Boudin has given us the most precise directions, how to treat intermittent fever by arsenic.[4-5] Everybody is agreed in acknowledging the great service which arsenical preparations render, not so much in the treatment of the morbid periodicity, where they are proven to be very inferior to quinine, as in the malarial cachexy, where arsenic is superior to cinchona and its derivatives. The arsenical medication cannot then take the place of cinchona, but it is the admirable complement of the latter.

The powerful antiseptic and anti-thermic effects of medicaments derived from the aromatic series have also been applied to the treatment of the paludal fevers, and in the case of certain of them this action was one of the first thera-

which Parisel described under the name of picric poisoning, very similar to quinine poisoning, and characterized by headache, vertigo and general enfeeblement. Dujardin-Beaumetz administers carbazotate of ammonia in pills containing one-sixth grain. He gives five or six of these pills a day. This medicament acts well in intermittent fevers, but its action is untrustworthy and inferior to that of quinine. (*a*)

[4-5] It is to Boudin that we are indebted for the best directions for the treatment of intermittent fever by arsenic. Nevertheless at the beginning of the seventeenth century Hadrien, Slevogt and Melchior Frick definitely established the antiperiodic and febrifuge properties of arsenic. Plencitz senior, and Slevogt made great use of arsenious acid, and affirmed almost constant success in the treatment of malarial fever. The latter was in the habit of giving from one-half to one grain daily. Boudin has gone so far as to give three grains a day. Millet has never exceeded two-thirds of a grain; Sistache begins by doses of one-half grain. Boudin's solution is as follows:

℞ Acid arsenions,..... 1 part.
Water,..... 1,000 parts.
Mix.

Delioux, of Savignac, has reduced the formula of arsenious acid to fifty centigrammes to the litre (1000 grammes) and each dose of a tablespoonful represents one centigramme (or one-sixth of a grain) of arsenious acid.

Sistache employs a solution containing five centigrammes (five-sixths of a grain) of arsenious acid to fifty grammes of water, *i. e.*, one centigramme to every ten grammes. Out of 229 patients affected with intermittent fever, treated with arsenious acid, Sistache has never had a failure. He affirms that arsenious acid is as efficacious as quinine, but that it acts more slowly. Also in pernicious fever it is completely inefficacious.

Delioux, of Savignac, prefers arsenic to quinine in the treatment of periodic neuralgias.

Moutard Martin considers the arsenical medication as superior to every other in the treatment of paludal cachexia. Hydrotherapy alone can be compared with it.

During the last few years, Mosler has proposed a different medication for impaludism with induration of the spleen. He injects directly into the parenchyma of the organ, from ten to twenty drops of Fowler's solution, following each injection by applications of ice.

[From Fowler's summary of his own experience, it appears that 171 out of 247 cases of ague were radically cured by the arsenical solution which bears his name. The cures generally took place within four days from the time when the administration of the medicine was commenced. Withering cured thirty-three patients out of forty-eight by the solution

(*a*) Braconnot, Ann. de phys. et de chim., t. XLIV, p. 297.—Aspland, Med. Times, 1862.—Parisel, Action physiol. et thér. de l'acide picrique (thèse de Paris, 1868).—Dujardin-Beaumetz, De l'emploi du carbazotate d'ammoniaque comme succédané du sulfate de quinine (Soc. de thér., juillet 1872, et Gaz. méd. de Paris, 1872, Nos. 37, 38 et 39). Nouveaux faits relatifs à l'emploi du carbazotate d'ammoniaque (picrate d'ammoniaque) comme succédané du sulfate de quinine (Bull. gén de thér., 1872, t. LXXX, p. 385).



peutic effects observed; thus, for instance, when salicin was first extracted from willow bark, it was considered a succedaneum of quinine. Since salicylic acid has been obtained by way of synthesis, this acid and salicylate of soda have also been applied to the treatment of fever and ague.[6] But it must be admitted that these medicines have been but little efficacious in the treatment of febrile intermittence; therefore, notwithstanding the results obtained by Bartels and by Zielewicz, this mode of treatment has not come into use.

I may say as much of resorcin, and, although Kahler and Lichtheim have maintained that this medicament is equal and even superior in rapidity of action to quinine, I have never obtained such an effect in the trials which I have made of it.[7] As for quinoleine, which is now obtained from the phenols and oxyphenols,

alone; in the remaining fifteen cases it failed entirely. Willan prescribed it in about fifty cases of different species of intermittents, and it succeeded almost instantly in every case. It was found by Winterbottom to be equally successful in the African intermittents at Sierra Leone.

In Philadelphia it was early employed by Wistar, Griffiths, Barton and Currie; the last named of whom mentions that it was a common practice in the State of Delaware to give the Asiatic pills, composed of arsenic and black pepper, for the cure of agues. In 1820 Dr. T. D. Mitchell found it more effectual than bark during an epidemic at Norristown, Pennsylvania; but unless he gave Fowler's solution in doses of fifteen or twenty drops, his patients derived no benefit from its use. Eberle was of opinion that it was best suited to the disease in persons of a firm and healthy constitution, and most apt to act injuriously when given in a debilitated, cachectic and irritable state of the system. In England, as late as 1833 we find Dr. Joseph Brown stating that he had given the arsenical solution in many hundreds of cases, without witnessing any permanently ill-effects produced by it, and he states that he has met with cases which were cured by arsenic where quinine had failed.

Extensive trials have been made with this medicine in intermittent fevers in this and foreign lands the past forty years, and it must be confessed, without establishing its superiority over the cinchona preparations in any form of malarial affections, unless it be certain chronic forms which have resisted quinine.

The rules for the administration of Fowler's solution in intermittent fevers are as follows: Children of from two to five years of age to take one-half drop at a dose for each year; between the ages of eight and twelve years, the dose should be from two to four drops. Beyond this age, three to five drops should be given three times a day for five days, then suspended for two or three days and again resumed to prevent a relapse. (Stillé, Materia Medica and Therapeutics, Art. Arsenic).—TRANS.] (*a*)

[6] Bartels considers salicylate of soda as an excellent medicament in intermittent fever. Zielewicz is of the same opinion, and gives the salicylate during the paroxysm to prevent a second attack; he admits, however the inferiority of this medicament to quinine, than which it is far less certain.

[7] Resorcin has been given in intermittent fevers by Lichtheim and by O. Kahler, in the dose of one-half drachm to a drachm at the onset of the attack. This dose

(*a*) Delioux de Savignac, Examen comparé des propriétés fébrifuges du quinquina et de l'arsenic [Bull. de thér., 1853, t. XLV, p. 294, 295).—Sistache, Emploi thérapeutique de l'arsenic [Gaz. méd., 1861, p. 67].—A Millet [de Tours], De l'emploi thérapeutique des préparations arsenicales, Paris. 2e édit., 1865].—Boudin, Traité des fièvres intermittentes et contagieuses des contrées paludéennes suivi de recherches sur l'emploi thérapeutique des préparations arsenicales, Paris, 1852.—Fremy, De la médication arsenicale dans les fièvres intermittentes, Paris, 1857.—Moutard-Martin, Médication arsenicale dans le traitement des fièvres paludéennes [Acad. de méd., 1872].—Mosler, Uebr Parenchymatose injection von solution arsenicales Fowleri in chronische Mitztumoren [Deutt Med. Woch., n° 47, 1880].

I have already alluded to it while speaking about the derivatives of cinchona, and I do not know that kairin, which has since been similarly obtained, has given any positive results.

There are several succedanea of quinine derived from the animal kingdom, such as oyster shells and cuttle-fish bones, formerly vaunted by Brault and Peneau, and especially spider's web, a popular old remedy of which Oliver has lately shown the real efficacy.[8] Despite the affirmations of these men I believe that the sulphate of quinine is still preferable and that in many cases nothing will take its place.

It remains for me now, having finished the enumeration of medicaments, to tell you how to use them to obtain as speedily and economically as possible the cure of intermittent fever. I emphasize the word economically, for this is an important matter. Do not forget that sulphate of quinine is to-day sold in our drug stores at a medium price of 1½ francs (or about 30 cents) a gramme. In regions, moreover, where the marsh miasm is prevalent you are apt to find an indigent population, and it will always be incumbent on you to effect the desired therapeutical results with minimum quantities of quinine, that is to say, with the least possible expense.

We ought from the point of view of the treatment of intermittent fever, to

markedly attenuates the symptoms, sometimes even causing their subsidence and cessation. Its action is immediate, as all observers testify, so that it may be given in the midst of an attack. It also lessens the volume of the spleen, and hence ought to be mentioned in the same rank as quinine. Dujardin-Beaumetz and Callais, in their researches on the action of resorcin in intermittent fevers, have obtained but meagre results; it is true that they gave much less doses than the above, and never exceeded fifteen grains. Perraton has also obtained uncertain and temporary results from resorcin in the treatment of malarial fevers. (*a*)

[8] Spider's webs have been used from time immemorial. In 1809 we read of a French curate who treated intermittent fevers by making patients swallow little balls of spider's web.

Dr. Oliver has again taken up the subject, and has made over ninety-three trials with pills made of spider's web. His conclusions are as follows:

1. Spider's web may cure malarial fevers of quotidian and tertian type;
2. The dose for an adult is thirty grains. For children a proportionately smaller dose;
3. Its effect is not so prompt as that of quinine; hence it should not be relied on in grave cases;
4. Spider's web has a better taste than quinine;
5. Relapses are less frequent than with quinine.

Brault and Peneau have also counselled the bones of cuttle fish and oyster shells in malaria. (*b*)

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(*a*) Dujardin-Beaumetz and Callias, on Resorcin and Its Employ in Therapeutics, Paris, 1881—Perraton, on the Employment of Resorcin, [these de Paris, 1882).

(*b*) Corre, Sur la toile d'araignée dans le traitement des fièvres intermittentes [Bull. de thér., 1883, t. CV, p. 331, et Trés. des mén., Paris, 1828].—Oliver, Toile d'araignée contre la malaria [Allgem. Wiem. Med. Zeit. 10 aoril 1883, et Zeits. d. A. o. Apoth. Vereins, avril 1883].—Brault et Peneau, De la guérison des fièvres intermittentes et larvées au moyen de l'os de seiche et de l'écaille d'huitre, 1864.



examine the three following points, and in their order: treatment of ordinary intermittent fever, treatment of pernicious fever (malignant intermittent), treatment of the paludal cachexia. Finally, we shall finish by a rapid examination of the hygienic conditions which one should recommend to prevent the development of intermittent fever.

As for the treatment of ordinary intermittent fever, we should place ourselves in two special conditions: either the individual resides at a distance from the marshy locality, or he is still exposed by his residence to the marsh miasm. In the former case by the sole fact of his removal to a more healthy region he may get well; this it is that explains how in our hospitals at Paris we are in such an unfavorable position to study the anti-periodic action of certain medicines. For generally the intermittent fever which we observe is light, and consists of relapses in individuals who have formerly contracted malaria in other countries. Therefore we cannot rely altogether on trials made in the hospitals of Paris, in deciding the febrifuge virtues of this or that medicine, and it is in regions where this fever reigns that such essays should always be made. In Paris then you can witness the disappearance of intermittent fever under the influence of repose, a simple emetic, or a small dose of quinine.

When your patient resides in the country where the marsh miasm is developed, your treatment will be more difficult, and you will have to study successively what preparation to use, at what moment to give it, and the proper dose.

As for the choice of the preparation, you had better discard all the pretended succedanea of quinine, also the powdered peruvian bark and the various old remedies that contain it,[1] the extracts of cinchona as well,[2] not because

[1] The bolus *ad quarternam* had the following formula:

| | Grammes. | |
|---|---|---|
| ℞ Pulv. cinchona, | 30 | 08 |
| Tartar emetic, | | |
| Carb. pot., | 4 | 00 |
| Syrup papaver, | q. s. | |

M. Make up into 60 boluses; all to be taken during the 24 hours.

The *Remède du Calvaire* is similar to the above; its formula is as follows:

| | Grammes. | |
|---|---|---|
| ℞ Yellow calisaya bark [pulv.], | 40 | 05 |
| Tartrate of antimony, | | |
| Rhubarb, ää., | 4 | |
| Carb. pot., | | |
| Syrup of cinchona, | q. s. | |

M. F. S. A. bol, No. x. Sig. One bolus morning and evening.

[2] The extracts of cinchona are very numerous; they are all acid, and present, according to the bark which has furnished them, a very variable composition. Tanret has given a table indicating for each gramme of the divers extracts the quantity of alkaloids and tannin contained, as well as the acidity, represented in lactic acid. According to this table, the Java bark is richest in alkaloids, each gramme having 0.157 of active principles, while the Loxa is among the poorest, each gramme representing only 0.014 of the alkaloids. The cinchona calisaya is an excellent bark, with the decimal figure, representing richness in alkaloids, of 0.115. Some of the red cinchonas are poor in alkaloids, but rich in tannin; the proportion of the latter varies in them all from 0.050 grm. to 0.210, grm. a

they are inert but because they are more beneficial in the chronic form of marsh poisoning than in intermittent fever. You should reject all the other alkaloids of cinchona and rely on quinine alone, whose effects can be determined with almost scientific precision.

You should prescribe either the sulphate or the hydrochlorate of quinine, and I cannot too strongly urge you, breaking the bonds of tradition which has given the preference to the sulphate, to use the chlorhydrate instead, a salt more soluble, more rich in quinine, and for that reason more active. In adjoining countries this substitute is an accomplished fact, and we should not be behind them in this regard.

You will administer the chlorhydrate of quinine in solution when your patient is poor, in capsules when he is rich, and you will understand the reason for this; the capsules as I have before told you, are a little less active than the solution; as for the latter the simplest and most economical way consists in

quantity contained per gramme in some of the red barks. We give below the table in part:

| SPECIES OF CINCHONA. | TANNIN. | ALKALOIDS. | ACIDITY IN LACTIC ACID. |
|---|---|---|---|
| Cinchona huanuco, | 0.065 grammes. | 0.050 grammes. | 0.054 grammes. |
| Cinchona Loxa, | 0.014 " | 0.176 " | 0.047 " |
| Cinchona flava [without any other denomination] | 0.010 " | 0.062 " | 0.050 " |
| Java cinchona, | 0.157 " | 0.030 " | 0.074 " |
| Cinchona calisaya, | 0.115 " | 0.047 " | 0.063 " |
| Indian cinchona, | 0.065 " | 0.050 " | 0.070 " |

Tanret has proposed to substitute tannate of quinine for the soft extracts, and would replace the potions made with soft extracts [so fashionable in France] by the following formula, which has the advantage of being always of uniform strength:

℞ Tannate of quinine, ..... As many times 23 centigrammes as you would have put grammes of the extract.
Acid lactic, ..... q. s. to dissolve.
Syrup, ..... 30 grammes.
Water, ..... 120 grammes.

Mix and dissolve.

Quinium is a complete extract of cinchona, obtained by alcohol and lime. This quinium represents 33 per cent of its weight of quinine, plus all the other active principles of cinchona. The formula of its preparation is given by Delondre and Labarraque. [It is a popular cinchonic preparation.] (*a*)

(*a*) Tanret, study of the extracts of cinchonia (Bull. de Thér., 1883, t. 105, p. 65).



causing your patient to take his quinine in a small glass of rum or brandy. But what shall be your dose, and when shall it be given? I will explain.

You know that the attack of intermittent fever is characterized by periods or stages, which are described under the names of period of chill, period of heat, period of sweating; that moreover, according as the fever returns every day, every two days, or every three days, you have to do with the fever in a quotidian, tertian, or quartan form. You know also, that these types may be double, and then you have double tertian and double quartan. I shall not dwell on this point, but pass at once to the consideration of the first question: at what period should you give the sulphate of quinine to derive the most advantage from it?

Practitioners have long hesitated between three methods;[1] that of Torti called the Roman method, that of Sydenham, called the English method, and that of Bretonneau, called the French method. According to Torti's method, you would give the quinine at the moment of paroxysm, not to arrest it, but to

[1] In the treatment of fever and ague, cinchona was administered according to three different methods:

1. The Roman method, indicated by the Jesuit fathers, and adopted by Torti.
2. The English, or Sydenham's method.
3. The French, or Bretonneau's method.

According to Torti's method, the cinchona is given in one dose, immediately after the attack. First fifteen grains, in one dose; then, two days after, a dose of sixty grains, and after an interval of eight days of rest, a thirty grain dose was administered.

According to Sydenham's plan, the cinchona was given after the attack, but in fractional doses in the interval of the attacks (half dram to dram doses every two hours, till from half an ounce to an ounce was taken). Sydenham prescribed the cinchona in the form of an electury, in pills or in wine. He used to put an ounce of powdered Peruvian bark into two quarts of wine, and direct the patient to shake it and drink eight or nine teaspoonfuls every four hours. Morton, Stoll, and Van Swieten adopted Sydenham's method. Cullen rejected it, and returned to the Roman method, somewhat modified; the cinchona was taken in small doses repeated every hour, and administered, not after, but before the paroxysm.

The method of Bretonneau consisted in giving two drachms of powdered yellow Peruvian bark, or fifteen grains of sulphate of quinine, in one dose or two doses, near together, immediately after the paroxysm. After five days of rest, the same dose was repeated, then after an interval of eight days, and so on, every eight days for a month. Trousseau, a pupil of Bretonneau, used to give two drachms of yellow calisaya bark in powder (or fifteen grains of quinine) in a couple of doses, one hour apart. He let the patient rest a day, and then gave the medicine in the same way the third day, generally in two doses, one right after the other. Then he allowed three days of interval, then four, six, seven, and eight, and for a month or two returned every eight days to the same treatment, never diminishing the dose. The medicament was always given at meal time.

Briquet has made a series of experiments to ascertain the best time to give sulphate of quinine, and these are his conclusions:

1. A dose of 4 to 6 grains of sulphate of quinine suitably administered, is sufficient to cut short any attack of simple intermittent fever in the climate of Paris, and in all other places not paludal.

2. When there is an interval of but a few hours in which to administer the febrifuge before the time of paroxysm, one may still hope to arrest the next attack.

3. If you have only 12 hours before the regular attack, you have almost a certainty of

prevent the following ague fit. Sydenham gave his Peruvian bark in one large dose after the attack, and in smaller doses in the interval. Bretonneau and Trousseau followed the method of Sydenham, but they employed larger doses, which they gave immediately after the attack; this is also Briquet's method, who would have at least fifteen hours between the giving of the dose and the ague fit which he wished to prevent.

While admitting the views of these three French authorities with regard to massive doses, I believe that the space of time which separates the administration of the doses from the onset of the attack is too long, and I am of the opinion that it is well to give it, not as Torti recommends, at the period of chill, but three to four hours before the paroxysm.

As to the dose, it should be variable according to the intensity of the fever, and you can give 50–75 centigrammes or one gram (from seven to fifteen grains) of chlor-hydrate or sulphate of quinine. When the fever is tertian, which is its most frequent type, you should give your quinine every other day, and note the action of your medicine, which ought to produce retardation and diminution in the intensity of the attacks until they completely disappear. Even then it is not best to cease the administration of the quinine, but to continue it for eight days or so, in smaller doses, a short time before the usual return of the paroxysm. All the rules which I have given apply to simple intermittent fever, and you should change your mode of treatment when you have to do with pernicious fever[2] (called malignant, remittent, or intermittent fever).

arresting it, but it is, at the same time, not best to leave a shorter interval than 15 hours between the administration of the last powder and the paroxysm.

4. As, finally, the febrifuge action of quinine continues without losing its power for a space of two days, at least, one may, if circumstances require, give the quinine that length of time before the attack. (*a*)

[2] Intermittent fevers may be pernicious from the first, or succeed simple attacks; after having been attended, for awhile, with the ordinary symptoms, the disease presents suddenly, or gradually, frightful phenomena, which are followed by death unless the disease be arrested by some remedial means.

The varieties of pernicious fever are numerous. We will notice them according to the symptomatology—the morbid phenomena accentuating themselves in certain organs and functions—as follows:

1. Pernicious fever, of cerebral form.
2. Pernicious fever with algid, choleriform, sweating symptoms.
3. Pernicious fever with cardialgic, dysenteric symptoms.
4. Pernicious fever of thoracic form.

1. *Pernicious fever of cerebral form* is the most frequent. It is characterized by coma, delirium, convulsions, paralysis.

The comatose form is the most common. It is this which is met with oftenest in children. It is characterized by somnolence, lethargy, and finally, coma, which generally succeeds the febrile paroxysm. It is rare that death comes on before the third or fourth attack.

The delirious form is characterized by a delirium more or less violent, sometimes

(*a*) Briquet, Therapeutical Treatise on Cinchona and its Alkaloids, p. 500.



This kind of fever, as you are aware, manifests itself by attacks of great gravity, and may be fatal in the first, second or third attack; here, then, there is no precise therapeutic rule, and as soon as you have diagnosticated the pernicious character of the affection, you may administer your quinine even during the paroxysm, in the promptest way possible.

You know that in light cases Jousset, of Bellesma, does not hesitate to have recourse to intra-tracheal injections of quinine, and I am inclined to think

furious; the agitation is extreme, the skin warm, covered with sweat, the pulse strong and vibrating, the pupils dilated, then coma and convulsions set in. You may observe a general tetanic rigidity, cataleptic phenomena, epileptiform convulsions, laryngeal spasms (hydrophobic fever), syncopes (syncopal fever). It is quite rare that the delirious forms develop at first; ordinarily, they are preceded by regular ague fits, attacks of fever, and violent pain in the head. At Senegal, according to Fonssagrives, the comatose form is sometimes observed among the fevers which are pernicious from the onset; this form is the most grave.

The delirious and convulsive form is but the prelude to the comatose fever, to which the patient succumbs in an insensibility as complete as apoplexy. When the attack is not fatal, the patient, little by little, after 12, 24, or 36 hours, comes to himself, and may regain fair health till the next fit.

A paralytic fever has also been described; this is rare. It is characterized by partial paralysis, by hemiplegia, or by paraplegia, as was observed in numerous instances at Senegal, by one of our confrères.

2. *Algid and choleriform pernicious fever.*—This is especially observed in hot climates. The algidity may be the first stage of the fever, or it may appear in the second stage. It is sometimes during the sweating period that the patient begins to become cold and turns pale. He complains of internal heat, demands cold drinks, then all at once he experiences a deadly chilliness, his face becomes cadaverous, there is agitation, thirst, the voice is broken, the pulse becomes small and precipitate, the skin is covered with a cold clammy sweat, and death often comes speedily, the patient remaining in full consciousness; or it may be, in a few hours, heat returns little by little, and the patient recovers.

The *choleriform* form exists alone, or is linked to the preceding. It is characterized by profuse, incoercible diarrhœa, and symptoms resembling those of cholera; suppression of urine, choleriform voice and aspect, cramps, vomiting. If a prompt remedy is not forthcoming, the patient succumbs to a cholera asphyxia. In the diaphoretic form, which is especially frequent in India, the two first stages are normal, or shorter than ordinary. During the period of sudation the sweats are of an excessive abundance, but become cold; there is general cutaneous chilling; the pulse falls; the patient is greatly oppressed; often there is suppression of urine; profuse stools, resembling beef washings, which, later, are colorless.

3. *Pernicious fever with cardialgic symptoms.*—These symptoms are often observed without any previous prodrome. They are characterized by a severe rending pain in the epigastrium and heart, generally supervening in the stage of chill, and often accompanied by nausea and vomiting, general anguish, coldness in the body and syncope. Death generally attends the second attack.

4. *Pernicious fever of thoracic form.*—Intermittent pneumonias have been described; Grisolle admits the existence of a pleuritic pernicious fever, and especially a pneumonic pernicious fever. In the case of intermittent pneumonia, the chill, the fever, the dyspnœa, the bloody sputa exist as in ordinary pneumonia, the crepitant râles localized in one side of the chest; then with the sweating stage all the symptoms are mitigated, or disappear if there be nothing but hyperæmia of the lung, but the stethoscopic signs persist, if the lesion is more advanced, only the fever and the subjective symptoms diminishing. Rarely there are true intermittent pneumonias; oftener there are intermittent bronchites or broncho-pneumonias, coinciding with the febrile paroxysms, and giving rise to cough, dyspnœa, thoracic pain, etc.

favorably of this practice; at any rate, we witness here the triumph of subcutaneous injections, and you ought always to resort to them, whether you make use of the bromhydrate, the sulpho-vinate, or the lactate. You will require large doses, and you ought never to hesitate to give fifteen or twenty grains, and even twice as much, increasing your dose according to the urgency of the case; there have been cases where as much as 75 grains have been administered.

When the individual has for a long time suffered from attacks of intermittent fever, and when, moreover, he continues to live in localities infected by malaria, grave modifications are often effected in the functions of certain viscera. The spleen becomes enormously hypertrophied, the liver is enlarged, the blood is profoundly altered, and symptoms supervene whose aggregate constitutes the malarial cachexia. I shall not here describe this cachexia, but what I can assure you is that the alkaloids of cinchona are impotent against it. Here you will often witness the triumph of arsenic, and hydro-therapy is of benefit.[1] This last means is one of the most powerful resolvents in splenic and hepatic engorgements, and signal success has been obtained in these cases by douches of cold water directed over the spleen or liver.

Here the tonic medication is indicated under all its forms, but all means of this kind are without avail if the individual does not submit to the hygienic treatment which enables him under certain circumstances to avoid the toxic action of the marsh miasm. This hygienic treatment I shall now explain.

The measures of prevention are of two kinds; the one on which I shall now insist, concerns the drying-up of the marsh itself and its purification, the other concerns private hygiene.[2] As for the first, you know that three methods have been employed to get rid of stagnant waters, namely, by filling in with

[1] Fourcade is the great advocate of the treatment of intermittent fevers by hydrotherapy. It gives, he says, good results where quinine fails. (*a*)

[2] The reclaiming of marshes and rendering them salubrious, is accomplished by drainage (where practicable), by filling in with earth (atterrissement), and by exhaustion (by immense hydraulic machines, moved by steam, wind, or water). *Atterrissement* is in some places successfully accomplished by utilizing the muddy water of torrents and directing it into the marshes where the earthly sediment is deposited, which gradually fills in the marsh with alluvium, making it arable. In some places in proximity to the sea, the tide water is employed for the same purpose, being conducted into the paludal district by means of suitable canals.

The clearing and cultivation of marshy lands is a very dangerous operation, being, as Vallin says, "the first trench which one opens under fire of the enemy; the more rapidly one digs, the more rapidly he finds shelter from death." These clearances, then, should be effected as rapidly as possible, and the reclaimed land should be utilized for large plantations of trees, which, by the active evaporation of the leaves, dry up the soil.

Considerable enterprise and vast sums of money have been spent in reclaiming these marshes, and one of the most astonishing works of modern genius is the drying up of Lake Facino, by Prince Torlonia, who spent more than 40,000,000 francs in this sanitary undertaking.

When the marsh cannot be filled up, drained, or exhausted, it can sometimes be made more wholesome by converting it into a lake, by digging around it, and heaping up earth all about its margins, and rendering these more perpendicular, so as to diminish as far as possible, the extent of the surface which the waters generally leave exposed during dry times. (*a*)

(*a*) Fourcade, on the Treatment of Intermittent Fever by Hydrotherapy—These pe Paris, 1872.



earth, draining off the water by suitable ditches, and, finally, subjecting the land to thorough drying; and in many countries where marshy regions exist, attempts have been made by the expenditure of enormous sums of money and arduous labors to render those localities healthy.

As for private hygiene, the physician and the physiologist can do much to establish rules as to residence and alimentation. You know that the higher you ascend the less you have to fear from marshy emanations; you know, too, that these emanations are carried to some distance by the wind, and this is the reason why a habitation should be chosen on a high elevation and sheltered from the winds that blow over the marshes.

The dietary of the patient should be restorative, and wine should be a part of it; the water that is drank should be pure and free from any paludal contamination. Despite all these precautions, you will not always be able to avoid the malarial intoxication. Nevertheless, there remains for you one resource, namely, to keep the inhabitants of miasmatic countries continually under the influence of Peruvian bark. In fact, there is no doubt that cinchona and its derivatives possess a prophylactic property, and in a recent expedition to the gold regions of Africa, the English officers derived great benefit from the preventive and protective use of salts of quinine. This is a very important fact, and I cannot too strongly recommend to you, when called to advise persons who are going to travel through, or sojourn in countries where this marsh miasm prevails, to insist upon the adoption of a prophylactic treatment by the salts of quinine. This finishes what I have to say about the treatment of intermittent fever, and I pass to the final lecture on the treatment of the eruptive fevers.

(*a*) Vallin, art. Marais, in Dict. encycl.—Bouchardat, Traité d'hygiène publique et privée, 1881.—Becquerel, Traité d'hygiène publique et privée, Paris, 1877, 6e édit., p. 292.—Durand-Claye, Mémoire sur le desséchement du lac Fucino, Paris, 1878.