Thesis
(a portion of which was read before the Royal Medical
Society of Edinburgh on March 2nd 1866 -)
on
Malarial Poisoning
(The "Ague Palmella").
and
Intermittent Fever,
by
Archibald Hewan.
Edinburgh, 31st March 1866.
A severe continued form of malarial fever—not yellow fever—occurs as an epidemic at certain indefinite periods in certain localities.
The subject of Poisoning by Malaria is one of vast extent and importance, and may be said to include all affections of the body resulting directly or indirectly from exposure to malarial influence.

To enter fully into the subject would require far more time and research than I have been able to devote to it.

It would require, for example, an examination into the different kinds of that form of Malarial Fever known by the name Yellow Fever, into that which is considered contagious and that not so; into the Remittent and the Continuous forms of Malarial Fever which may be distinguished from the Yellow Fever as non-malignant; and then to trace and describe all their lesions, and all the nervous and other affections of the body which result from them.

But as I regard these several forms as merely essentially a different degree of development of the same poisonous element when introduced into the system, it seems but sufficient to dwell mainly on the most conspicuous and striking, though certainly not the most deadly, manifestation of the poison. This is the observed in the Fever known by the name of Intermittent Fever or Ague.

My plan is first to treat of this Fever; next, to look into its cause, namely, Malaria; and then to give an abstract of what has been only very recently discovered to be the true noxious element of this hitherto un-analyzed Poison.
(1) Macculloch on Malaria, 1827, page 84.

Intermittent Fever is a disorder which manifests itself in a well marked manner through the nervous system. It is one in which the poison of malaria plays an important part.

This Fever, known also in this country under the name of Ague, has been long known in tropical countries where salt and fresh water marshes abound. But it is not confined to those regions. It is not uncommon in many parts of regions where the severities of Winter are felt, in some parts of England for example: and even as far north as Scotland in former times; in the Count of Gironde in Perthsire, for example. It is common in some parts of France, Italy, Holland, etc.

Intermittent Fever is said to have raged like a plague in London in 1558, and was very fatal; but, except in the fees of Lincolnshire, Cambridge, Shire and Essex, etc., it has become much less frequent and comparatively unknown. This is owing principally to the great improvements that have taken place in the draining of lands, and the cultivation of the soil.

James I and Cromwell are said to have died of Intermittent Fever embattled in London.

In treating this subject I shall confine myself to the following heads:
I Definition

II Types

III Phenomena and Symptoms

Pathology

Cause

Treatment.

I Definition: - Calmette's definition is "Fever arising from marsh miasma, consisting of many paroxysms, or at least with evident remission intervening, returning with remarkable exacerbation, and, in general, with shivering; one paroxysm only in the day." How this definition, although concise and simple, is not circumstantially quite correct.

Dr. M. Intosh objects but in so far as he alleges that "Paroxysms of Intermittent have taken place from sudden changes of temperature in situations where no miasma has existed," and then he goes on to tell of a very severe case of this fever that came under his notice which lasted for six hours, and which "was produced after exposure to frost after the individual had "got wet on the top of a coach." But Dr. M. Intosh has omitted to state whether or not the said individual had "on the top of the coach" passed through a malarious district, or had been subjected to any malarial influence.
He adds, however, in support of his allegation, that "all John Hunter informs us that two children had been "from worms; they died hard, but it did them no good, "but the worms were destroyed. They got well." Where the children dwelt, what was the physical condition of the locality, in which they resided he omits to say. However, we cannot entirely disregard the statement of such eminent tacile observers. "In like manner," adds "Mr. Estomi," we have seen from many diseases "of particular parts, more especially of the liver and "spleen, and from an induration of the mesenteric "glands. Many instances are also on record from "repelled eruptions, the drying up of old discharges, "as well as from the application of cold."

My only objection to Cullen's definition is his making it "one paroxysm only during the day." This, as well as the term afterwards, is incorrect.

A brief definition of Intermittent I would give as follows: - Fever, arising for the most part, if not entirely, from malarial influences, consisting of "paroxysms, occurring after distinct intermissions, and with marked periodicity. The paroxysm ushered in by "an intense sensation of cold, shivering, "Captain Burton, a bold and enterprising, "
"Traveller particularly within the tropics, and who has frequently suffered from intermittent fever, facetiously describes it thus: - 'It is an exhilarating attack, a highly intellectual complaint; it heightens all the faculties; the memory becomes most acute; visions of past things fill before the mental eye with startling vivacity; flattering hopes of the future bubble from the brain.'

Now this is quite in Burton's style, a highly entertaining companion both by tongue and pen. But his description, though apparently fanciful, is not altogether unreal during one stage at least of the malady. I, having been myself a frequent sufferer, having seen many patients while in the paroxysm, I am unable to endorse the statement or definition so facetiously described by this entertaining Traveller.

The delightful sensations to which he alludes, and which are experienced in a more or less degree during the course of the attack, afford, as it were, some slight compensation for the terrible sensations of intense cold which overtake in the attack, and the opposite feeling of burning heat which so soon after supervenes upon the cold.

II Types: - There are usually described
namely, the Quadratidian, the tertian and the tertian tertian.
and there are modifications of these, namely, the double-
quadriatidian, and the double-tertian tertian.

**Type I - The Quadriatidian:** - occurs every
24 hours, comes on generally in the morning, and attacks
mostly the young and women. It occurs most commonly
during the time when malarious exhalations are being
generated most actively. The attack (paroxysm) lasts longer than the tertian.

**Type II - The Tertian:** - occurs every 48
hours; comes on late in the day; attacks the robust
and those who have already suffered from one type
or the other; or, at all events, those who have been subjected
to malarial influences for some time previously.
Hence it is the type which, more frequently than the
others, develops itself in those who have resided in
malarious regions after they have left them, provided
the system has not been too far deteriorated and lowered
by the poison, in which case the remittent or Continued
form of malarial fever is most commonly induced.

The Double Tertian is that modification
of the Tertian type where an attack occurs every day,
like the Quadriatidian, which also occurs every
day. the hour of accession on every alternate day differ
Thus, on Monday the fit comes on at 10 o'clock, on Tuesday at 1, on Wednesday at 11, and on Thursday at 1, and so on alternately.

Another modification of the Double-Diurnal is that wherein two distinct fits occur on the same day, one on the day following, but two again on the third day, as on the first, and so on.

**Type III.** The **Quarternian**—occurs every 72 hours. Its cold stage more severe than any of the preceding; and the whole duration of the paroxysm is much shorter. It is also of less frequent occurrence.

There are also modifications of this type which are however very rare.

Any one of these types may pass into the other. For example, the **Quotidian** may pass into the **Diurnal**, and when this happens it is regarded as a favorable indication, one indeed of approaching recovery. In like manner may the **Diurnal** pass into the **Quarternian**; the **Quarternian** or **Diurnal** into the **Quotidian**.

Again, either of the above-named types may pass into the **Remittent** or **Continued** form of **Malarial** Fever. This latter term might indeed be considered or employed as the proper or generic expression for the fever.
from which may be classified the special forms just named, that is, the Intermittent, the Remittent and the Continued, as modifications of one or the same disease, differing mainly in the intensity of its development, from whatever circumstances that may be occasioned.

The Remittent form may be regarded then as a more acutely condition of the Intermittent, having for its intermission a very slight abatement, and that sometimes not very well defined. It occurs in those places where Malaria more profusely abounds.

Again, when a person, after a residence of some considerable time in a Malarious district during which he may have suffered from Malarial Fever, leaves it for a healthy climate, that is, one without Malaria, an exciting cause such as exertion, fatigue, or other depressing agent may set up an Intermittent.

If, however, the Constitution has very seriously suffered and been deteriorated by the poison already, the same exciting causes may induce the Remittent or worse still, the Continued form instead. Much, of course, depends, in these cases, upon the constitutional susceptibility of the individual affected.

Another type of form remains to be mentioned.
It is called Pernicious Intermittent. This is happily of rare occurrence.

In all the other forms of Intermittent, or indeed, of Malarial fevers recovery is the rule, and death the exception. But in the Pernicous, the reverse holds good; death is the rule, and recovery the exception.

The Pernicous is characterized by the intense development of the poison, so that the first or cold stage is extremely marked. The temperature of the body during this stage becomes unusually cold, and much more so than the patient expresses, or seems to be aware of. The powers of the system become so completely overwhelmed by the virulence of the poison that the patient fails and dies generally during the second or third seizure.

III Phenomena and Symptoms:—

These may be divided into three distinct stages:

1st. The Cold. 2nd. The Hot. 3rd. The Sweating.

1st. The Cold Stage:— A person who has once suffered from intermittent fever is liable to a recurrence of the malady, and he is therefore made sensible of its approach by certain premonitory indications.

He experiences a sense of weakness and
general discomfort: he is languid, listless and incapable for physical or mental action; he sighs, stretches himself tyans incontrollably. He feels his toes, and the extremities of his fingers (numb); his skin becomes dry and rough, his nails, cheeks, lips, and ears are blueyish and livid, a chilliness gradually creeps over his whole body; his face is pale, the features shrunken and pinched; he buttons his coat, heaps on one top coat after another and pulls up their collars over his ears, and exposes himself to the direct rays of the sun, studiously avoids every breeze.

Finding all those efforts to warm himself fruitless and unsatisfactory, he at length seats his behind into which, most helplessly looking, he throws himself, invariably unless he happens to be an old sufferer, with all his clothes on; then drawing up his knees to his chin in vain attempt to procure warmth and to concentrate all the available heat of his body, he keeps that all the bed clothes, blankets, pillows, and other coverings within reach be heaped upon him. And now the violence of the attack fairly sets in; his whole body quivers with violent impulses, so as to shake the whole bed, and as shown often witnessed,
even the room itself; his teeth chatter so strongly as, in some cases where they are loose, to knock them out. He has pains in his head, back, and limbs generally; his respiration is quick and irregular, his pulse feels oppressed. He has frequent calls to make water, which is copious and pale, simulating that of a female in hysterics. His stomach is irritable so that he vomits or retches.

With reference to the sense of cold manifested, it is worthy of remark that although the extremities are generally colder than natural, the temperature of the body is sometimes above the normal standard. We may therefore refer the shivering, which is referred by the patient to the feeling of cold, rather to some impression directly on the nervous centres than an actual degree of coldness of the body. Hence then, as Dr. Watson has remarked in his "Principles of Physiology," intermittent fever may be looked upon as a malady belonging essentially to the nervous system.

The duration of this cold stage varies. Usually it lasts half an hour or thereabout; but it may sometimes extend to one, two, or even three hours.

Gradually the shivering and sensation of cold subside; the patient lies quietly; he falls and
expresses himself more lively; his faculties are once more aroused, or he falls gently asleep.

II

The Hot Stage:—By slow degrees the hot stage succeeds the cold. The face begins to regain its natural aspect; the blood returns to the capillaries with increased force, and flushing takes place; the skin, from its abnormal roughness, again becomes smooth; the general surface of the body warm, then hot, and even prunent. Symptoms of cerebral disturbance now begin to manifest themselves such as headache, general or frontal, pains in the eyeballs, intolerance of light and throbbing of the temporals and carotids. The pulse becomes full, quick, and bounding; the breathing deep, sighing, and labored; the urine, from being pale, plentiful, becomes scanty and high colored.

The patient tosses about the bed uncomfortably in quest of the easiest coolest spot; he jerks about his limbs, and, throwing off his coat and clothes, seeks to bring his parched body into direct contact with the surrounding cooler atmosphere.

One of the most distressing sensations is the excessive thirst which the patient vainly tries to allay by repeated draughts of cold water, while, at
the same time, the irritability of stomach, with its accompanying retching, vomiting, aggravates this sensation, and renders the condition of the patient one of extreme suffering.

It is at the beginning of this stage that Captain Burrows's unhappy definition applies. Patients are then inanely thoughtful, talkative, fidgety. But the mental faculties, at length, become slightly disturbed, and, in most cases, delirium supervenes.

The duration of this stage varies more than the last. It generally lasts from three to ten or twelve hours.

III. The Sweating Stage:—Towards the termination of the Fift Stage, moisture begins to make its appearance on the forehead, and soon after, the arms, legs, the whole surface of the body are "bathed in a universal sweat.

The bed, the clothes become drenched by saturation with the excessive secretion, and these require to be frequently changed. Gradually, however, it grows less, the thirst slackens, the pains cerebral and articular depart, and the patient drops off into a profound sleep from which he awakens much refreshed.
The amount of perspiration exercised is estimated to amount in some cases, according to D. M. W. Innes, to as much as two pounds weight. For my part, I am ready to attest this. I have seen the perspiration abundant in many cases, but more particularly so in my own case on one occasion. My night-shirt and bed-clothes were literally saturated with the excretion so that I had to get a complete change of linen four times during the night. It is best, however, to admit that I had taken 50 grains of Chinino at the commencement of the sweating stage, just when I perceived that the excretion had begun to be poured out.

**Interval and Intermission:** These are terms given by pathologists to the succession and alternation of disorder and health, which it is of some interest and importance to consider.

**Interval** is the term given to the whole period embraced from the commencement of one paroxysm to the commencement of the next, comprising therefore that period during which the attack lasts, and that period of comparative health, which immediately follows, and which lasts till the next paroxysm.

**Intermission** is the term given to that period
and condition of comparative health which lasts from the termination of one attack to the beginning of the next.

Accession of Aque:—This for the most part occurs in the morning or early in the forenoon. Out of 751 cases recorded in India, 659 occurred in the forenoon. (Jaycock).

Termination of Aque:—When Aque terminates spontaneously it does so on the 3rd, 9th, 13th or 17th day, most commonly on the 13th (Jaycock).

IV. Pathology of Intermittents:

In treating this important branch of the subject, we shall take up one by one each of the stages that have been alluded to.

First, the Cold Stage:—The poison being carried by the blood into the system we see it manifested first through the nervous system. This is shown by the intense feeling of cold and the shivering that takes place. What the actual pathological change on the nervous tissue is I do not pretend to say. I am not aware that it has ever been described. Whatever that may be, the Sympathetic System would seem to be much involved. The effects of morbid nervous action are quite apparent. We see an irregular determination of blood and a sense of coldness and debility, the result, acholic
Spasm of the whole body. For example, the livid appearance of the nails, lips, cheeks, and ears, the engorgement of the internal organs, and their impaired functions consequent upon the cessation of the blood from the capillaries of the external surfaces; the lungs embarrassed and the breathing difficult, and the short dry cough which not unfrequently occurs; the energy of the mental powers suspended from a want of free circulation through the brain— all these denote the existence of much nervous derangement. On this point quoting from Dr. Innes, the late celebrated Dr. Gregory of this university, he held the following views:—

"The languor and debility," he says, "depend upon diminished nervous energy; the uneasy feelings upon muscular debility; the paleness of the face and extremities, and the shrinking of the features, are owing to spasm of the extreme vessels; the weakness is to be explained by the blood being propelled from the surface by debility or prevented from entering the vessels by spasm; thus the cold may be produced either by the spasm or by the debility; the tremors depend upon debility of the muscles, but there is also some irregularity of nervous energy; the breathing during the cold stage is small, frequent, and anemic owing to debility of all the muscles that serve for respiration; while at the same time the congestion of blood
"produced by the weakened action of the heart, wound upon
its beating to be often repeated, and the respiration to be
faster than natural, which circumstance tends to increase
the sneezing; the heart partakes also of the debility; this
debility of the heart produces an accumulation of blood
in the great vessels, and thus occasions that unusual
motion in the organs of respiration termed yawning.
Want of appetite, nausea, and vomiting are owing to
debility of the fibres of the stomach. Costiveness is produced
partly by spasm. Failure of attention and memory are
also delirium, owing to debility."

Second, The Hot Stage: — The phenomena of this
stage may be ascribed to reaction. It is explained thus:
the blood which had accumulated about the heart in the
cold stage at length becomes a stimulus to the organ.
The process of nature, those called ven medicativa nature,
shocked and paralysed by the poison for the time being, if
not indeed completely, overpowered as in the Pernicious
Intermittent, rally and restore itself to bring back
health. The blood in these efforts is driven in
increased quantity, with greater force over to the surface
of the body, and thus again, but in a manner directly
opposed to the former stage, the balance of the circulation
is lost, and secretion and excretion are suppressed.
But the nervous disorder, though in a diminished degree, still continues. Again the heated wave of blood flows back, the congested capillaries relax, and now we have the third, the \textit{dealing stage}:

It is at this stage that, as we have said, relief begins to be felt. The system becomes depleted; the turbulent wave of recovery no longer fluctuates; the natural action of the nerves subsides, and all is again quiescent.

To sum up the whole in the words of an American writer on the subject: "When the tissues have become poisoned to a certain extent, there is a reaction on the part of the system; an effort of nature to eliminate the poisonous products already in the body. This effort is the paroxysm, which constitutes what we call the disease." (Dr. Salisbury in \textit{American Journal of Medical Science})

The organs affected in intermittent fevers are most frequently the liver and spleen which undergo various changes of enlargement, hardening or softening; the mucous membrane of the stomach and bowels sometimes becomes involved; the mesenteric glands not infrequently become enlarged, especially in children - \textit{tuber mesenterica}, the blood becomes defibrinated, loses its red corpuscles, the bile being increased, the skin loses its healthy appearance, and assumes a dirty yellowish color."
(1) A pathological condition which I should not omit as occurring in many cases of intermittent or other malarial fevers that came under my notice is the development of purpuric eruptions over the body. This state of things generally happens during the period of convalescence, and the boils are more numerously developed on portions of the body where blisters or other crustaceous have been applied.

They also occur independently of any attacks of the fever, but seem to act simply as another plan of eliminating the poison.

Herpetic eruptions appearing at the angle of the mouth during the progress of an intermittent are looked upon as a certain sign of approaching recovery.
line which is quite characteristic.

Sometimes in advanced cases, a tendency to dropnaic affusions takes place. A defect of the lower extremities, general anaemia or even ascites may occur. (1)

The mental powers too lose their former energy to such an extent that even after complete removal from a malarious climate, in considerable time, alaries before they are restored. On the front I speak from personal experiences to observers, coupled with those of others who have themselves suffered.

**Marked appearances observed on dissection.**

On this front I am unable to say much from personal observation. I have seen very few cases died of the Remittent or Continuous form of fever, and none at all from the Intermittent.

In one case however, which came directly under my notice a few months ago, and where the patient died from a Remittent of three weeks duration, which came on immediately on his arrival in England after a few years residence in an intensely malarious tropical climate, the only organs examined were the heart, livers, and Spleen. Circumstances which existed at the moment debarred us from making a
more minute investigation of the organs named, and a more thorough examination of the body.

The body had an emaciated appearance, the skin a sallow complexion—greenish-yellow. There was slight oedema of the trunk of the body, with anaemia of the lower extremities.

The heart was somewhat enlarged and flabby; the muscular textures pale and soft; the valves sound; competent, but the blood unusually fluid and devoid of clots. During the illness which terminated in death a loud bruit was heard constantly over the base of the organ which was considered anaemic, and ascribed to the extreme unhealthy condition of fluidity of the blood, and which had gradually become so as the inevitable result of chronic malarial poisoning.

In the thoracic cavity, there was slight serous effusion.

The lungs were healthy, but with a slight pleuritic adhesion on the left side, and remarkable little consolidations of lymph some adherent on the diaphragmatic surface of the pleura, while others floated freely about in the effused fluid.

In the peritoneal cavity, there was considerable serous effusion which had to be scooped out.
(1) During the patient's illness, there was a dull deep-seated pain on pressure on the border between the epigastrium and right hypochondriac regions, but on examination after death no marks of inflammation were found. It was not sufficient to account for it. But on the internal anterior surface of the liver were found slight lymphoid deposits as if inflammation had existed there some time previously.

(2) In another case which came under my notice in Old Calabar, one where we examined simply the brain on account of prolonged delirium febris, we found a general serous affection in an unusual degree, and a softening to a slight extent of the cerebral substance, but my memory, aided by notes, fails to recollect any other lesion.
in order to admit of our investigations.

The liver was one half again its usual size, very pale and gelatinous, almost pulpy, and having on its anterior surface a mottled appearance. It was somewhat similar, though in a less advanced stage, to the liver of an English greyhound which I inspected after death in old Calabas. The dog had been observed to shiver frequently, then become hot, to lose appetite, become emaciated, and at length it died. Its liver on examination was found exceedingly soft and pulpy, quite disintegrated, so as hardly to be seen being lifted up by the fingers.

The spleen was at least five or six times its normal weight, highly congested and indurated. (2)

Dr. M. Intosse has recorded forty-one cases of dissections which were made by Monsieur Baily about 140 years ago. Mons. Baily went to Rome for the express purpose of investigating the pathology of intermittent fevers. In his summary of these cases, which Dr. M. minutely records, he says, "From these and other cases it appears that M. Baily found in thirty-three dissections more or less extensive disease in the brain; in twenty-two of these there was the blemish of other marks of inflammation in the cerebral
coat, and in eleven, inflammation of the sub stance of its brain. In twenty cases there was gastroentritis. In four cases gastritis by itself; and also four of enteritis complicated with gastritis. In eleven the spleen was softened; in some mitra nous enlarged; one weighed from two to three pounds, and another from eight to ten pounds. In two cases the spleen was hardened. In three cases the spleen was ruptured, and in one it was gorged with blood. In two cases the liver was softened, in four gorged with blood, and in one case inflamed. In two cases there was pericarditis; in three pneumonitis; in three peritonitis. In one case there was inflammation and enlargement of the parotids. And then he adds: "The statements respecting its appearances on dissection in intermittent fevers will be found fully corroborated in the words of Morgagni, Pringle, Coghill, Chevalier, and their fellows."

Before passing on to the next great division of our subject, it may not be uninteresting to refer to the periodic recurrence of the paroxysms, merely in order to show that it has not escaped our notice.

It is a curious and very interesting subject for study and research, and many have been the speculations indulged in by pathologists. Some of them eminent as to
its exact cause I nature.

In Watson's "Practice of Physics" I find that Willis ascribed it to a periodic development of the fermentable "matters of the blood", but he forgot to say why it is periodic, which is the knowledge desired.

Reil referred it to some general alternating law of the universe as we see manifested in the "alternation of light and darkness", the periodic recurrence of the "seasons", the ebbing and flowing of the tide, the succession of appetites and satiety, of the states of sleeping, waking, "and so on". But really this affords no explanation after all.

Cullen thought it was owing to some law of the animal whereby it is subjected in many respects to a "diurnal revolution".

Others have ascribed it to habit which is well known to exercise an important powerful influence upon the functions of the body, but those who promulgate this doctrine forget that habit does not hold good in every case at all events of the second paradoxus which of course must take place before the habit comes possibly be acquired.

In my humble opinion this periodic recurrence is one of these occult causes which will ever remain so
There are several of them. The poison or influence which generates Scarlet fever produces a rash which, as a rule, appears on the second day; that of Small pox on the third; and that of Measles on the fourth. How do these happen so? Honestly we cannot say, and this never shall. So it is with the periodic recurrence of Intermittent Fever. Its subtle influence is likewise beyond our reach, and will likely continue to be one of the ultimate facts of pathological science.

The Cause of Intermittent Fever:

The principal, if not indeed the only cause of Intermittent Fever has long been acknowledged on all hands to be Malaria. Reference has been already made in this paper to cases of Intermittent Fever alleged to have arisen from the presence of worms in the intestinal canal, and also from long exposure to excessive cold. But even admitting these to be bona fide genuine cases, both as regards cause and effect, they are of such rare and exceptional occurrence that we may be excused from taking any further notice of their existence.

The subject of Malaria itself is one of such interest that I shall pass it over here, and refer upon its discussion at another part of this paper. See page 37.

We now pass on to the next division of our subject, viz.
VI Treatment of Intermittent Fever:
Here we shall consider:
1st. The treatment during the paroxysms, and
2nd. The treatment during the intermission.

1st. Treatment during the paroxysm:—During the cold stage, the indication is warmth to the body in whatever way it can be most efficiently applied. The patient should go to bed, for comfort as well as convenience afterwards, let him divest himself of all his ordinary clothes, and put on his night-shirt. Then cover him over with blankets and other suitable covering. But there are better ways of procuring heat. Of these I shall name the warm bath, and, better still, the hot-air bath. This latter is obtained in a very simple manner. The patient is seated on a chair sufficiently elevated to allow a burning spirit lamp or candle to be passed under it. The patient, chair and all, are invested with a large blanket; or two so closely applied as to prevent any admission of atmospheric air. A fold of the covering is then raised, and a lamp or candle passed under the chair, and shut in. In a few minutes the enclosed air becomes heated, and the result is obvious. Then after being kept in a sufficient time till not only heat is felt...
oped, but perspiration begins to be excited, a few minutes in a warm bath will be found both very soothing and salutary.

Or, again, if the patient must lie in bed hot bricks or hot water bottles shonee be applied to his feet and along the lower extremities and the trunk of his body.

But the cold wet sheet is a means that I have found to answer perhaps better than any other. It is the wet pack of the dropattic establishments. Take a sheet moderately wrung out of cold water, thoroughly envelop the patient with it, then apply closely and firmly around it several layers of blanket. By this means I have seen the cold stage cut short, the patient carried rapidly through the hot or second, into the third or Sweating Stage. Under this regimen the patient commonly falls into a sound sleep, and awakens drenched in perspiration. He is then placed in a warm bath to complete the process, after which being thoroughly dried, he should remain warm in bed to promote the secretion.

During the continuance of the wet pack or, at all events at its commencement, small occasional draughts of some cold diluent, even water itself will be...
found serviceable.

Among the other agents usually employed during the cold stage I may mention hot drinks, friction, opium, emetics, bloodletting &c.

Hot drinks:—These are generally most agreeable to the patient, and may be either of a stimulating or simple nature. Of these, I may name hot water, simple hot tea, brandy or whisky toddy, wine negus, &c. These are all more or less objectionable on account of the irritability of stomachs which are liable to become a state index of this organ that is so little liable to arise spontaneously—

Friction is sometimes of great benefit, and is generally very grateful to the patient.

Opium will be found of great benefit in this stage. We have already referred to the assertion of the blood from the capillaries which are in a state of spasm appears

From a full dose of opium, to relieve this, and the blood is enabled to return recirculate through them. For this end I give the following draught.

Rx. Friction, opii vel.
Lignus opii (Bottle) M X X X x 2.
Aetheris Chlorici vel.
Spiritus Aetheris Nitrosi M X X X.
Aqua pura — 3½ misse.
The very worst and most persistent case of malarial fever that I ever had under my care was one in which there was a constant nausea, but which, from some peculiarity in the synarchy, could never be brought to vomit, not even by specia

The poison of malarial seemed to fix its virogeasp

upon the constitution which at length, after a period of nearly three years, succumbed to an insidious case of malarial Poisoning
Emetics are especially useful when the stomach happens to be loaded at the accession of the fit. By thin action also the energy of the system is aroused, and reaction more speedily takes place.

Instead of causing irritability of the stomach which has often been urged against their administration, they often tend to prevent it. When judiciously administered, they evacuate the contents of the stomach, and thus relieve that organ of matters which, the function of digestion being arrested, would tend of themselves to promote irritability. Moreover, if what has been recently alleged as to the true cause of intermitterte be the correct one, namely, the existence of the "yne palmella" on the mucous surfaces, or in the excretion from these tissues in persons laboring under the malady, then the judicious administration of an emetic may be of great value in getting rid of some of these foreign bodies. Caution, no doubt, should be exercised in administering emetics, and when they are used, caution at all events should be avoided. The aciduca is the emetic I have found most serviceable. Its action is purely mechanical, and it has not infrequently a useful apparent effect at the same time.

Blood letting has been highly extolled by
Some, and as severely condemned by others. Mr. Macintosh's name stands prominent among the former class. For my part, I must admit that, looking over the records of cases in which blood letting was employed by himself or by others, the success which attended its use seems to me to justify his strong recommendation of it.

I have not myself had recourse to bloodletting except in two cases of Malarial fever of any kind, in both of which there were special urgent symptoms for the relief of which the extraction of blood seemed advisable, and which indeed proved to be of immediate advantage. I am not, however, prepared to recommend bloodletting as a general rule in Malarial fevers occurring in climates eminently relaxing. Much may depend upon the climate, and the physical condition and habits of the patient.

In thus expressing my opinion, I merely express what my judgment, guided by my observation, dictates. Feeling satisfied that less formidable measures would suffice, I never except in the cases mentioned above, fell subject to employ it. But, on the other hand, we have the recommendation of this therapeutic agent, founded upon the experience of success of Mr. Macintosh and others, so strong that its consideration should by no means be
altogether disregarded.

Treatment during the hot stage:—The indication here is to lessen the heat, and to promote diaphoresis. The patient should be kept lightly covered, and if he be very restless, a large fan may be formed of great service for helping the air in motion. The forehead, face, upper extremities, should be fanned with dilute vinegar or water. The process of fanning after this application will be found very soothing. There is great thirst, but more permanent quenches are to be obtained from small sips of cold water, or from sucking a moist sponge or rag than from large draughts of cold water, which very much tends to irritate the stomach. If the stomach be irritable give small effervescent powders (of soda with a small quantity of water), quenched down into the stomach to be dissolved there. Hydrochloric acid (diluted) from 4 to 6 or even 8 drops I have given with marked benefit to the patient at this stage. But by far the best agent here is Opium as already recommended in the Cold Stage. Speedy relief to the patient from his restless nerves, his headache and other spell-like symptoms is almost certain to follow.

To prevent suppression of urine which the Opium is likely to induce, and to promote the diaphoresis, give small doses of the hydrate of potash—say 10 grains—or the above named Soda powder every 2 hours or so. These
(2) For excessive irritability of stomach, injections may be necessary at the pit of the stomach. In one case which I had under my care, and a most anxious one it was when the irritability continued unabated for several days, when the introduction of the patient became alarming, immediate and almost magical relief was afforded by a tiny blister at the pit of the stomach, and the application of freezing morphia to the denuded surface.

(2) For excessive headache and delirium, the pediluvium and other derivative measures, such as liniments to the calves will be found of essential service.
from doses are composed of 15 grains of Carb. Soda and 10 grains of
Tartric Acid. They tend to diminish the irritability of the stomach
when present. But in the 96th or 97th grain of Morphine to each poison will be found of
service (1)

It is during this stage that headache, when present
is most severe. Sometimes it goes to the length of delirium.
Cocks and colds will be found useful. It may even be neces-
sary, if when this headache is most severe, it is to persist
at once, to apply a blister to the nape of the neck,
or, which will be found most convenient to the patient
by lying on his back, behind each ear. (2)

Treatment during the Sweating Stage:

Very little need be said on this point. The patient
should be lightly covered, and the perspiration should be
promoted by the means indicated above. Care,
however, should be taken that diaphoresis is not
prolonged too far.

In changing the bed and clothes, all current
of air through the apartment should be carefully shut off;
the body should be well dried with a towel, and precautions
taken that the patient be not chilled.

Treatment during the Intermittent:
The administration of Quinine

The administration of Quinine during the intermission is one easily enough managed. But its administration during the paroxysm of Intermitent or Remittent fever requires a passing notice.

In the first place, it should never be given where there is irritability of stomachs, or even a tendency towards it.

It should not, as a general rule, be given during the cold stage; because if there be a tendency towards irritability of stomachs which commonly begins at this stage, it is rendered persistent.

Quinine may, however, be given at the beginning or during the hot stage, and when so given, it should be in large doses, from 10 to 30 grains. Very marked beneficial
1. Avoid all undue exposure to the sun, to currents of air, and more particularly, to early morning and night air.

2. Let the diet be of the most simple and easily digestible kind.

3. Keep the bowels moderately active.

4. Take moderate exercise; occupy the mind in agreeable healthy pursuits; avoid over exertion and excitement.

5. As a tonic and antiperiodic, Quinine should be taken to as much as 10, 15 or 20 grains during the 24 hours. A larger dose, say from 6 to 10 grains should be taken 2 hours before the expected attack. Iron, in its various forms, is an excellent adjunct to the Quinine.

Arsenic, in the form of the Arsenious or Arsenic acid, or Fowler's solution, is sometimes found useful as an antiperiodic in inveterate cases, may be given alternately with the Quinine.

6. Change of air; and complete removal from malakous influences most particularly.

Many other therapeutic agents have been handed on the cure of Intermittents. I shall do no more than barely mention them.
effects have followed its administration at this stage, by this heroic mode of attacking, as it were, the disease at the outset of its career. The patient breaks out into a universal sweat, which, if judiciously promoted, ends in recovery.

Quinine should be given at all events, when the first appearance of diaphoresis appears. By this time the nausea and other contrary symptoms that may have existed, have subsided. It should always be commenced with a large dose, finished on a 4 or 5 grain dose of Cinchonin.

But Quinine should never be given in those persistent forms of continuous fever, the result of Chronic malarial poisoning, in which case there is more or less of eczema, high colored urine, nausea, and at all events a dry harsh sallow skin, and faintness. In these cases the indication is to excite the secretions the kidneys and liver; for example. For this purpose I am in the habit of giving first a small dose of Camphor which promotes diuresis, and repeated doses of the following mixture:

R. Liguoric Taranaci M X X X X

Tinctura Scilla M X X X X

Spiritus Aetheris nitro Liq. X X X X X X

Agua pura ad Zys cor

First haustus.

Quinine may then be usefully administering in combination with small
1. Willow bark and its alkaloid, salicine in Britain
2. Holly leaves and its alkaloid, thecine in France
3. Terebinth, the crystalline salt of pepper.
4. Cobweb, the web of the black spider.
5. Charcoal, or what is somewhat similar, the
   **Smell of a Candle**. On this subject Dr. Watson in
his Practice of Physic remarks "A clergyman of my
acquaintance assures me that he seldom fails to
cure agues among his parishioners by administering
to them the smell of candles which he takes care to have
collected. He does not inform them of what his black
powder consists. I presume "continues Dr. Watson" that
its virtue may proceed from the charcoal it contains,
unless it be derived from the confidence his flock has
acquainted to place in his specific."

The consideration of Intermittent
Fever would not be complete without a word or
two as to the prophylactic treatment:

In no disease is this of more importance
since the disposition to a recurrence remains for
a considerable time after the last attack. Indeed
an attack not infrequently comes on even after the
person is removed from all noxious influences.
doses—say 3/ of Epsom Salts.

(1) Several cases have come under my notice, but the most remarkable was one not very long ago. It was that of a young gentleman who, as a merchant, resided in one of the most malarious districts on the west coast of Africa. During his residence there for about one year, he enjoyed excellent health, even while his companions and neighbors were suffering more or less severely from one or other of the malignant fevers. At length he returned to Scotland; when, not long after his arrival, very severe recurrences of tertian ague came on, which continued for some time, and which, in a short time, very much reduced his strength. At the time when I saw him, he was looking very much jaundiced. But I understand that he is now quite recovered.
and this although he has never been attacked during his residence amid malaria. Many cases of intermittent fever occurring to persons after a return to a non-malarious climate, but which were engendered by a residence amid malaria.

The first measure that should be adopted if at all practicable by way of prophylaxis is. Removal from all malarious influences and to a temperate climate.

Second. Avoid all undue exposure to cold, damp, that.

Third. Avoid exposure to night, early morning air, to moonlight nights in the open air, and especially to sleeping in the open air at night.

Fourth. Avoid draughts of air more especially when the body is heated & perspiring.

Fifth. Change immediately all damp or wet clothes, wet shoes & stockings. An excellent plan when the body has become wet either from perspiration, rain or other cause is to take a cold bath for a few minutes, after which rub the skin well and put on dry clothes.

Sixth. The employment of the wet dripping sheet as is used in dysapathy is an excellent tonic every morning. During the excessive heat of the day, it is also found very soothing & strengthening.
I have found a warm bath, followed by the dressing sheet, soothing. Treatments where the continual use of the wet sheet alone began to lose its previous good effects. Seventieth. The bombs should be kept regular. For this purpose a dinner will consist of from 3 to 5 grains of Rhubarb only being found serviceable.

Eighth. Wear flannel next the skin. Indeed the entire use of woollen clothes will be found safe and most salutary.

Ninth. Moderate exercise, physical and mental.

Tenth. A fair generous diet with the occasional use of wine, alcohol, or beer.

Eleventh. Cinchona in 2 or 3 grain doses occasionally not always.

These prophylactic measures apply equally to the Remittent and Continued forms of Malarial Fevers.

They apply equally to persons newly arrived in a malarious country. On this point I may remark that persons arriving from a healthy region and full of health and spirits, are looked upon with contempt at the contracted, slow-goming, care-taking characters of the residents. Observing all nature luxuriously and active around them, and despising
the advice and caution of the old residents as simple and absurd, they proceed on the idea of setting a good example for the purpose of rectifying what they regard as improving the degenerate notions of their younger brethren. But in a very short time thereafter, they find out their mistake, so that after a little practical experience of what they find they are really unable to accomplish they fall in thousands of residents, if indeed any fragment of longer exposure has not already proved fatal.

Persons arriving in a Malarious Climate for the first time should

Avoid undue exposure to the sun, heat, smoke particularly. Strictly avoid exposure to night and early morning air. If duty compels them to go out at these times, some stimulants like coffee cannot be obtained should be taken. I have tried both, both in the preference by a long way to coffee. The action of this beverage is more uniform. That of spirits is fierce and then depress while that of coffee is afford a steady warmth, comfort & continued exhilaration. Truly it may have been said to take the cup which cheers but not intoxicates.

Quinine should be taken two or three times a week in 2 or 3 grain doses each time. It should be borne in mind that Quinine does not expressly keep away
fever altogether.

**Malaria**, as the cause of Intermittent Fever to which I have referred to at page 24, I prefer to treat of separately, because, in the first place, it is worthy of a separate and particular consideration; and, secondly, on account of the new and interesting light that has recently been thrown upon it by researches and discoveries in the Western Hemisphere.

The word *Malaria* which is now very commonly employed in referring to pestilential evacuations from morsely grounds is borrowed from the Italian. It is composed of two words *mala* and *aria* signifying bad air. Another term not infrequently employed is *Miasma*, in the plural *Miasma*.

Several lengthy dissertations have been written on this subject by authors long since passed away, but whose works remain as monuments of their careful study and researches in that field of enquiry. Of these I may name Dr. Macculloch whose work published in 1827 is a most elaborate and profuse treatise on the subject. That writer gives a very extended account of the production and propagation of Malaria, and the nature and localities of the places by which it is produced, etc. Another writer, Dr. Aiton, published
his work in 1832 giving to the public somewhat similar information.

Moreover, all writers on tropical diseases have dwelt now or less upon this mighty source of the most common diseases they had to contend with, namely, Intermittent, Remittent, Continned Yellow Fever, all different forms or different degrees of the generic disease Malarial Fever. Of these writers I may mention Bancroft, Chisholm, Jackson, Fellows, Pingle etc.

In all these publications the same kind of information on the subject exists.

In more recent times the writings which are published relating to the subject are for the most part extracts or compilations from the older authors whose knowledge & actual experience of Malarion was greater than there is opportunity for acquiring at the present time. The reason is obvious. As the progress of civilization advances lands which were formerly malarious are drained rendered fertile, so that the fact stands out prominent namely portions of England, may even of Scotland, which were at one time eminently malarious & promotion of Intermittents are no longer so.
Seeing then that the subject has been so thoroughly exhausted, at least to a certain limit, it is clear that what I have to say on it here, in a general way, will be nothing new, but principally a repetition of, or a compilation from, what has been already written. Very recently however a new light, as already hinted, has been thrown upon the subject, and I therefore gladly avail myself of it, regarding it as one of the most valuable and interesting bits of knowledge that we have yet acquired about Malaria.

From time immemorial, a close relation was found to exist between certain forms of disease and marshy districts. These diseases were the different forms of fever called intermittent. It was supposed that the cause of these fevers must necessarily lie in the exhalations which arise from these regions. The air which abounded in these regions was carefully analysed but nothing of peculiar and distinctive importance was found to characterize it. It was found that in healthy regions, the gases collected by stirring up the marshes in unhealthy regions, namely, carbonic acid, carburetted hydrogen, nitrogen, and oxygen, could be inspired, causing any of these diseases peculiar to Malarial regions.
It is however commonly regarded as an established fact that the poisonous agent is a product of vegetable decomposition, and that heat and moisture are indispensable to its formation. This idea may hold good in the majority of instances where Malarial fevers exist, but intermittent ones occur also in dry land districts, for example in the plains of South America, in the high lands of Ceylon, etc.

Malaria is most abundantly generated in the tropics under the combined influence of heat and moisture, so that its dire effect is most powerfully witnessed in the vicinity of large tropical rivers, on their banks or in their deltas. These noble looking streams become filled to overflowing in the rainy season, the grounds flat below, around them become saturated. Gradually they subside as the rainy season becomes less severe, and as the continuous evaporation takes place under the full vigour of an unclouded sun.

It is at the beginning of the drying season that Malarial Fevers are most rife, corresponding therefore with the periods when the exhalations are most profuse.

I have named tropical regions as those
places where Malaria is observed to abound most. But there are many other places not called tropical where Malaria its morbid influence are as severely felt during the time that they are generated. I refer to Italy where in the Pogetoe marshes near Rome, and in Tuscany and other parts Malarial fevers abound extensively during the Summer months, at which time the heat of the Sun is as powerfully felt as in the Tropics.

Again there are places in France in Switzerland in the Netherlands in England even at the present time, formerly in Scotland in Ireland &c. &c. where during the heat of Summer Intermittents, or other effects of Malaria prevail.

A marsh in the proper sense of the term is not indispensably necessary to the evolution of Malaria. Vegetable decomposition heat under certain circumstances will suffice. For example, it was the custom in India at one time to prepare manure from the remains of the Indigo plant after the colouring matter had been extracted. These remains were thrown together in heaps, and allowed to remain exposed to the alternate heat of the sun & soaking with rain for thirty years. But it was eventually discovered
(1) Cyclopaedia of Practical Medicine, vol III
that they were productive of Malaria by the effects which they produced on those living in their immediate vicinity.

The temperature necessary for the development of Malaria is stated to be above 60° F. At the temperature of 75° F. to 90° F. it is most violently felt.

It is a remarkable fact that the ill-effects of Malaria are sometimes not felt in the immediate vicinity of its production. Thus Ellenborough informs us that the stagnant waters of Lake Agamus exhales delirious effluvia which are carried backwards to the north-east to two or three villages, and even to the Convent of Comalcalco, a league distant, and situated on a high mountain. Dr. Maculloch also mentions a case occurring in Malta, where "the Malaria which is produced on the beach beneath a cliff produces no effect on the spot itself, while it affects, even to abandonment, the village situated above." There are other cases like these recorded, but they form the exception to the general rule.

I have also stated that the effects of Malaria may be felt a considerable time after the person has removed from the Malarious district.
Art, Malaria, Cambridge Encyclopedia.
While as has been already hinted at page 1467, vegetation is not essential to malarialis, it is found on the other hand, that moisture is not necessary for the production of the malarial fevers of the East known by the name of jingle-fever.

Again, while heat & moisture together in marshy districts, the malarial element, an excess of moisture prevents its development, and by impeding the access of atmospheric air towards or prevents decomposition. This explains the apparent anomaly of an uncommonly rainy season producing opposite effects in different localities, sometimes not far distant from one another. Thus in the West Indies a rainy season induces general sickness in the dry but well-cleared islands of Barbados, while at Trinidad, whose central portion are a sea of swamps, and where it rains nine months in the year, excessive rain is a preserving from sickness; where rain falls only eight months or less the swamps become dry, exposed to the sun, and severe Remittent are sure to follow. (1)

This agrees substantially with what I have observed of the period of full development of malarialis on the West Coast of Africa. The "sickly season" in those regions corresponds exactly with the beginning of the Rainy. The beginning
Amount of Rain which fell in Old Calabar in 1862

From January 1st to February 18th... 3.4 (an unusually rainy month)

- February 18th to March 8th... 1.3
- March 8th to April 3rd... 4.9
- April 3rd to April 14th... 2.7
- April 14th to May... 22... 8
- May 22nd to June 16th... 4.8
- June 16th to June 26th... 2.5
- June 22nd to July 5th... 3.35

On July 6th... 6.15

- July 6th to July 9th... 2.70
- July 9th to July 10th... 1.15

- 10th to 17th... 3.10
- 17th to 21st... 3.70
- 21st to August 4th... 4.2

- August 4th to 7th... 3.7
- 7th to 10th... 2.4

- 14th to 22nd... 3.1
- 22nd to 26th... 4.2
- 26th to 29th... 3.2
- 29th to Sept. 7th... 5.5
- Sept. 17th to Oct. 31st... omitted

All November... 3.8

No rain at all in December... 0.0

81.8
of the Dry Season. It is at these periods that the severe forms of fever predominated. During the rains, it is true, there are cases of fever and malaria, owing in a great degree to the excessive amount of moisture in the Air.

Besides, all the marshy grounds are not equally covered, so that decomposition to a certain extent does go on, though not to the same extent as during the other periods named, when the full and more continuous force of the sun is felt.

The "infecting distance" of malaria is one which has been variously considered. Thus J. Mortimer calculates it to be from 1400 to 1600 feet of altitudinal range, and from 600 to 1000 feet of horizontal direction. Sir Gilbert Blane calculates from observations made during the ill-fated Walcheren Expedition that in Europe the horizontal spread of marshmias makes our fresh water is less than 5000 feet. In the tropics however the range either way may be considered as much greater. It has appeared true, with what amount of correctness I am not at present prepared to say, that those living on shipboard in the middle of a wide river suffer less than those living on shore, or who live on ships situated near to the shore.

Malaria is said to cause other maladies besides Intermittent Fever. Among these may be named Neuralgia, dysentery, Cholera, idiotic Paralysis in Inscaney Switzerland, etc.
The American Journal of the Medical Sciences
January 1866. Article II

"On the Cause of Intermittent and Remittent Fevers" by
J. H. Salisbury M. D. Professor of Physiology, Histology,
and Pathology in Charity Hospital Medical College"
The "Ague Palmeira" alleged to be the peculiar noxious element in Malarial Poisoning:

Chemists have long sought, but in vain, to detect any special ingredient in the air of malarious regions. I read of only one chemist, Boussingault, who asserted that the air collected over malarious districts differed in any way from that collected over the most healthy districts.

Recently, however, an American observer has carried on an extended series of observations on this subject of malaria, the result of which is that he has published a paper full of interest, demonstrating that the peculiar noxious ingredient which he finds to exist in localities where Intermittent and Remittent Fevers abound floats in the air; at all events, are found on the soil of certain localities, and also in the secretions and excretions of persons labouring under these fevers. 11

Professor Salisbury was led to inquire into the matter from having been engaged in a lengthy series of careful experiments connected with camp diseases, and those affecting vegetation as the curl in peach leaves, and the blight in apple, pear, and quince trees. 12, and in studying the causes and consequences of fermentation, gangrene, decay, and the changes going on in diseased
"Tissues"

His field of research was in the sick Malarial district of the Ohio and Mississippi valleys in 1862. Heavy rains had fallen up to about the first of July after which a gradual drying up of moisture took place, where intermittent fever began to show itself during the months of July and August, and increased rapidly till it had invaded nearly every family on aque levels.

The Expectoration was the first thing examined. This was taken from patients under intermittent fever and also from others living in the malarial atmosphere. It was examined under the microscope.

"The first saliva secretions and mucous expectoration of the morning were those used." These were found to contain "a great variety of zoosporoid cells, animal-cellar bodies, cleatoms, dissimades, alveol cells and filaments, and fungoid spheres. The only constant bodies, however, uniformly found in all cases, and usually in great abundance, were minute oblong cells, either single or aggregated, consisting of a distinct "nucleus, surrounded by a smooth cell-wall, with a "hollow clear, apparently empty space between the outside "cell wall [nucleus]." From their peculiar appearance..."
Dr. S. felt convinced that they were not fungoid, but "cells of an algaloid type resembling strongly those of the "palmella." These peculiar bodies were found only in
those living within the influence of malaria, and subject
to ague. In those residing above the summit plane of ague, they were "invariably absent," while diatoms
di media, fungoids, spheres, and aminalcular bodies
extended to some extent to all heights above the ague line.

Dr. Saldbury having fully satisfied himself that
these palmella were the only ones he could rely upon
as constantly present in malarial levels while they were absent above them, his next step was to
find out their source and character.

To accomplish this object, he employed rectangular
plates of glass 16 x 22 inches. He placed these on four
pegs - one peg at each corner of a plate, raising
one foot above the surface of stagnant pools and
marshy grounds that were partially submerged.
The arrangement was made at dusk. Before sunrise,
they were removed. Large droplets of water were now found
on the main surface of the plate. These droplets were then
examined under the microscope were found to contain
many of the cells previously observed as occurring in the
expectoration, but none of the minute algal cells.
But on the upper surface of the plate these bodies were "formed in considerable numbers." Dr. S. repeated my carefully these experiments, "varying widely the localities "with the same results."

In the course of his enquiries and observations, Professor Salmon found that he suffered from a "dry feverish sensation in the throat "and pharynx, often extending to the pulmonary mucous "surfaces" whenever he had to pass over the ground or "bog on which he carried on his observations. Furthermore, his expectoration at such times was "fleshes", filled with the minute oblong cells above "described." This led him to a very particular examination of the "bog. He found on the bog's "surfaces which were recently broken by the tread of cattle, a whiteish-looking mould, not unlike "an incrustation of some salt. Here he suspended "his plates of glass, and on the following morning, he found the inferior surface of the plates covered "with the minute cells" he was in search of. Urgently, "pursuing his researches, he immediately secured "samples of fresh earth which were covered with "the incrustation" as well as some which were not, "and also sections of the boggy turf."
Under the microscope a fragment of the
mucillation was found to be made up of aggregated
masses of the minute cells so uniformly met with in the
expectoration of those exposed to the influence of its heavy
"cool vapors of material levels." The cells were seen
to be algoids, emanating from plants of a palameloid
"type." There were several species, and in the
"larger ones grew several species of mucidinous
"fungi."

In the immediate neighborhood of the bog from
which the above results were obtained the inhabitant
were frequently subjects of a gum, during the wet and
drying season - the drying season, August and September,
especially -

Professor Saliency, wishing to determine
how high above the ground the bodies found on the
under surface of the suspended glass plates were
erected, ingeniously contrived an apparatus
consisting of an upright glass screen which he
smeared with a concentrated solution of Chloride of
Calcium, and a large funnel in front of the
screen but placed at right-angles to it, so that
the wind cones blow through the funnel to carry any
particles which it conveyed - to be deposited on the screen.
(c) It is gratifying to find that these observations correspond
with the already recorded facts by me that the violence of
during the material poison is greatest at night and early morning.
Exposures.
In this manner was the apparatus employed "suspended at different heights above the low aque levels at all hours of the day and night" when the following facts were ascertained:

1. That Cryptogamic spores and other minute bodies are mainly elevated above the surface during the night. That they rise and are suspended in the cold, damp exhalations from the soil after the sun has set, and that they fall again to the earth soon after the sun rises (1).

2. That in the latitude of Ohio, these bodies seldom rise above from thirty five to sixty feet above the low levels. That in the northern and central portions of the State, they rise from thirty five to forty five feet while in the southern from forty to sixty feet.

3. That at Nashville and Memphis they rise from sixty to one hundred feet or more above the surface.

4. That above the summit plane of cool night exhalations, these bodies do not rise, and therefore do not extend.

5. That the clay air of malarial districts is quite free from these palmelloid spores, and from causes
that produce intermittents.

In prosecuting these researches Professor Salisbury frequently and purposely visited those grounds on which the palmelloid plants were found to exist; on each occasion the dry and constructed feverish feeling of the face and throat already referred to was set up. And other medical men who accompanied him experienced the same sensation. Hence he not unnaturally inferred that the minute cell emanations from these low vegetable organisms are capable of exciting local fevers in the mucous surfaces with which they come in immediate contact, and, further, that there is strong presumptive evidence from what had been previously determined, that by repeated and continued exposure to them they may cause fever of either an intermittent or remittent type.

In places where aque of the worst form prevailed, the aque palmellae were found in the vicinity growing in rich profusion on the humid broken soils. And in these places the aque often ran into fevers of a remitting or continued type. This corroborates most opportunely the view that I have long entertained which I have already expressed that these fevers
namely, the Intermittent, the Remittent and the Continued
fever of malarious districts are essentially one and
the same disease differing in form, severity, accord-
ing to the amount of the malarial poison propagated,
or the degree of constitutional susceptibility of
the individual under its influence.

Among the many varied experiments
performed by Professor Salterbury and the observations
made by him, one of two deserve notice as being
of a most interesting satisfactory nature.

Case 1. In company with a medical friend he
visited a family who lived in a locality previously
empt from aegue. But suddenly a severe form
of tertian attacks the family. The family consists of
a man, his wife, and seven children. But only the
man his wife were attacked.

On making a careful examination into
the place and its surroundings the cause was soon
discovered. A piece of ground hitherto inert has
been recently opened up, the soil excavated. This
soil which was a rich peaty loam with some black
blue clay was found to be covered with "ague plant;"
The gathering of which for examination produces on
the medical gentlemen so engaged "the symptoms of local..."
"fevers as previously described." Another person who accompanied them to the excavation "became so much affected in the throat, fences, things that he had to retire from the place.

As to the diseases affecting only the man this night, while his seven children escaped, it was explained accounted for in this way: the man and his wife slept in a room on the lower floor, while their children slept in a room on the second floor immediately over theirs. The man stated moreover that every morning he noticed that the fog from the excavation grounds extended to the house, and rose about two-thirds the way up the first story, and entered freely his sleeping apartment through the open window, and had the same odour as the soil containing the aqae plants and produced the same febrile symptoms in the throat, fences. He never had noticed this fog to rise as high as the second story window where his children slept. The foggy vapours dissipated soon after sunrise, and before his children were up. He states that he has lived there for more than forty years, and had never had the aqae before; that all his neighbours around, on the same and lower levels, were now suffering from the
disease." This case is of my peculiar interest, as marking out with singular precision the extent and the effect of malarious influence.

Case II. I shall give this case entirely in Dr. Swithin's own words:--"An interesting instance of the readiness with which the emanations from these aque palmella produce the disease, presented itself, the last of September, one mile west of the city of Lancaster. At this point, a few rods south of the pond, and about fifty rods west of Judge Van Tromp's residence, is a small pond, that affords water to a small fluming mill. During the months of August and September, the water became low in this pond, and the aque palmella made their appearance in abundance on the drying peaty mud from which the water had retired. From the time these plants appeared till the last of September, the wind was in the South. There being no buildings on the north side of the pond, there was no appearance of the disease. Near the last of the month, the weather became cool, the wind changed suddenly from the north and northwest. About thirty rods a little southeast of the pond, twenty to thirty feet above
it on the hillside, a strong healthy laboring family resided, who had been up to this time, entirely free from ague. The wind blew over the pond directly towards this house. About the fourth day several members of the family were taken down with the disease. The wind now suddenly changed to the Southeast, blowing across the pond directly towards the tollgate about forty poles distant where a family resided in which were four small children. The family had been up to this time also exempt from the disease. The third or fourth day, two cases of intermittent fever occurred among the children, and soon after the father was attacked.

"Here" continues the matter "is an interesting case of the transmission of the malaria influenced by the winds. These families had lived for nearly two months in the vicinity of an abundant crop of ague palmelly without taking the disease. The pond being small, banks abrupt, and soil around dry, no fogs or night vapors to any extent, emanated from the place to diffuse the poison. What malaria matters
"there were emanating from this point, were borne north by the prevailing wind. As soon, however, as the winds changed, and blew over the pond toward the neighboring abodes, the disease, in a few days, appeared."

Several other cases are recorded of an interesting character, but all bearing upon the discovery of the "aque palmettii" in places where aque raged. This discovery seems to be the uniform result of careful examinations of the soil. Nothing further needs be urged on this particular.

Looking now to the nature of the soil which produced these organisms, the author states that they are "developed in great profusion" on the rich limestone, black, alluvial lands. In these limestone regions "where the water is hard, and the soil highly calcareous" these palmettii are usually of a
pink, brick-red, greenish or yellowish color. In such localities intermittent, are apt to assume a congestive type, the functions of the eliminating organs (epidemic and mucous surfaces thoracic, splenic glands) become much deranged and partially suppressed; acidemic + phosphoric states follow; and in this condition of the system, quinine, iron
and arsenic, alone or combined, do but little good, and, often in seed and bad cases, tends to aggravate the disease, while the "functions of the eliminating organs" are restored to their normal condition, or to increase activity, the tonic and antispasmodic influence of quinine or cinchona is speedily felt.

Where, however, the soil is free from lime and the water is soft the aque palmella develops are mostly white or slightly tinge with yellow and green. Under such influences the disease is altogether of a better marked and milder kind. It spread more readily to the ordinary curative measures, except in cases of long exposure or standing.

The plant seems to be capable of speedy destruction by caustic lime. In one case the author directed some of that substance be sprinkled over an isolated crop discovered in a kitchen garden, which was causing egne in the family. No further cases occurred after the application.

The distinctive appearance and botanical characters of the plant may now be described—

As already noticed, the palmella is, in calcareous soils, of a purple, brick-red, greenish or yellowish
appearance; some have a metallic lead colour by reflected light, a dirty brownish-green by transmitted light, while in soils free from lime the plants are chiefly "white, or slightly tinged with yellow or green."

Professor Salisbury still more minutely describes and draws them thus. He says:

"It may be here remarked that the Palinellas belong to the lowest known vegetable organisms. The special forms of the type causing malarial disease he calls "Gamiasmas (earth mimics)."

"Gamiasmas (Salisbury). Plants having the appearance of cells, each consisting of a thin outside wall enclosing an inside cell filled with minute spores, either single or aggregated, multiply by duplication, segmentation without a parent membrane, and also developed from spores. Colours various, as red, green, yellow, white, phthaleine, &c.

"G. auburn (Salisbury) colour, brick-red, Lewis the soil to appearance of having been sprinkled over with brick-dust. Produces intermittent of a congestive type.

"G. verdans (Salisbury) colour, green.

"G. paludis (Salisbury) colour, greenish yellow, form mostly on non-calcareous soils"
"S. plumon (Salisbury). Colours, plumbon by reflection, and a dark green by transmitted light.
"S. alba (Salisbury) Colours, greenish or yellowish-white.

"In all these species," adds the author, "the mass of the visible dust or incrustation upon the soil, is usually made up of innumerable multitudes of minute spores that have escaped from the plants beneath them. These most minute of all known organic cells are the organisms that are elevated in the night earth's exhalations."

Dr. S. makes several other remarks on this part of the subject which it is not important to dwell upon here.

We come now to consider the plant as manifesting itself in any of its excretions.

Its detection in the gallic or rectors and mucous expectoration from the respiratory passages has been already referred to.

The Urine: — Dr. Salisbury examined under the microscope the urine of "several hundred cases of intermittent and remittent fever." In some cases they were examined before treatment, in others after treatment had commenced. The results of these examinations, in Dr. S.'s own words, are they establish the fact that aque plants, the same as
grown upon the aqueous soil, are constantly developing in the system of the intermittent fever patient; and that the urinary organs constitute an important outlet for the elimination of this fever vegetation.

"That the urinary organs, with the perspiratory apparatus, are the important channels through which nature strives to rid the organism of the exciting cause, and through which the physician's remedies operate by all the medicinal means at his disposal, to eradicate this disease.

"They explain to us the important reason why it is that quinine breaks the continued recurrence of the paroxysm, while it does not eradicate the poison; and why diuretics and diaphoretics and expectorants are such all important aids in eliminating from the system the material cryptogams.

"While quinine braces up the system by its powerful tonic action upon the organizing processes of the epithelial tissue, and through this imparts such toxicity to the nervous system as to enable it to resist the paroxysm, it is well known not to act upon the exciting cause; although it may control for a time their further development, in the same way that it checks the multiplication of yeast plants in fermentation."
D. S. also established the fact by his investigations that in intermittent fever corneous cells are present indicating the presence of glyco-organic matter in the urine. He also found Cholesteroline, which, along with glyco-organic matter, he adds, are to be found in the liver and spleen. Cholesteroline, he says D. S., largely manufactured normally by the spleen, glyco-organic matter, normally by the liver, while the Kidneys never normally organize particles of these bodies, so that in intermittent fever we find the Kidneys taking on a function belonging to the liver and spleen, "indicating perhaps, something like a metastasis of function, and pointing us to these organs for disturbances that are excited by the cryptogamic poison of aqua."

"The aqua plants," writes D. S., "occur in the urine in the form of little cottony flecks, so small that they are hardly noticeable to the unaided eye, and too small in number to communicate turbidity to the excretion."

The amount varies in different cases. The more severe and long-continued the disease, the more abundant they are. "They are very bright in color, highly transparent, and at times take developed in the bladder, pelvis of kidneys, and ureters, often in considerable numbers."

It may be of interest here to note that D. S. found "other plants in aqua cases of long standing", ...
"where the patient had been receiving constant accessions to the disease, by being exposed daily to the exciting causes". These are "yeast plants, species of Penicillium and \textit{aspergillus...}\textit{the mycelia [cellular spawns] after rising to the surface, in short time after the urine is voided, producing fertile threads and fruits." In such cases, Dr. Smith remarks, he has "known the intermittent to merge after some weeks into continued fever of a typhoid kind."

Some further remarks are made on the development of these plants which are interesting in a pathological point of view; but the intent of this paper, which is to embody a concise view of the discovery of the \textit{Palmella} as the aque plant, and which has been already drawn out to a limit much greater than I expected, obliges me to forbear taking any further notice of the matter in the meantime.

The only remaining subject which I shall take notice of here is, the \textit{artificial (so to speak) production of Intermittent fever in places where this disease had never been known to occur.} For this purpose Dr. Salis bury transported some malarious soil "covered completely with the \textit{Palmella...} previously described...to a high hilly district."
"five miles distant from any malarious locality, and
"where a case of ague had never been known to occur.

She there placed the boxes of cryptogams on the sill of
an open second story window, opening into the
sleeping apartment of two young men; removed
the covers and gave directions that the boxes should
not be disturbed, and the window left open.

She suspended a plate of glass over the boxes
on the fourth day, during the night, and found,
on the following morning, the under surface of the
plate covered with the framboidal spores. While, to
a plate suspended in the room, and moistened
with a concentrated solution of Chloride of Lime
she found numerous cells of the same kind adhering.

The Effects on the Young Men:— On the twelfth
day, one of the young men had a well-marked paroxysm
of ague, and on the fourteenth the other suffered likewise.
They both began to feel unnatural; they died about the sixth day.
The type was, in both cases, tertian; the three stages of the
paroxysm well marked, and the disease was readily
controlled by appropriate remedies.

Other members of the family, who slept on the
lower floor of the house escaped.

A similar experiment to the above was
carried out at another place in the same neighborhood. One young man and two boys were exposed in the same way as above described. Of these the two boys were affected one on the tenth, the other on the fourteenth, day of the exposure, while the young man escaped.

The above account is given in as condensed a form as I have been able to employ, where best suited the words and expressions of Dr. himself. It would have added a little more interest and given more conclusiveness to the experiment, had Dr. stated that these young men and boys had not visited a malarious locality at any time and more particularly just before they were made the subjects of experiment. Yet, for all that, I am inclined to place implicit confidence in the integrity of the experiments, and to take for granted that, like a truly scientific tactual observer, he had conscientiously assured himself of the fitness of his subjects for these delicate researches.

In a post note Dr. Salisbury gives the following:

"Another interesting instance of the production of a gum paroxysms by this vegetation occurred since the paper was partially in type. After exhibiting, about the first of November, a large pan of soil, covered with this vege-
station, to the class in one of my lectures, I placed it inside the table in Dr. House's office. It was loosely covered with a newspaper and forgotten.

"In a few days the Doctor began to have pains in the back and limbs. These symptoms were soon followed by a well-marked paroxysm of ague. As soon as this occurred the fan of plants came to mind and was removed."

I shall merely add that these observations experiments and inquiries were carried on by Dr. Salisbury during a period of nearly three years.

On reviewing the above interesting and very practical observations, I am led to the conclusion that this alleged discovery, which bears an air of truthfulness on its face, with proof of numerous advantages not only as of pathological interest, but also of useful practical importance.

I need hardly say that I never saw the plant, perhaps for the simple reason that I never looked for it, and thus because I did not know to do so.

As to the construction of the throat harness that Dr. Salisbury refers to, I recollect of having had
such sensations when travelling at night along the banks of the river; but as the night air was cold, I simply ascribed them to those of "taking a cold".

His conclusions that the plants do not exist in the atmosphere during the day agree with my own observations as to the comparative safety of exposure during the day or night. Exposure during the day, even by a hot sun is comparatively harmless provided the precaution be observed to use an umbrella (as this is not always attended to), and the body be not exposed to a current of air while perspiration is being freely excreted.

These observations & researches of Dr. are of great advantage in guiding & stimulating observers who go to malarious districts.

It remains to be seen whether these curious little "aque palmella" are to be found in the blood, in the tissues and organs as well as in the secretions & excretions of those who have suffered perhaps died from the Malarial Poison. If such be the case that an immense vegetating preserve must be the whole body of an individual fully brought under its effects, drooping from Chronic malarial poisoning.

Ninine seems to have the effect merely
of paralysing the action of the plant. Any agent that will
not only paralyse but completely kill it remains to be
discovered. And now that we are able to isolate it see this
particular element, the day may not be far distant
when such an agent will be brought to light.

In conclusion, I have only humbly
express a hope that this feeble endeavor to write
upon a subject of not a little interest to myself will
meet with some sympathy and indulgence while I,
through it, present myself as a Candidate for the high
privilege and honor of a graduate in Medicine
of the world-renowned University of Edinburgh.

Archibald Dovvng

March 31st 1866.