formed during the operation is taken up. A few more washings with pure water are to be repeated, and we are convinced of their being free from baryta, by the addition of a little sulphuric acid producing no white precipitate; the oxide of gold thus purified, is to be dried in the manner previously described.

By this process, which perfectly succeeded with M. Caventou, a quantity of chloruret of gold containing three *grammes* of the metal, afforded at least three *grammes* of oxide. Not more than half this quantity is obtained when sub-carbonate of potass is employed, because the chloruret of potassium which is formed, and the alkali in excess, retain a large quantity of oxide of gold in a state of solution and colourless combination, as in the experiments of MM. Pelletier and Javal.

PROPERTIES OF OXIDE OF GOLD.

Oxide of gold, in the state of hydrate, is yellow, but when dry it is violet approaching to black. Whatever precautions are used in drying this oxide, it never totally dissolves in hydrochloric acid; it always leaves a residue, very slight it is true, in consequence of a portion of the oxide of gold being reduced to the metallic state during the process of drying.

Sulphuric and nitric acids, dilute or concentrated, have

no action on oxide of gold. This property may serve to isolate oxides of the same colour that have been intentionally mixed with it, as the oxides of copper, deutoxide of iron, &c.

PREPARATION OF THE OXIDE OF GOLD BY TIN OR PURPLE POWDER OF CASSIUS.

In the first place, dissolve chloruret of gold in at least sixteen times its weight of cold distilled water: secondly, prepare a weak solution of proto-hydrochlorate of tin, acidulated with hydrochloric acid. Add the latter solution, gradually, to the former until no more precipitate is formed. Filter the liquor, and wash the precipitate thoroughly with boiling water as long as the washings form a precipitate with nitrate of silver. The precipitate dried at the temperature of boiling water, is the purple powder of Cassius, which appears to be a combination of deutoxide of tin and metallic gold.

ACTION OF THE SALTS OF GOLD ON THE ANIMAL SYSTEM.

According to M. Orfila, three-quarters of a grain of muriate of gold, dissolved in a gros of distilled water, and introduced into the jugular vein of a large and very strong dog, produced the following effects: difficult and stertorous breathing, anhelation, suffocative symptoms, and slight vomiting, which gradually increased in intensity, and terminated in death. In another experiment, half a grain of the deuto-muriate of gold dissolved in two gros and a half of distilled water, was injected into the jugular vein of a small dog; the symptoms succeeded each other with astonishing rapidity, and in four minutes the animal was dead. A third experiment was made on a strong dog: two grains of the salt were dissolved in a gros and a half of distilled water; the animal exhibited the same symptoms, and died in three minutes.

On opening the bodies of these animals, it was found that the effects of the salt were peculiarly manifest in the organs of respiration and circulation, and especially in the

blood; the lungs were livid, gorged with blood, did not crepitate, were rugose, of an unnatural colour, and scarcely floated upon water; the heart presented a violaceous colour, the ventricle and the left cavities being filled with black blood, the right ventricle contracted. The action of this salt on the blood was so prompt that the crural artery, opened a few moments before death, poured forth reddish brown blood, which soon became black. The mucous membrane of the alimentary canal was unaffected.

M. Orfila has also introduced chloruret of gold directly into the stomach of several animals, in order to ascertain its direct effects upon that organ. Through an opening made in the œsophagus, three grains of the chloruret were introduced into the stomach of a small dog; the animal languished for two days, and died on the third. Another dog was made to swallow a solution of ten grains of muriate of gold in an ounce of distilled water; the animal vomited thrice, and discharged frothy saliva; two days after, he was able to eat; the fourth day he refused nourishment, and died on the night of the seventh. On opening the first animal, the mucous membrane of the stomach was found to be inflamed, red, and ulcerated; in the second it was also ulcerated, and in a state of suppuration. In both animals the muriate of gold had acted as a corrosive poison.

According to M. Chrestien *, the muriate of gold is much more powerful than corrosive sublimate, but it is less irritating to the gums: given in the dose of a tenth of a grain per diem, it occasioned in one instance a high fever. M. Chrestien observes that the frequency of the pulse is greatly augmented by the action of the muriate. "This excitation," he says, "which I regard as indispensable to the cure of the disease, kept within proper limits, is never accompanied by any palpable disturbance of the functions. The mouth is unaffected, the tongue moist, the appetite continues, and the alvine dejections are natural: in general an increase of urine and perspiration are the

* Methode Iatraleptique, 2d. edit., p. 398.

only effects observable. But if the dose be pushed too far, there is risk of producing general erythism, and even inflammation of some organ. The fever thus induced, is accompanied by an unwonted and continued heat of the skin."

M. Cullerier has seen patients who were quite unable to bear the muriate of gold. A lady forty-five years of age had ulcers in the nasal fossa; he gave her this medicine in the dose of the fifteenth of a grain; at the second dose gastric irritation came on, redness of the fauces, dryness of the tongue, pains in the bowels, and purging; when these symptoms had disappeared, a twentieth of a grain was administered, and the same effects were produced. Renewed attempts were made with the same medicine, but were not more successful, and she was at last cured by the use of mercury, to the action of which she was likewise very sensible.

According to the same surgeon, the general effects of hydrochlorate of gold and soda are, internal heat, headache, dryness of the mouth and throat, oppression, gastric irritation, constipation or diarrhœa, and accelerated circulation. I was once consulted by a patient to whom muriate of gold had been imprudently administered; he had taken only the tenth of a grain in a cup of milk, for eight days successively. At the end of that time he was seized with a most intense gastritis, accompanied with various nervous symptoms, such as cramps and acute pains in the limbs, agitation, and sleeplessness. After the irritation was allayed, there still remained extreme heat of the skin, want of sleep, and fatiguing erections. This state of excitation, notwithstanding the mildest and most restricted regimen, continued for three years, and the patient was unable to take wine even when much diluted with water.

CASES FOR THE EMPLOYMENT OF THE PREPARATIONS OF GOLD.

The preparations of gold were used in medicine before they were employed by M. Chrestien; they were recommended in syphilitic affections, even in the sixteenth cen-

tury, by Gabriel Fallopi. But it is not only in the treatment of venereal diseases that M. Chrestien extols these remedies; he has used them with success in the majority of the diseases of the lymphatic system, in scrofula, goître, herpes, scirrhus, and even tubercular phthisis. Lalouette, in his *Traité des Scrofules*, strongly recommends the employment of the salts of gold. Some physicians, who have repeated M. Chrestien's experiments, have failed to obtain equally satisfactory results; but a great number, among whom we find MM. Gozzi, Niel, Destouches, Risuens, &c., have, by following implicitly the directions of M. Chrestien, obtained eminent success. M. Duportal* has related two cases of cure effected by this means; one of an ulcer of the face, which was esteemed cancerous, and had resisted all the ordinary remedies.

M. Cullerier does not consider muriate of gold as a specific in syphilis, though he has cured several cases with it. M. Cullerier, Jun., has communicated the result of his experience with this medicine in the venereal hospital; he administered the hydrochlorate of gold and soda to a certain number of patients, of different ages, sexes, and constitutions, some having symptoms of recent syphilis, as ulcers, buboes, pustules, excrescences; others inveterate, as ulcerated throat, palate, nasal fossa, &c., exostoses and periostoses, cutaneous pustules, and pains of the bones. In the first cases of the first series, the effects of the salts were as prompt as those of mercury; in others the benefit was less decisive, and in some no relief was obtained; recourse was then had to mercury.

In the consecutive diseases he obtained some favourable results; the symptoms were ameliorated in two or three cases; only one was entirely cured, and to others it was given in vain.

MODE OF EMPLOYMENT.

M. Chrestien has united the preparations of gold with soluble extracts of plants; with sugar to form lozenges;

* Annales de Physique et de Chimie, tom. LXXVIII.

with syrups, and with cerates to be rubbed into the soles of the feet, after the method of Cirillo. MM. Duportal and Pelletier disapprove of these mixtures, because animal and vegetable matters, dissolved or not, decompose the acid solution of gold, and reduce it to the metallic state. M. Proust also states that there are few vegetable juices, acids, gums, sugars, extracts, &c., which have not the property of de-oxidising gold. These mixtures are therefore treacherous, and should not be employed. The best mode of using the salts of gold is that of friction on the gums; and the hydrochlorate of gold and soda is the preferable salt. It has been employed at the Hôpital des Vénériens reduced to powder and mixed with fifteen, twelve, ten, eight, six, and even four times its weight of some vehicle; starch or powder of lycopodium washed with alcohol seem to preserve the auriferous salts the best; their decomposition is more or less rapid with other powders, such as liquorice, mallow, &c.

FRICTIONS WITH THE MURIATE OF GOLD AND SODA.

M. Chrestien recommends the following formulæ;

Crystallized muriate of gold and soda.....1 grain.
Powder of iris root (deprived of all its soluble parts by means of water and alcohol).....2 grains.

Powder of lycopodium is generally preferable to that of iris.

At first divide the grain into 15 parts; then into 14, and so on gradually until as much as the eighth of a grain of the muriate enters into the composition of each powder. One of these is to be rubbed into the tongue and gums once a day: it is rarely necessary to employ more than four grains thus divided to effect the cure of primitive venereal symptoms, as chancres, buboes, &c.

We said that four grains are generally sufficient; sometimes even three will suffice, but these are cases in which the symptoms disappear during the administration of the second grain. Some cases demand a much larger dose.

Dr. Weter, of Mulhouse, where the temperature is considerably below that of Montpellier, has frequently cured primitive cases with four and even three grains, but he is

often obliged to raise the dose to six, seven, and even eight grains.

M. Girardot, of Warsaw, relates that he has cured military men by the use of the preparations of gold, without any interruption of their duties for a single day. He asserts that in cold regions, from 30 to 40 grains of the salt are requisite; this dose appears to me very strong, and whatever may be the difference of excitability in the inhabitants of the north, I should reluctantly venture to prescribe such a dose. It is not only in the north, however, that the different action of these salts is observable; the enervating nature of a very hot climate, as that of the isle of Bourbon, renders a much larger dose necessary than is requisite in our temperate climates. M. Chrestien observes, that in Poland and Bourbon thirty grains and more are required to produce the same effects as five or six grains in the south of France. In those countries the eighth of a grain, the commencing dose, is rapidly increased to a fifth, a third, half a grain, and even a grain.

When syphilis is complicated with scrofula, M. Chrestien is more particularly obliged to exceed four grains.

PILLS OF THE OXIDE OF GOLD.

Extract of the bark of mezereon root.....2 gros.
Oxide of gold by potass.....6 grains.

Mix carefully and divide into 60 equal pills.

The six grains of oxide may be replaced by one grain of the triple muriate.

M. Chrestien recommends these pills in scrofula and lymphatic congestions: he commences with one per diem, and gradually augments the dose to eight.

Dr. Niel, who has written upon the use of the preparations of gold, has advised a particular method of employing them when the state of the tongue and mouth prevent the use of frictions on these parts. He raises a small blister on one side of the neck, and the part is dressed night and morning with an ointment composed of a grain of lard and a grain of gold divided by mercury; at the same time a

grain per diem of the oxide of gold is given internally, in the form of a pill. After eight days, the dose of divided gold and the oxide are increased each half a grain. In a fortnight, as the artificial sore begins to heal, it is stimulated by blister-ointment and the divided gold replaced by an ointment containing the tenth of a grain of muriate of gold and soda, which may be increased to an eighth, and even the sixth of a grain. The application of this ointment causes itching, but little irritation. While this external treatment is going on, the oxide of gold is given internally, and should be continued for some time after the syphilitic symptoms have disappeared.

The second observation brought forward by Dr. Niel is relative to a person in whom the muriate of gold and soda, in the dose of the tenth of a grain, by friction on the tongue, caused such excessive irritation that he was compelled to resort to some other preparation. Having produced a blistered surface on each side of the neck, he applied a slight layer of the following cerate;

Gold divided with mercury.....1 gros.
Lard.....1 once.

When the blisters are becoming dry, this ointment may be replaced by the following;

Muriate of gold and soda.....10 grains.
Lard..... ½ once.

These means being persevered in for about four months, the cure will be complete.

Dr. Simoneau, of Florence, having applied a seton to the back part of the neck of a patient who had deep syphilitic ulcers of the mouth, conceived the happy idea of dressing the seton with an ointment of muriate of gold. This mode of treatment, analogous to that of Dr. Niel, was attended with decided success.

SALTS OF PLATINA.

The processes for obtaining the salts of platina are exactly the same as those employed for the salts of gold.

The elder Cullerier has made some experiments with hydrochlorate of platina and soda, and the results differ in no respect from those detailed under the article hydrochlorate of gold and soda.

GRENADINE, AND BARK OF THE POMEGRANATE ROOT.

The decoction of the bark of pomegranate root has been much extolled in tenia, ever since M. Merat published, in France, the treatise of M. Gomes * on the use of this medicine. In the memoir of the celebrated Portuguese physician, we find sixteen cases in which the decoction was successful in expelling teniæ; since that time its efficacy has been established by numerous observations.

Among the French physicians who have recommended this bark may be mentioned M. Bourgeoise †, who has published many interesting facts on the subject. His successful cases amount to thirty-four, but he never administered the decoction until the patients had voided some portions of teniæ or some cucurbitinæ, and was always particularly careful to use bark of the best quality,—a very important point, for the pomegranate bark of commerce is often adulterated with that of the box-tree and other inferior articles. If the bark of the punica granatum of our gardens be employed, that from a graft should be sedulously avoided.

COMPOSITION OF THE BARK OF POMEGRANATE ROOT.

The best analysis we possess of this bark has been furnished by M. Latour, of Troyes: he has demonstrated the existence of seven substances in it. 1st. Wax. 2d. Chlorophylle. 3d. Resin. 4th. Gallic acid. 5th. Tannin. 6th. Crystalline matter (Grenadine). 7th. Fatty matter.

* Journal Complimentaire, tom. XVI. p. 24.

† Bibliothèque Médicale, Dec. 1824.

GRENADINE.

Of all the above matters grenadine alone merits attention. It appears in the form of silky crystals, resembling amianthus, and of the purest white. It burns without residue, and yields no ammoniacal product. It is fusible, and with care sublimes in great measure.

Grenadine is neither acid nor alkaline. Cold alcohol dissolves traces of it, but it is easily soluble in boiling alcohol; this affords an additional means of obtaining it crystallized. It is insoluble in ether, but soluble in water to any extent. Nitric acid transforms it into oxalic.

Grenadine is so remarkably sweet that it might easily be mistaken for sugar; but it differs from saccharine matter in not fermenting, also in its volatility and crystallization. M. Latour finds it to be composed of;

Carbon	38.16
Hydrogen	6.86
Oxygen	53.85
Azote	1.13

M. Couerbe has lately scrutinized this analysis, and asserts that grenadine contains no azote. He has not published his results, but has communicated them to M. Latour, that new researches may be instituted.

The preparation of this substance is very simple; it consists in reducing the bark to powder, exhausting it in the first place by ether, and then by boiling alcohol, thus reducing it to the form of a soft extract. By treating this extract with water we easily dissolve the grenadine, which is afterwards purified by repeated crystallizations in alcohol.

MODE OF ADMINISTRATION.

The evening before the decoction is to be taken, it is usual to give an ounce and a half or two ounces of castor oil with an equal quantity of syrup of lemons. Herb broth and a rigorous diet are also prescribed until the following decoction is administered.

Recent or dried bark of the root of punica granatum (bruised)..... 2 onces.
Water..... 2 livres.

Macerate in the cold for twenty-four hours; then boil gently until it is reduced to one livre, and strain.

This quantity of decoction is to be taken in three doses, one every half-hour or three-quarters of an hour.

Generally in an hour, seldom so long as two hours after the third dose, the tenia is expelled entire, twisted upon itself and firmly knotted in many parts.

Sometimes the first two doses are rejected by vomiting; notwithstanding which the third dose must be taken. It has been reported that doses of bark, such as we have advised, are apt to produce serious consequences, but M. Bourgeoise, who always gives similar doses, has never seen anything to induce him to lessen the quantity, he has even greatly exceeded it. If the tenia should not come away entire, the decoction must be repeated the next day, and even for several days.

I am not aware that grenadine has yet been tried as a vermifuge.

FATTY PRINCIPLE OF THE BUDS OF THE MALE FERN.

M. Peschier, apothecary at Geneva, brother of the physician of that name, read a paper to the Helvetic Society of Natural Sciences at Soleure, on the fatty principle of the buds of the male fern (*Aspidium filix mas*). He obtains it by digesting the buds in sulphuric ether. Dr. Peschier * states that he has employed this ethereal tincture against tenia with constant success. This preparation has an oily consistence; mixed with some extractive substance it is used to form pills, each containing a drop of the fatty matter. Eight of these pills are often sufficient, but in some cases it is necessary to augment the dose to thirty

* Bibliothêque Universelle, tom. XXX. p. 205.

drops, divided into small doses; the exhibition of this quantity, however, should occupy several days. Dr. Peschier asserts that this medicine, thus administered, does not fatigue the patients, and that it destroys the worm, which may afterwards be expelled by any mild purgative.

I have made use of this oil for some years for expelling tenia, and have constantly obtained the most gratifying success; but the doses must be gradually and cautiously increased, lest exhausting purgations should ensue.

M. Caventou digested the root of the fern with sulphuric ether. This ethereal tincture was of a very high colour; by spontaneous evaporation, a viscous fatty matter was deposited, of a brown colour, nauseous odour, and acrid taste.

A scruple of this matter in emulsion, with milk of almonds and a little gum, administered to a patient as a vermifuge, produced no effect. An isolated fact, however, should not be considered decisive evidence, and we still recommend this substance to the notice of practitioners.

PHOSPHORUS.

M. Sedillot was occupied for a number of years in determining the use of phosphorus and its preparations, both as an internal and a local remedy. In the second volume of the Littérature Médicale Etrangère, which he published in 1799, and in the Journal Génerál de Médecine, the first sixty volumes of which he edited, will be found collected a sufficient number of memoirs on this heroic medicine to compose its entire history. The following is a brief summary.

He obtained his first notions on this subject from the seventh volume of Haller's Theses. The original dissertation is entitled: *De Phosphori loco medicamenti, aliquot casibus singularibus confirmatâ, auctore J. Gabr. Mentz*, 1751. Prior to this time very little is said by authors respecting phosphorus. The first case, quoted by Mentz,

has date 1748. After a malignant petechial fever an obstinate diarrhœa supervened, attended by great anxiety of the præcordia, delirium, and general prostration of strength. Two grains of phosphorus made into a bolus with theriaca were administered, and immediately produced tranquillity, sleep, and gentle perspiration. At night and the following morning, a dose of three grains was given. The perspiration became profuse and had a sulphurous odour. In a short time the functions were re-established, and the disease was subdued. The second case was one of extreme debility, the result of a bilious fever. Six grains of phosphorus in conserve of roses were given, in two doses, in the course of the day. A sound night's rest and a plentiful diaphoresis brought about a cure. In the third case, there was delirium and general weakness, consequent on malignant catarrhal fever. Six grains of phosphorus in two doses, as in the former instance, produced similar effects.

The great efficacy of this powerful remedy has been celebrated by Morgenstern, (*Schulzii Prælect. in dispensat. Brandenb.* 1753,) and by Hatman (*Dissert. sistens spicileg. ad phosphor. urin. usum internum pertinens*).

Wolff, in his inaugural dissertation at Göttingen, in 1791, reports twelve cases, extracted from his father's journal, on the use of phosphorus. The results were so extraordinary that the author did not scruple to denominate phosphorus a divine remedy. He mentions that each dose contained two or three grains of this substance dissolved in a few drops of ether; but we shall presently see that there is some error here as to the extent of the dose.

The London Medical Review for March, 1799, contains a report made by a society of physicians in London, on the medicinal virtues of phosphorus. They place this substance in the first rank of alexiteric and alexipharmic remedies, and state that it has been employed with success where vital action was nearly extinguished; but they advise it to be used with the utmost caution.

Dr. Conradi, in the Bibliothèque Britannique, considers

phosphorus well adapted to restore the vital powers. He has employed it in malignant fevers after the first stages, and when the exhaustion of strength indicated the near approach of death. Out of seven cases that he mentions, four were restored; the three other patients, though not cured, found considerable relief from the medicine.

Mandel speaks of the efficacy of phosphorus in atonic epilepsy; but his observations do not appear to be conclusive.

Hufeland has observed the good effects of phosphorus in a case of obstinate gout with concretions, in which the medicine caused profuse perspirations; also in a case of slow poisoning by lead and arsenic, and in one of marasmus which threatened the life of the patient.

In the midst of all this success, Weickard, in the second part of his multifarious writings, has related cases and experiments which should warn practitioners against the imprudent administration of this remedy. He cites three instances of death caused by it, both internally in doses of three, four, five, and six grains, and employed in frictions associated with some unctuous substance. On opening the bodies, gangrenous patches were observed in the stomach. The same appearances were exhibited in a dog that had been the subject of experiments.

Alphonse Leroy, in the first volume of the Memoirs of the Société Médicale d'Emulation, relates an experiment made on himself, which nearly proved fatal. Having seen that the German physicians gave phosphorus to the amount of six, eight, and even twelve grains per diem, mixed with confections, he took three grains of it made into a bolus with theriaca. He soon repented of his imprudence when he recollected that heated phosphorus requires no more air than what is contained in the stomach, to produce combustion which might perforate that organ. For two hours he was extremely uneasy, but he drank repeated quantities of cold water, and was at length relieved. His urine became very red. The next day his muscular power was doubled, and he felt an intolerable venereal ir-

ritation. This last phenomenon was exhibited in the laboratory of Bertrand Pelletier. A drake and several ducks having drunk from a basin which contained a solution of phosphorus and copper, died; but the propensity of the male to tread the females was so intense that he died first. Alphonse Leroy has obtained very great success with his remedy, which he considers one of the most powerful in medicine. Le Cointre, his pupil, physician at Rambouillet, has found it equally beneficial. Other French physicians have directed their attention to phosphorus, and have obtained remarkable results from its employment.

In 1802, the father of M. Gaultier de Claubry, a skilful physician, published in the Journal Général de Médicine, four most interesting cases, in which the good effects of phosphorized ether in paralysis and atony with infiltration, are fully displayed.

M. Gumprecht inserted in the London Medical Repository for 1815, two instances of the efficacy of phosphorus in paralysis.

In addition to the treatises on phosphorus that accumulated on every side in 1815, there appeared a work by Daniel Lobstein, whose object was to point out the diseases in which phosphorus and its preparations might be used, and to determine the doses and the best mode of administering them. After different chemical observations on this substance, he adduces a number of cases, some from authors of the first respectability, and others from his own practice. Notwithstanding the good sense and ability of M. Lobstein, one can hardly refrain from thinking him a lover of the marvellous; for in his hands this remedy seems to have effected absolute resurrections. The diseases in which he has given it with the greatest success, are ataxic and adynamic fevers with extreme prostration of strength, obstinate intermittents, rheumatic and gouty affections, amenorrhœa, chlorosis, &c.

M. Lobstein has also seen great benefit result from the internal use of phosphoric acid, in the dose of 20 or 30 drops in a glass of sugared distilled water taken every three hours, in pulmonary phthisis, provided the disease

was exempt from all inflammatory complication. A draught of sugared milk was given after each dose.

The recent chemical researches of M. Couerbe, which prove the existence of phosphorus in the brain, invest this medicine with a new therapeutical interest.

Dr. Hacke, of Stralsund, has employed this remedy in ulcer of the womb; the quantity of the discharge and its fetid odour, speedily diminished.

Bertrand Pelletier relates the case of a man who had indulged in venereal pleasures without restraint, and had all the symptoms of dorsal phthisis, being reduced to the last degree of exhaustion. He was prescribed a mixture composed of phosphoric acid and honey, and in a very short time recovered his strength and plunged with fresh ardour into his old excesses.

Alphonse Leroy has known persons who were in the habit of using a lemonade composed of phosphoric acid, sugar, and orange-flower water, with the idea of preserving their health and strength, and even of prolonging their lives. He gave this lemonade in putrid malignant fevers, and preferred it to that made with sulphuric acid.

M. Sedillot has seen astonishingly rapid cures of scrofula with caries, in its worst form, effected by phosphoric acid. He has also found great advantage from frictions, night and morning, with phosphorized ointment in atonic paralysis, debility, and chronic rheumatism affecting weakly habits. But even here care must be taken not to prolong the use of it immoderately, for a sudden, general, and painful erythism may be produced, which is often intractable, and in some cases incurable.

PREPARATION OF PHOSPHORUS, AND MODE OF EMPLOYING IT.

No preparation of phosphorus in a solid form can be trusted; for there will be either an entire combustion, and then the effect is uncertain, or the combustion is incomplete, and then the dose cannot be calculated upon; or combustion may not take place at all, and then the remedy becomes dangerous. Under this category may be classed

all the English and German preparations, in which phosphorus is suspended in linctus, emulsions, confections, the luminous pills of Kunckel, the phosphorized powder of Leroy, &c.

Bertrand Pelletier, who has made many valuable discoveries respecting phosphorus, has pointed out an excellent method of preparing this substance for medical purposes. He was astonished that Conradi should mention it as an easy thing to dissolve three, and even four grains of phosphorus in a gros of ether, while M. Hufeland asserted that an ounce of ether would not dissolve more than eight grains, and that neither of them described the modus operandi. After several experiments, he obtained the same results as M. Hufeland, but in order the more easily to regulate the doses and the administration of them, he reduced the quantity of phosphorus contained in each ounce of ether to six grains.

His process consists in putting six grains of phosphorus cut into small pieces into an ounce of sulphuric ether, rectified to 65° of Cartier's areometer, and occasionally shaking the mixture for three or four days.

The dose of this medicine is from ten to fifteen drops in a glass of ptisan or some mild drink, repeated in such a manner that the entire quantity given at the end of three or four days shall be from 120 to 150 drops; this is generally sufficient to effect a cure.

This liquid may also be used for frictions, when they are deemed necessary.

M. Lobstein adds the essential oil of cloves to M. Pelletier's preparation. But the addition of this oil is of no advantage, says M. Sedillot, for the phosphorus still remains luminous. The same may be said of a solution of phosphorus in any essential oil.

On this point M. J. Pelletier thus expresses himself (Journ. Gen. de Médicine, tom. LIX.): "All those preparations in which the phosphorus is not in a complete state of division, are dangerous. The same may be said of those in which the phosphorus is only dissolved in a volatile substance, as ether and the essential oils, because

exposure to air and heat, by volatilizing the solvent, sets the phosphorus at liberty, which is therefore liable to be inflamed by heat and friction. But to fatty and fixed oils this objection does not apply, as they are not volatile, and consequently do not leave the phosphorus at liberty; and if by chance they are absorbed, the phosphorus is absorbed with them, being in a state of true solution. I am ignorant of M. Lescot's method for dividing or dissolving phosphorus; I only know that he employs, as Morelot quaintly says, a compound of 'hydrogen, oxygen, and carbon,' not to say a non-azotized animal or vegetable substance. The excellence of this plan I cannot doubt, after the testimony of several physicians and the well known ability of its author, and I only desire that it should be published."

This opinion coincides with M. Sedillot's description of Lescot's method. "M. Lescot prepares phosphorus by combining it with fatty substances, and rendering it aromatic by some essential oil; it thus forms a liquid, and if necessary an ointment. Phosphorus thus divided is not luminous, nor does it ever precipitate."

M. Sedillot, having witnessed M. Lescot's method, communicated it to me some years ago, having previously disclosed it to his son, a physician at Dijon, and to M. Caventou. It is as follows:

SCENTED PHOSPHORIZED OIL.

Phosphorus	1 once.
Olive, or sweet almond oil	1 livre.

Cut the phosphorus into very small pieces, introduce them into a phial with a ground stopple, and add the oil. Leave them in contact, at the ordinary temperature, in a dark place, for a fortnight; then decant, and scent it with oil of bergamot. Let it be kept for use in a well-stopped bottle, and in the dark. I should, however, advise a less quantity to be made at once.

Twenty-five or thirty drops of this oil may be given internally, in linctus, mixtures, emulsions, or mucilaginous drinks, for four or five days together.

For external use, an ointment may be prepared by

mixing it with lard in suitable proportion. This may be used in friction, for five, six, eight, or ten successive days; this ointment not unfrequently becomes luminous during the frictions, unless it be kept in the dark.

The importance of phosphorus as a medicine, and the unhappy consequences which are likely to result from its incautious administration, have made it imperative on me to enter into these details.

ON THE EMPLOYMENT OF PHOSPHORIC ACID.

Phosphoric acid has also been the subject of numerous observations and experiments, which have at length determined its utility. Dr. Lentin read to the Royal Society of Göttingen a memoir entitled *De Acido phosphori cariei ossium domitore*, wherein he observes that phosphoric acid constitutes the essential part of bone, since it exists in all bone that retains its solid form, and when dissolved by some chemical action, the residue which results from this decomposition is found to be saturated with it. He has, therefore, conceived it possible that this acid may be usefully employed in caries of the bones.

For this purpose he applied compresses, moistened with phosphoric acid diluted with eight parts of distilled water, over ulcers beneath which the bone was carious. He repeated this dressing twice a day, and when the ulcer was no longer fetid he used injections of it, and covered the whole with a pledget steeped in myrrh and mastic. In many similar cases, Dr. Lentin has derived the greatest advantages from this application; the ulcers lost their fetid odour, the ichorous sanies gradually changed into the character of good pus, and the exfoliation of the portions of carious bone went on with facility.

BI-CARBONATES OF SODA AND POTASS.

There is no doubt that the gastric juice poured into the stomach during digestion is of an acid nature. The experiments of Prout, Children, Prevost and Leroyer, Tiedemann and Gmelin, tend even to prove that this acidity is owing to the presence of hydrochloric acid. Moreover, MM. Prevost and Leroyer, Tiedemann and Gmelin, Leuret and Lassaigne have observed that the presence of soda in the other fluids that assist in digestion, saturated the free acid, and that this saturation was essential to the complete solution of the food. M. Darcet * shewed, by experiments on himself, that the bi-carbonate of soda in small doses, rendered digestion more easy, and in another interesting memoir he demonstrated that the waters of Vichy owe their active properties in promoting the flow of urine, and other secretions, to the presence of carbonate of soda, of which they contain more than of other salts; and it is well known that these waters are especially serviceable in difficult digestion, chronic affections of the stomach, calculous disorders, &c. Soda may be employed in the same circumstances with equal advantage; thus it appears that theory and practice combine to establish the medicinal character of the bi-carbonate of soda. Mascagni is said long ago to have recommended the employment of bi-carbonate of potass in the treatment of calculous diseases. Dr. T. Farnesi read in 1813, to the Lombardo-Venetian Institute, a memoir for the purpose of calling attention to this advice of Mascagni, but the memoirs of M. Darcet have most eminently contributed to extend the use of the bi-carbonate of soda, and to this able chemist we owe most of our knowledge respecting its mode of action.

MODE OF PREPARING ALKALINE LOZENGES.

Place powdered bi-carbonate of soda and sugar in a well dried bottle; shake the bottle well, that the powders may be thoroughly mixed. Take any quantity of this

* Sur la preparation et l'usage des pastilles digestives contenant du bi-carbonate de soude. (Annales de Chimie et de Physique, 1826.)

powder, and add to it mucilage of gum tragacanth and oil of mint; mix them well together on a marble slab, and form the mass into lozenges, which, dried in a warm room or in the open air, should each weigh about one *gramme*.

DARCET'S FORMULA.

Dry bi-carbonate of soda in fine powder	5 grammes.
Finely powdered white sugar	95 „
Mucilage of gum tragacanth prepared with water	q. s.
Essential oil of mint.....	2 or 3 drops.

As these lozenges slightly attract the moisture of the atmosphere, they should be kept in well stopped bottles or in a very dry place. Any other essential oil may be employed instead of mint, to render them aromatic; the balsam of Tolu is very suitable for this purpose.

MEDICINAL EMPLOYMENT OF ALKALINE LOZENGES.

Each lozenge, weighing one gramme, contains nearly 0.05 gram. of bi-carbonate, therefore twenty are equivalent to a glass (verre) or two decilitres of the mineral waters of Vichy, a litre of which contains, in round numbers, five grammes of bi-carbonate of soda. Experience has convinced M. Darcet that two or three of these lozenges are sufficient to remove indigestion, and that for this purpose they are more efficacious than the waters of Vichy. He considers the action of the soda as purely chemical, saturating the excess of acid in the primæ viæ. Much benefit has accrued from the use of these lozenges immediately the stomach is disordered: if taken before a meal, digestion will be greatly facilitated.

These lozenges being very useful to assist digestion, should be prescribed before and after a meal to patients affected with gout or calculi. But in cases of gravel, and even of gout with concretions, gaseous waters, like those of Vichy, should be prescribed conjointly with the lozenges. Or instead of these waters, half a gros, or two gros of bi-carbonate may be taken in any proper fluid; a vegetable diet containing no azotized food being strictly adhered to. (See Recherches sur la Gravelle, par M. Magendie, Paris, 1829.)

DIGITALINE.

M. Auguste Leroyer, of Geneva, has read to the Société de Physique et d'Histoire Naturelle, of that city, a memoir on the active principle of Digitalis Purpurea, which he has succeeded in isolating, and with which he has made several experiments on animals. I shall detail the result of M. Leroyer's researches, that new experiments may be instituted to determine the possibility of obtaining an extract that shall be always identical and possess uniform properties. This result would be appreciated by every physician who knows how often the utility of digitalis is diminished by its variable character.

MODE OF PREPARATION.

M. Leroyer takes one livre of digitalis purpurea and first treats it with cold ether and then with the same agent heated in a close stove, in order that the temperature may be more easily raised. The tinctures obtained in this manner, were, after filtration, of a greenish yellow colour and a bitter taste; the residue from their evaporation has a resinous appearance and is insupportably bitter, producing upon the tongue a sensation of numbness like that which is experienced from chewing aconite. Exposed to the air, this residuum powerfully absorbs moisture. When taken up by distilled water, it divides into two parts; the vehicle holds one of them in solution, the other is precipitated and presents all the characters of chlorophylle; the aqueous solution of the etherial residue reddens turnsol paper. Hydrate of protoxide of lead was then added to neutralize the free acid thus indicated and to separate from the bitter principle that which is apparently combined with it. The salt of lead thus formed was soluble, and consequently could not be separated from the bitter principle; several earths were tried for the same purpose, but with no better success; it was therefore necessary to resort to another method. After evaporating to dryness the portion treated by the

lead, it was again dissolved in highly rectified ether; by this operation he obtained the bitter principle of digitalis disengaged from those substances with which it was united. By evaporating this solution a brown heavy substance is obtained, that restores, though slowly, the blue of turnsol paper reddened by an acid. If in this last mentioned character, observes M. Leroyer, as well as in its bitterness it approaches the alkalies, its extreme deliquescence separates it from them. This deliquescence prevents it from crystallizing in a distinct and permanent manner; but M. Leroyer thinks that it does crystallize regularly under favourable circumstances. Dr. Prevost having placed a drop of the solution of digitaline in alcohol on a piece of glass, and cautiously evaporated it by means of a spirit of wine lamp, detected with a microscope numerous and well defined crystals of various forms. The same observer states that the basic form of them all appeared to be a straight prism with rhomboidal base.

Every one versed in chemical experiments will easily see, from these details of the method pointed out by M. Leroyer, that it is uncertain whether that chemist has obtained a pure principle; indeed, the contrary seems most probable. These analyses should, therefore, be repeated, that our present distrust and hesitancy may be removed.

ACTION OF DIGITALINE ON THE ANIMAL SYSTEM.

M. Leroyer made the following experiments. He dissolved a grain of digitaline in the abdomen of a middle-sized rabbit; in a few minutes the respiration became slower, the pulse, which had been rapid, fell to 60, and became very irregular; all the vital phenomena were gradually extinguished, and the animal died without agitation or pain, like one falling asleep. This fact, adds M. Leroyer, is the more remarkable, as a rabbit is very easily convulsed.

Half a grain of digitaline dissolved in two gros of warm water was injected into the vein of a cat: the animal died in a quarter of an hour with the same symptoms as the

above. During the last few minutes, the respiration fell to six or eight, and the pulse, feeble and irregular from the beginning, at length entirely disappeared.

A middle-sized dog was killed in fifty minutes by injecting into the jugular vein half an ounce of water containing a grain and a half of digitaline in solution.

The arterial blood of animals killed by digitaline was of a decided venous colour, and had very feeble tendency to coagulate; examined with the microscope, the red globules seemed, especially in the cat, a little altered in form, but not decomposed. Other observations have been made on small animals, from the moment they were submitted to the influence of the poison until that of their death. As the latter event drew near, the blood appeared more and more disposed to become fluid, but the globules presented no trace of metamorphosis. It appears that the deleterious principle in solution in the blood, acts directly on the nervous system.

Nevertheless, an attentive examination of the brain and its appendages have not enabled MM. Leroyer and Prevost to discover on what parts the digitaline acts. The cerebral sinuses were gorged with blood, but the cerebral substance itself did not appear to have undergone any change.

It is desirable that the chemical and physiological experiments of M. Leroyer should be repeated.

SALICINE.

Willow bark has been frequently employed against intermittent fevers. M. Leroux, of Vitry-le-Français, has succeeded in extracting from it a substance which is, in all probability, the active principle to which it owes its febrifuge qualities.

The methods pursued by MM. Caventou and Pelletier for the extraction of quinine, and by M. Henry for obtaining sulphate of quinine, appearing inexpedient to M. Leroux, because of the great solubility of *salicine* in water,

its intimate cohesion with the colouring principle, and its tendency to be destroyed by acids, he devised the following process.

Boil three pounds of the willow-bark (*salix helix*) dried and reduced to powder for three quarters of an hour in fifteen pounds of water, holding four ounces of sub-carbonate of potass in solution; strain and add to the cold decoction two pounds of fluid subacetate of lead; allow it to settle, filter, treat with sulphuric acid, and precipitate the lead by a current of hydrosulphuric acid; saturate the excess of acid by carbonate of lime; filter again, concentrate the liquor, and neutralize it by dilute sulphuric acid; decolorize by means of charcoal, and filter while it is still boiling: crystallize twice if the salt remains coloured after the first crystallization, and dry in the shade. This process yields about an *ounce* of salicine; made on a large scale, it might perhaps give twice as much for the same weight, when we consider the loss by charcoal, filtering, &c., in so small a quantity. M. Leroux, who prepares it in considerable quantities for sale, obtains five per cent. of the weight of the bark *.

Salicine thus prepared is in small silky groups of white crystals, of a pearly lustre: it is very soluble in water and alcohol, insoluble in ether, intensely bitter, and has the aromatic odour of willow-bark.

M. Leroux at first considered this substance as a new vegetable alkali, but a more careful examination with M. Gay-Lussac, has convinced him of the contrary; for though very soluble in water it has no alkaline reaction; its neutralizing power, if any, is very feeble; moreover, it contains no azote, which exists in considerable quantity in the vegetable alkaline bases hitherto known.

MEDICINAL PROPERTIES OF SALICINE.

This substance is eminently febrifuge, as numerous observations will attest. I am constantly in the habit of using it at the Hôtel Dieu in intermittent fevers and other

* Salicine exists in the bark of many species of willow, as the common willow, *Salix monandra*, *S. incana*, *S. fissa*, &c.

periodic affections, and have often found it succeed when the sulphate of quinine has failed; sometimes the contrary has happened, but this in nowise diminishes the value of salicine, the discovery of which is a real benefit to mankind.

EMPLOYMENT OF SALICINE.

I generally give twelve grains in twenty-four hours. It is seldom that I exceed this dose, though it may be done without inconvenience, for not long ago I gave from twenty-four to thirty grains; but experience has shown that such large doses are unnecessary.

LACTIC ACID.

The existence of lactic acid was for a long time doubted; it was admitted by several distinguished chemists, while it was denied by others who thought the acid in question to be nothing more than acetic. These doubts are at length dispersed, to the great advantage of therapeutics, for it appears to me very probable that lactic acid will become a useful medicine.

PROCESS FOR OBTAINING LACTIC ACID.

It is extracted either from milk or from the juice of beet-root. If the latter is to be used, it is left to itself in a heated room whose temperature must constantly be from 25° to 30°. In a few days a tumultuous movement, called the viscous fermentation, takes place, and hydrogen mixed with carburetted hydrogen is abundantly evolved. When the fermentation is over and the liquid has regained its former fluidity, which generally takes place in two months, it is evaporated to the consistence of a syrup; the whole mass is then traversed with numberless crystals of mannite, which, washed with a little water and squeezed, are of the greatest purity; the mass also contains sugar which has all the properties of grape sugar. The product of the evaporation is treated with alcohol, which dissolves the

lactic acid and precipitates several matters which have not yet been examined. The alcoholic extract is taken up by water, which leaves a new deposit; the fluid is then saturated with carbonate of zinc, by which a precipitation still more abundant than the former is effected. After concentration, the lactate of zinc crystallizes; it is collected and heated with water, to which animal charcoal previously washed with hydrochloric acid is added; it is then filtered boiling, and the lactate of zinc separates into perfectly white crystals: these are again washed with boiling alcohol, in which they are insoluble. By treating them successively with baryta and sulphuric acid we obtain the lactic acid, which must be concentrated in vacuo. Finally, by agitation with sulphuric ether, which dissolves it, a trace of flaky matter is separated *.

A large quantity of milk, left for a considerable time to ferment and treated in the same manner, also affords lactic acid. M. Corriol has recognized it in the aqueous infusion of strychnos nux vomica.

PHYSICAL AND CHEMICAL PROPERTIES OF LACTIC ACID.

Concentrated in vacuo until it loses no more water, lactic acid is a colourless liquid of a syrupy consistence, and whose density at 20°.5 is equal to 1.215. It is inodorous; and excessively acid to the taste, like the most powerful vegetable acids. It imbibes moisture by exposure to the air. Water and alcohol dissolve it in every proportion.

One of its most remarkable properties, and which claims the especial notice of medical men is the celerity with which it dissolves phosphate of lime, especially that of the bones.

EMPLOYMENT OF LACTIC ACID.

Lactic acid being a solvent of food in the stomach, I conceived that it might be used with advantage in dys-

* Annales de Chimie et de Physique, April, 1833.

pepsia or simple debility of the digestive organs, and my suppositions have been confirmed.

I give it in the form of lemonade or lozenges.

LACTIC LEMONADE.

Liquid lactic acid	1 to 4 gros.
Common water	1 pinte.
Simple syrup	2 onces.

LACTIC ACID LOZENGES.

Pure lactic acid	2 gros.
Powdered sugar	1 once.
Gum tragacanth	q. s.
Volatile oil of Vanilla	4 drops.

These lozenges should weigh half a gros each. Keep them in a well-stopped bottle.

Six of them may be taken in twenty-four hours without inconvenience.

From the readiness with which lactic acid dissolves phosphate of lime, it would be reasonable to try this acid in cases of white or phosphate of lime gravel. I have not yet had an opportunity of making the experiment.

I have commenced a series of clinical experiments with the lactates of soda, potass, &c., but I have obtained no results worth publishing. I recommend, however, these salts to the attention of medical men.

VOLATILE OIL OF BLACK MUSTARD SEED.

To procure this oil, at least 10 kilogrammes of the best black mustard powder should be used.

Mix this powder with from 50 to 55 kilogrammes of water and place the mixture in an alembic. A worm (serpentin) being adapted to the alembic, and a receiver with two tubulures; distil. The volatile oil is condensed at the bottom of the receiver in the form of brownish flakes. When six litres of water have passed over, change the receiver, since the product that is afterwards obtained deposits no volatile oil; decant the supernatant water from the oil when it has quite settled at the bottom of the

receiver, and rarefy it by a naked fire in a small alembic. It will thus be obtained almost colourless.

EMPLOYMENT OF THE VOLATILE OIL OF BLACK MUSTARD SEED.

This oil diluted with its own weight of alcohol at 40°, and used by friction, is an excellent rubefacient; its action is almost instantaneous.

Rubbed for a few minutes on a determinate part, it very speedily occasions phlyctœnæ similar to those produced by blisters.

By itself this oil is an excellent substitute for the ammoniacal ointment. It presents no other inconvenience than its penetrating and disagreeable odour, which is, however, more supportable than that of concentrated ammonia.

END OF THE FORMULARY.

APPENDIX

TO THE FORMULARY,

BY THE TRANSLATOR.

KREOSOTE.

Kreosote, discovered by Dr. Reichenbach, of Blansko, derives its name from κρέας, flesh, and σωζω, I save. It was obtained originally from pyroligneous acid, and subsequently from the black inflammable liquid called *tar*, which distils over with that acid. This tarry matter, which is also formed in the preparation of coal gas, was found by Dr. Reichenbach to contain no less than six new principles: namely, paraffine, eupione, *kreosote*, picamar, capnomor, and pittacal.

PHYSICAL AND CHEMICAL PROPERTIES.

Kreosote is a colourless transparent liquid of an oily consistence; it possesses considerable refrangibility, and is a non-conductor of electricity. It has a burning taste, followed by sweetness, and its odour is like that of wood-smoke, or rather of smoked meat. At 68° its specific gravity is 1.037.

It boils at 397°, and is not congealed by a cold of—17°. It requires about 80 parts of water for solution, and is soluble in every proportion in alcohol, ether, sulphuret of carbon, eupione, and naphtha. It has neither an acid nor an alkaline reaction with test-paper, but combines both with acids and alkalies. Of all the acids, it unites most readily with the acetic, dissolving in every proportion: by strong nitric and sulphuric acids it is decomposed. The

feeblest acids separate kreosote from its combinations with potass, soda, lime, and baryta. It unites with chlorine, bromine, iodine, phosphorus, and sulphur.

Albumen, mixed with the aqueous solution of kreosote, instantly coagulates.

The antiseptic properties of pyroligneous acid have been long known; it has been frequently applied to the preservation of meat, fish, &c., the decomposition of which it not only retards but causes to retrograde when already commenced. These qualities are doubtless owing to kreosote, which is of itself still more powerful as an antiseptic. The agency of smoke in curing hams, herrings, &c., may likewise be accounted for in the same manner.

MODE OF PREPARING KREOSOTE.

This substance exists, as already stated, in crude pyroligneous acid; but it is best prepared from those portions of oil distilled from wood-tar which are heavier than water. This tarry matter being heated and rectified, carbonate of potass is added, to neutralize the acetic acid associated with it. The acetate of potash separates, and the oil is again distilled; care being taken to reject the first products, and not to carry the distillation to dryness. The oil that comes over is then treated with a solution of caustic potass of the specific gravity 1.12; great heat is produced, and a portion of *eupione* formed, which floats on the surface and must be rejected. The alkaline solution is made to boil slowly in an open vessel; by which it absorbs oxygen from the air, and assumes a brown colour. After cooling in the open air, dilute sulphuric acid is added, until the oil is set at liberty. It is then distilled with water containing a little caustic potass, and kept boiling until the quantity of oil which passes from the retort begins to decrease. The product is again distilled with potass, and treated with dilute sulphuric acid as before. Another distillation being made, a small quantity of phosphoric acid should be added to separate and saturate the ammonia which may be associated with the oil.

As long as any eupione remains, and the mixture has a

brownish hue, the solution in potass should be repeated. To obtain kreosote in its utmost state of purity, it must be distilled with pure water, and the product of the distillation rectified until no water passes over when the heat is raised to 397°.

PHYSIOLOGICAL ACTION OF KREOSOTE.

Dr. Reichenbach, while prosecuting the researches which issued in the discovery of kreosote, found that his fingers were deprived of their epidermis. This substance, applied to the tongue, causes violent pain but no tumefaction.

Insects and fish thrown into the aqueous solution of kreosote are killed, and plants die when watered with it. Two drachms given in a little water to a puppy, caused entire prostration of muscular power, followed by vertigo, and stupefaction: vomiting was also produced, and spasmodic contractions of the abdominal muscles. The respiration, which was laborious from the first, was soon almost entirely obstructed by the secretion of viscid mucus; at length tremors of the limbs and convulsions came on, which in two hours terminated in death.

On opening the body of the animal, all the tissues, except the liver, exhaled a strong odour of kreosote. The whole extent of the mucous digestive membrane appeared inflamed; the matters contained in the stomach coagulated white of egg, and when heated smelt strongly of kreosote. In the heart and the immediate great vessels, the blood was more than usually coagulated, and the lungs were gorged with reddish-brown blood. No signs of congestion were observed in the brain.

MEDICINAL EMPLOYMENT.

We have mentioned that the antiseptic qualities of pyroligneous acid are to be attributed to the presence of kreosote; by a parity of reasoning, the medicinal virtues of tar-water are owing to the same principle. Bishop Berkeley's extravagant praise of tar-water is notorious; but whatever the efficacy of that substance may be, kreo-

sote, when quite pure, is certainly much superior, as it is not contaminated by the presence of eupione, &c., which Dr. Reichenbach has proved to be highly injurious.

Dr. Reichenbach's first experiments with kreosote were made on slight burns and wounds, which it presently cured: he then tried it in burns of a more serious nature; in gangrene; in caries of the phalanges of the fingers and toes; in tooth-ache; in scrofulous ulcers of the throat, &c.; in chancres and other syphilitic ulcers. In all these cases it proved rapidly and completely successful. He has given it internally in several cases of hemoptysis; in two of these the sanguineous expectoration, which had continued for some days, was stopped by four drops of kreosote on sugar, administered daily for four days.

Dr. Elliotson has made trial of kreosote in phthisis, cholera, diabetes, neuralgia, epilepsy, and in some intractable cases he has found it very successful. In epilepsy and phthisis it was of little avail, but when respired in the latter disease, increased facility of respiration and expectoration was observed; in some instances of chronic catarrh, excellent effects were obtained from its inhalation from a solution of five to fifteen drops in about a pint of water, repeated several times daily.

In hysteria, neuralgia, and other forms of morbid excitability, he has found kreosote peculiarly beneficial.

A young girl labouring under acute pain in the hypogastrium and pelvis, with various other nervous symptoms, was cured by a drop of kreosote, gradually increased to seven drops, administered thrice a day. Its efficacy in diabetes has also been confirmed.

Having remarked the tranquillizing power of kreosote in these diseases, Dr. Elliotson tried its effects in cholera. In two cases it allayed the vomiting completely, but proved of no further advantage. Further trials of its anti-emetic power have convinced him that no medicine can be compared with kreosote in arresting and preventing vomiting. In dyspepsia, also, characterized by pain, acidity, nausea, &c., he has found it very useful; but he has observed flatulence aggravated by it.

Some of the French physicians have successfully employed kreosote. Bertholet and Goupil have used it in burns and in various dry and moist tetters. Cloquet and Tealier have found it beneficial in cancer of the womb, and many other practitioners have narrated its efficacy in ulcers, &c., &c.

On the other hand, Hubschmann (Annales de Chimie, 57. 105) considers that as a therapeutical agent its powers have been greatly overrated; and Gräfe, of Berlin, (Gräfe and Walther's Journal, Part 22,) is of the same opinion. The latter mentions several cases of failure with kreosote: they both, however, acknowledge its utility in removing the pain of carious teeth.

MODE OF ADMINISTERING KREOSOTE.

Dr. Reichenbach observes, that in the cure of certain ulcers, wounds, and tetters, kreosote water was sufficient; but this is often unavailing, and pure kreosote must be employed.

This substance, when applied to ulcers, produces at first considerable inflammation; the kreosote should upon this be discontinued, and again resorted to in a few days. This treatment should be pursued until the bad condition of the ulcer is changed.

For external use, from five to ten drops may be sprinkled on a poultice, or the same quantity applied to the surface of the sore by means of a camel-hair brush. An ointment is made by adding ten drops of kreosote to an ounce of lard; this may be used both to dress ulcers and to rub into the sound surface. As a lotion, to be used in frictions, from two to eight drops should be added to an ounce of distilled water.

To remove the pain of carious teeth, Gräfe directs it to be dropped upon cotton; it should be applied in the same manner to stop external hemorrhages.

Kreosote may be given internally, either in the form of mixture or in pills. The following mixture has been recommended;

Kreosote..... 1½ drachm.
Mucilage of Gum Arabic..... ½ ounce.
Cinnamon water.....5½ ounces.
Mix.

A small spoonful to be taken twice or thrice a day.

The foregoing account of kreosote is necessarily incomplete, but if it lead to a further investigation of the properties of this apparently valuable medicine, it will not be altogether useless.

IODURET AND HYDRIODATE OF IRON.

Dr. A. T. Thomson, who has the merit of introducing these preparations to the notice of the medical world, deems them of sufficient importance to be described in a separate form *.

MODE OF PREPARATION.

To prepare the ioduret for medical use, 126 parts of pure iodine, and about 40 or 50 parts of clean iron filings, are put into a flask with 1500 parts of water; heat is applied until the liquid becomes clear, after which it is filtered. This is a solution of the hydriodate of the protoxide of iron; it consists of hydriodic acid 127 parts, or one equivalent, and oxide of iron 36 parts, or one equivalent. When the solution has evaporated nearly to dryness, both the acid and the oxide of iron are decomposed, and water is formed by the union of the hydrogen and oxygen that are evolved, so that a compound containing only iron and iodine, or a solid ioduret remains. The components of this ioduret are, iodine 126 parts, or one equivalent, and iron 28 parts, or one equivalent.

The solid ioduret should be immediately transferred to a dry bottle fitted with an accurately ground stopple, and well secured from the influence of the atmosphere.

* See Observations on the Preparation and Employment of Ioduret and Hydriodate of Iron, by A. T. Thomson. 1834.

The best proportions for forming the medicinal solution or hydriodate, are three grains of the dry solid ioduret to each fluid drachm of distilled water; if water containing any earthy or saline carbonates be used, decomposition instantly takes place. The solution must also be secluded from the light.

PHYSICAL AND CHEMICAL PROPERTIES OF THE IODURET AND HYDRIODATE OF IRON.

When properly prepared the *ioduret* of iron is of an iron-grey colour, brittle, and of a crystalline texture; when dry it is inodorous and simply styptic, but when moist it exhales a slight odour of iodine and is slightly acrid. It fuses at 350° Fahr., and is decomposed at higher temperatures.

The solution of the *hydriodate* of iron varies in colour from a deep greenish-brown to a very pale green with a tint of yellow, or to perfect transparency, according to the neutral state of the salt and the quantity of water employed. It is decomposed by chlorine, the mineral acids, arsenious acid, meconic acid, gallic acid, and tannin, the pure alkalies and their carbonates, pure cinchonine and quinine, sulphate of copper, nitrates of lead, mercury, and silver, infusions of fox-glove, nightshade, henbane, and tobacco, and all vegetable infusions containing *fecula*. It remains in solution with all the saline *sulphates*, &c., and with bitter vegetable infusions which contain neither tannin nor gallic acid.

ACTION ON THE SYSTEM.

When taken in doses of from three to five grains the hydriodate of iron makes no sensible impression on the stomach, although it sharpens the appetite and improves the digestive functions; it seems to stimulate moderately the intestinal canal through its entire length, as it opens the bowels, and while it produces the black colour of the alvine discharges characteristic of all the preparations of iron, it corrects their fœtor. When it does not affect the bowels it augments the action of the kidneys, increasing the flow of urine; and if the solution be taken two or

three times a day for several successive days, the presence of both the iodine and the iron can be detected in the urine. Dr. Thomson has swallowed ten grains at once, and experienced no other unpleasant effects than an uneasy sensation at the epigastrium accompanied with nausea and slight headache.

Of its influence in disease he speaks very highly; no general attenuation or absorption of healthy glandular organs, such as not unfrequently attends the use of iodine, has been observed from its employment.

MEDICINAL EMPLOYMENT OF HYDRIODATE OF IRON.

"The class of diseases", says Dr. Thomson, "wherein it is likely to prove useful, are those in which the capillary system requires to be stimulated, and the tone of the habit to be maintained or to be brought up to the healthy standard; scrofulous affections, tabes mesenterica, chlorosis, incipient scirrhus, rickets, amenorrhœa, atonic dyspepsia," &c., &c.

In France, M. Andral has employed it in phthisis, to modify the qualities of the blood, and M. Pierquin greatly extols its efficacy in leucorrhœa and amenorrhœa.

MODE OF ADMINISTRATION.

Two or three grains taken in distilled water two or three times daily, are the doses recommended by Dr. Thomson. This quantity may be gradually increased to four grains, occasional purgatives being prescribed throughout the treatment. Hydriodate of potass is sometimes added to the draught.

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THE NEW REMEDIES.

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COMPARATIVE TABLE

OF

FRENCH AND ENGLISH WEIGHTS AND MEASURES.

French Weights.	English Weights. Avoirdupois.			
	lb.	oz.	dr.	gr.
Kilogramme, or 1000 grammes	2	0	2	0
Livre, or 500 grammes	1	0	8	0
Once	0	0	9	6
Gros	0	0	0	60
Grain	0	0	0	$0\frac{5}{8}$

18 grains = 1 gramme ; 4 grammes = 1 gros.

French Measures.	English Measures.		
	oz.	dr.	min.
Litre	35	2	12
Pinte	32	2	11
Livre	16	1	40
Once	1	0	40
Gros	0	1	5
Gramme	0	0	16

The expression five grammes, used in the translation instead of 'coffee-spoonful,' may be considered equivalent to the English tea-spoonful, and the term five gros to the English table-spoonful *nearly*.

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TRANSLATOR'S APPENDIX.

ERRATUM.

Page 10, line 14, *for* " sulphur ", *read* " sulphuric acid ".

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