On Some Recent Suggestions for the Treatment of Pulmonary Consumption

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During the past two years few subjects have been brought more prominently before the medical profession, and, it must be respectfully added, before the lay public than the Treatment of Pulmonary Consumption.

The discovery of the Interale Bacillus by Koch in 1882, and the advances subsequently made in the methods of detecting its presence, have marked an important era in the history of the disease from the pathological point of view, and it is confidently hoped that it would merely an equally important advance in the therapeutic side. The foundation, it has believed, has been laid for asafe and rational mode of Treatment, which, by attacking the cause, Shoned, if not cure, at least alleviates this widespread and fatal malady.
A multitude of remedies with bactericidal properties were experimented upon, both in the laboratory and by the bedside; the result being that the value of a number of drugs that had hitherto been used empirically, has been determined with more or less of accuracy; many have been discarded as useless; others have been shown to be of decided value; while in not a few the title of 'specific' has been claimed, where cases of cure have followed their use.

An immense impetus was given to the study of the treatment of consumption by the discovery also, associated with the name of Professor Koch, and during the past two years many new means of treatment have been tried with more or less successful results.

Pulmonary consumption fills such a prominent place in the category of diseases in this country, and annually claims such a large number of victims.
(It is death, attributed to it being less than 14 per cent of the total number of deaths) that any effort made toward its alleviation or possible cure must be welcomed, and any new means suggested to combat it must receive the most careful trial, until its true position and value in the treatment of the disease be established.

This is the sole 'apologia' I can make for the choice of subject in the following thesis.

To have ventured to describe (I might almost say to enumerate) all the remedies that may fairly be called of recent introduction would be far beyond the scope of this thesis; and I have consequently been obliged to limit myself to a review of four only of such remedies viz.:

1. The antirrhizal salts.
2. The serum of dogs or of goats.
3. Tuberculin.
4. Equine col andlodiform.

Each of these therapeutic agents is still,
and must be for some considerable time, sub judice; and, with an ever-increasing literature on each and all the s. dr. deacons to bring into from the actual state of our knowledge at the present moment from the literature so far published on these agents, being not proof, I venture to think, without value.

I have not ventured to draw final conclusions, nor even to make comparisons with the value of the respective remedies,—neither process being in fact possible at the present time; I have found myself compelled to limit my account of them to a brief statement of the history of and nature of the remedy, and of the claims advanced on its behalf, and to a resume of the clinical results so far obtained.

While it is fully recognised that Pulmonary Disease is, in its widest sense, a constitutional disease, and that no treatment can for a
From the considered satisfaction that does not take the first complex, in view of all its manifest features, both scientists and clinicians recognize the fact that it is ultimately dependent on the growth within the body of the tubercle bacillus, and that in that sense it is a local process.

The indications for its treatment have therefore been two-fold in their character. To place the patient in the most favourable environment, to maintain his nutrition, to avoid anything that shall have a deleterious effect on his “lone” or vital powers — in the broadest sense of the term, that constitutional treatment, on the one hand, has been supplemented on the other by an endeavour to destroy the local process, by attacking directly or indirectly the bacilli themselves.

In the light of recent pathological investigations, it would seem necessary to add yet a third line of attack, viz. an attempt
to neutralise or destroy in the blood and tissues the toxic products of the bacillus, - albuminous bodies to the direct action of which the fever, sweating and disorders of digestion have been recently ascribed.

The endeavour to cut short the growth of the bacillus has largely been centred on the search after some one agent, that, without proving harmful to the host, should directly attack the bacillus and kill it in situ.

An immense number of remedies that in the laboratory have been found to possess the power of killing the tubercle bacillus, have been consequently employed in cases of phthisis. The ling (tightly) speak of them as antiseptics or directly bactericidal remedies. In the majority of cases it has been found that the maximum strength of dilution which the patient can receive without harm is very much less than the minimum strength which is the
Laboratory tests or checks the growth of the bacilli in cultures. But on the other hand many of these agents have been found clinically to possess undoubted value in alleviating the symptoms of the disease, and although they are given to such as to preclude the possibility of the agent coming in contact with the bacilli in sufficient concentration to exert a bactericidal action, avoiding a satisfactory explanation of the beneficial effects noted, such agents remain numinous as valuable adjuncts to the means at our command in the treatment of puerperal fever. In this category must be placed the combination of quinine and iodine as considered in the following pages.

A second method of attacking the growth of the bacilli locally has been by using means to so alter the soil in which the bacilli grow as to render it unfit to further sustain the growth.
Of this group of remedies, which may be called indirectly bactericidal, Koch's Interculin is a prominent example; and the salts of Camphoradin—which, and point out later, claim to act beneficently through a local exudation of serum which forms an insusceptible medium for the growth of the bacilli, must also be included in this category.

Finally it is necessary to add a class (to which indeed belong a very large proportion of the remedies in use), viz., remedies that have been found by experience to modify the downward course which most cases of pulmonary consumption assume on later follow, but whose action is not sufficiently clearly understood to enable them to be placed in either of the other classes. In this group must be placed the serum of dogs or of pork blood.
I.

Catharact. If Polished or Lode.
Note

The small figures refer to the list of references.
These can be found at the end of this chapter.
Cannaridin or Potash

This remedy was advocated in the treatment of pulmonary consumption by Professor Oscar Liebreich of Berlin, sung in 1871. His first communication was to the Berliner Medicinische Gesellschaft on the 25th February 1871.

Nature of the Remedy.
Cannaridin is the active principle of the Spanish fly. It was first described by Rodrigues as a chemically pure crystalline substance, with the formula C_{10} H_{2} O. Liebreich used the Potash salt prepared as follows.

Take 20 centigrammes of Cannaridin, and 40 centigrammes of carbonate of Potash; place them in a vessel containing one litre. Add 20 grammes of water, and warm until a perfectly limpid solution is obtained. Then stir, continuing to warm, add gradually water little by little.
little up to one litre. The solution is then allowed to cool, and enough water again added to make up one litre. Each cubic centimetre of this solution contains two decimilligrammes of the salt.

To prepare the solution (which has been recommended by Lublinski as less painful than the potassic) the same process is followed, save that for 20 centigrammes of camphor, 30 centigrammes of (0·3·0·001) camphor is sufficient.

**Dosage and Mode of Administration**

It is given by hypodermic injection, usually in the back.

The usual dose is from 1 to 2 decimilligrammes (0·0001 to 0·0002 gr.). The maximum dose used by Liebreich was 6 decimilligrammes. Dr. Swain, of Germany, recommends that never more than 1 dram should be given, so as to avoid all risk of urinary trouble; such a dose should be given in two
Successive days, and then an interval of at least one day should be allowed to elapse before the dose is repeated.

Physiological Action

Locally, the effect of the injections is to produce very considerable pain, sufficient in some cases to be called "intense," of a smarting or burning character. The pain lasts usually for not more than a few hours, but lingering (all of these cases, less in number and intense pain) states that in some cases it lasted for from one to two days. The pain varies with the site of the injection according to Dr. Sollem and Dr. Kaplan, and Dr. Helsford. These physicians found that it was least severe when the injections were made into the arm, and least severe when made into the buttocks. Dr. Carter of Liverpool found that a preliminary injection of cocaine to occurance of pain could be avoided. Local redness is occasionally seen, and in some cases slight inflammation.
action in the subcutaneous tissue; but
the occurrence of suppuration has not yet
been recorded by any observer.

The soda salt, as first pointed out by
Rubiniński, is much less painful than
the potassium - an observation confirmed
by the experiences of Denny &
Constitutional, the injection,
according to Liebreich, produces no general
reaction such as is seen after the use of
intermediate. He states that they had
no effect on the temperature, either in
raising it or reducing it; and in this,
he is supported by German.

On the hand, Formaline of Danoë,
Kosmarch, Hering, and Flamme and
Welford all observed a general reaction
with a rise in temperature of from
1° to 2° F. three hours after the injection,
and a fall to the former point from
four to six hours later.
The two last named observers found
that this rise of temperature was vari-
able both in the time of its appearance
and in its degree; and that it appeared
totally closely with the intensity and duration of the pain set up by the injection. It was more often observed in women than in men, and were frequently met with at the commencement of the treatment than afterwards.

On the circulatory system its special effect has been noted, — in particular its depressing effect on the heart has been recorded. Slight headache and giddiness in some cases may denote some minor disturbance, which indeed must be considerable, if the induction of fever attributed by Liebreich to the use of these agents do indeed take place.

No appreciable effect is produced on the pulse (Fenwick and Wellsford).

On the alimentary system. Abdominal pain occasionally follows the injections; and diarrhoea has occurred in a few cases, but ceased of itself (Haydon).

E. J. C. Chalmers 4th, has called attention to the occurrence of pain and vomiting coming on some time after the patient has been under treatment; and he points...
out that cannabinin has been used with success experimentally to produce typical perforating ulcers in the stomach of rabbits and also to set up a severe form of gastritis. This danger would appear to be little more than hypothetical in the human subject, no observers having yet recorded more than slight abdominal pain, but the warning might be worth bearing in mind if a prolonged course of treatment were contemplated.

On the urinary system, the tendency of cannabinin to cause urinary trouble has long been known, and this would appear to form one of the most serious objections to the use of the drug.

All observers have noticed the occurrence of albuminuria in a varying proportion of cases, — Tomalin in 3 out of 5, Her- 3

nig in 6 out of 10, Connel in 1 out of 7, P. Guttmann in 3 out of 7, while Baldin — had only one out of 22. Demarest observed in everyone of his 20 cases, 3

Finnick and Helsford had to abandon the treatment in half their cases (3 out of 16).
An account of the occurrence of albuminuria. Hematuria is a not in frequent result of the injections, but is less common than albuminuria.

Hematuria is a frequent result. Albuminuria was noticed in three cases of phthisis by Forman. Hematuria is an occasional result, but not so frequent as albuminuria. The occurrence of tubercles, lymphatic glands, and epithelial cells noticed by P. Guttman.

All these unusual results have, however, been produced by doses exceeding 1 decimole. Grimming states that when the dose does not exceed this amount, no urinary trouble is ever caused; and that such a dose is sufficient to produce the therapeutic effect of the drug.

Amenorrhea was noticed by P. Guttman in two of his cases.

On the other hand, an increased secretion of urine was observed by Kempe and by Frenkel and Kellogg.
On the Respiratory System.

No appreciable effect is recorded on the character of the respiration. No depression or other unfavourable symptoms appear to follow the injection.

All the cases of which we have records have been cases of pulmonary or laryngeal inflammation, or some other disturbance of the respiratory system. Consequently the effect of the injection on the healthy lung has not been observed in the human subject, or at least such observation does not appear to have been recorded.

The effect on the respiratory system of tubercular patients I have deferred to the section following.

Therapeutic Application in Phthisis

Professor Liebreich, in introducing the drug to the profession, based his observe-ments on the observation that in rabbits which died of the toxic effects of Cantharides, an increased circulation of serum was found to be present from all capillaries,
not only of the kidneys (hence the
urinary troubles that had so frequently
been observed follow the use of the Spanish
day) but also of the lungs and of other
organs.

He further stated that if the capillaries
be already irritated, the stimulation
caused by the drug is increased; and
that this might be shown by the use of a
dose too small to affect healthy capillaries,
but which nevertheless caused stimulation
from those already irritated.

"It may be asked," he wrote, "what
advantage is to be gained by this
stimulation? We know by the works of
Roux how this serum, and not only
that of the dog and rabbit, but also,
according to Klemm and others, of men, also
possesses a bactericidal action. Therefore
conclude that the serum secreted
might exercise on a given point a
direct action in the pathological process."

This action he thinks might be toward:
1. Nourishing the cells, and bringing
back their normal condition.

2. Destroying the bacteria.
nourished cells.

It is therefore to the action of the serum and not to any direct action of the carbohydrate itself that we attribute the results.

As to its value in pulmonary and laryngeal fevers, clinical observers have come to very varying conclusions.

The following is a brief resume of all the clinical records I have been able to obtain from current literature.

The first observers—Hayman, Lantgraf, and Freudenthal—in the discussion that followed Liebreich’s paper, claimed to have observed very distinct improvement in both pulmonary and laryngeal cases, but particularly in the latter. Suggestive improvement was noticed in all the cases. Hayman gave 24 of 27 cases, of which 10 had only then begun the treatment. Of the remaining 17 who had been some time under treatment, 11 had tuberculosis lesions of the lungs, in addition to affections
of the lungs; and in all but one there were bacilli in the sputum. They were all treated at the Poliklinik and made no change in their mode of life.

He found that after three or four injections the voice steadily improved, until hoarseness almost entirely disappeared; that infiltration of the vocal cords began to diminish as soon as the injections were commenced; that ulcers healed.

In the chest, the physical signs cleared up, and in some cases the abnormal signs even disappeared. Hypostasis became less in quantity, more mucous and less purulent. Cough subsided and in four cases ceased altogether. Night sweat diminished and in some cases disappeared. In the case treated fever ceased after the 4th injection, but then recurred once. In lumbal regions the pain diminished. The temperature became lower and pale; the ulcers cleaner and began to heal. In one patient who was almost voiceless, in a few weeks improved, the voice returned.

The presence of bacilli in the sputum was confirmed, and it was found that the disease in the lungs was diminishing as well as in the chest. The patient was improved in every respect.
after nine injections the ulcer had disappeared; after three there was no abnormality in the throat and a scarcely visible infiltration of the left vocal cord, whilst the physical sign in the chest had cleared up.

Similarly encouraging results were also recorded by Frankel.

German also noticed improvement in voice and deglutition, and in laryngeal appearances in laryngeal cases, and went so far as to say that "no other remedy produces so rapid a diminution of the tuberculous process in the larynx." That while he is loud in its praise in laryngeal tuberculosis, he has to confess that in pulmonary lesions he could find no change in the tubercular process in the lungs.

Professor L. T. Thomas, on the other hand, found distinct improvement in six cases of pulmonary consumption, all late or less severe cases. He found that the cough decreased in four out of the six cases, his opinion as
first increasing and afterwards (in 5 days or 10) diminishing. In 10 to 40 days from this point, the spleen subsequently ceased altogether, a day or two only remaining while weight, strength and fever disappeared. Appetite improved, sleep became regular and weight increased 5 and 2 lbs. respectively in a fortnight.

In these two physical signs improved; but of the remaining four, in three they showed no improvement, and in one they grew worse. These lacerated symptoms were present then improved.

He concludes that the treatment in the whole is beneficial, and deserves further trial, its advantage being these:

(a) The composition of the remedy is known.
(b) It can be prepared by every body.
(c) It admits of accurate dosage.
(d) It gives rise to no serious complications.
(e) It can be safely applied to women in pregnancy.

He suggests that Cantharadin might be replaced by powdered cockroaches (Multa).
(Organics) which are comparatively less in the nervous system, while exercising a decidedly stimulating influence on
the heart.

During the past month Demme has published the results of 30 cases treated by carbonic acid. Ten of these had not
been sufficiently long under treatment to justify any conclusions. Of the remaining 20 the results were favorable,
particularly in laryngeal cases. He claims that 20
ingermany, that results
are obtained by this treatment more surely
than by any other method.
The effects on the larynx he found to be slight,
but irritation became sooner. Laryngeal
cases were greatly improved, and two he
stated the "certainly cured." In other cases,
temporary improvement alternated with relapse.

Salt, fluid and sublimates had favorable
results, but no cases of cure.

There is thus a fair body of evidence
which, taken alone, would establish a
strong case in favor of this method of
treatment; but on the other hand there are a large number of observers who have been far less fortunate in their results, and it is necessary now to consider their evidence.

Professor Combe found that in none of his seven cases was there any improvement whatever in the languid symptoms; and that the general symptoms were also unaffected by the treatment.

He sums up to this effect that, on the whole, the beneficial action of camphoramide does not seem to have been proved, either in languid or in febrile cases in treatment.

Dr. Forman of Durham reported five cases, three of which were febrile.

Of these three, in two there were no appreciable results; while in the third the injections produced a general and local reaction, the development of a new zone of dulness and increase of sputum.

S. Gullermann has equally unfavorable results; and in one an eminent Dr. Carter of Liverpool found that 700 cim.
Improvement occurred beyond what might necessarily be expected from the ordinary care and treatment in hospital.

Dr. Solomon Fenwick and Welton used the drug in fifteen cases; the pulmonary disease was incipient in two, very chronic in three, and active in eleven.

With regard to its effect on symptoms, they found that in three cases, slight to marked improvement; whilst in the other 13 no change could be detected.

In 8 cases, loss of weight was recorded during the course of the treatment; in 3 a slight increase took place, while in 3 the weight remained unchanged. In 7 cases the Cough slightly increased, apparently in consequence of the treatment; in 5 it somewhat improved; whilst in the remaining 4 no obvious difference could be detected.

An initial increase of temperature in almost invulnerable, and in nearly all it became at the same time somewhat dry, hacking, and frothy, while the patient stated that the phlegm was froth and 1
more firmly than before. But the ultimate results were not satisfactory. At the cancellation of the treatment, it was found that in 8 cases the expectation had permanently increased, in 3 there was a slight decrease, and in 3 no change.

With regard to physical signs, they found that "in 11 cases the disease apparently progressed uninfluenced by the treatment, new foci of disease appearing in hitherto healthy districts," while the x-rays showed that the previously consolidated tissue tended to break down in the ordinary way. In three chronic cases the physical signs remained unaltered. There is one point however which is deserving of some notice. In many cases, where the expectoration became purulent, most expectoration appeared at the bases of the lungs and in the region of the larger bronchi, while in 3 cases a distinct attack of subacute bronchitis became super-added to the tuberculous disease, a phenomenon which subsided...
within a few days after reinstituting the treatment."

The bacilli have been found to be unaffected by the treatment in number and appearance. Isocarbo thought that he noticed a slight diminution in their number, but this is unsupposed by other observers. He also found that they seemed to have lost their ordinary reaction to colouring agents, but Paul Flammann found no difference in this respect.

The balance of evidence would thus appear to be rather against the value of Camphor-Bismuth salts in the treatment of pulmonary phthisis, that is, it is not easy to find any improvement that has been recorded has been almost entirely subjective. On this point Janvier and Welphord write as follows:

"In the majority of the cases recorded, such symptoms as appetite, sleep,
cough and even night sweats were considerably improved by the use of Can.

Tharidinal of potash, and in our own cases the accounts given by the patients themselves were always of the same encouraging, though they talked it with the steady advance in physical signs. They proceed to give examples of the "true effect of hope"; in four cases, where plain water was substituted for the salt solution, the subjective symp.

tom nevertheless steadily continued to improve. Their final conclusions are as follows:

1. That Cantharidinal of potash is absolutely useless in producing any obvious beneficial effect in febrile

malign interstitials.

2. That in doses exceeding 0.2 mg. it is apt to induce albuminuria, with pain in the loin, strangury, and even hematuria.

3. That for the latter it should in no case be used without the most careful

and supervision, and that it is there-
We will adopt for our patients practice.
Thus differing into cures in the
very point visited only Professor
Quinn of Harvard.

Doubtless has been thrown on the
pathological explanation, pain by theories
of the action of the drug.

J. C. Even experiments on several
pairs of rabbits. In all the rabbits
he caused a inflammation of the
ear by means of injections with Carcinum
om. by immersion in hot water (53°C.)
In one of each pair of rabbits he in-
jected from 2 to 4 decinmals strengths
of Carcinum; inflammation set in.

With a daily dose of even 4 mg he
always found diminution of the inflammation
in the ear; in no case did he find
that there was acute inflammation in the
injured ear than in the control animal.
He hence concluded that the richness
hypothesis that severe inflammation
more readily provoked in irritated than
in healthy capillaries unimportant.
be found no severe inflammation in the lungs of animals that died from the effects of crotal venom.

This last observation is, however, quite exceptional, and stands alone against a large body of evidence on the other side. Lichstein quoted Comin, Heuschoff, Angericht, and Hanemann, who all found that "not only in the kidneys but also in the lungs, while there was an inflammatory lesion, there was by the sides of the capillaries a peculiar process, a sort of serous precipitation, secretion, which is met with also in the renal glomeruli. That is why these animals die of suffocation, even when artificial respiration is practiced."

Comin found this serous secretion in the vessels of the kidney, lungs, trachea, membranes of the whole bronchial tract ("carte aérien") of the intestine, and in the serous membranes of the cranial and peritoneal cavities.

The clinical evidence of the occurrence of this secretion is not so strong.
as the experimental evidence; but
that such an effect is produced finds
some support in the fact, noticed by
the opponents, as well as the advocates of
the treatment—that the secretion constantly
becomes more offensive.
In certain cases still stronger evidence
is forthcoming. Comiex in one case
which ended fatally a week after the
treatment was begun, formed adhesions,
swellings around the tuberculous foci
in the lung and at the base of the tongue;
and even sees a hypothetical danger in
the possibility of the serum thus forced
out into the tissue, not finding an outlet
and causing local swellings and oedema
with disastrous results.

Germnay also noticed induration round
the tuberculous foci in the lung, but it
was quickly reabsorbed.

Hawerkos observed in one case a similar
course induration in the lung, when
the patient coughed he brought up serum
fluid.
II.

The Injection of Serum
A. Of Dof.
B. Of Goats.
Treatment by the injection of the serum of an animal's blood.

In 1888 M. M. Hénoncourt and Ch. Richet presented to the Académie des Sciences the results of certain experiments they had made on the effects of injecting the blood of a dog into the peritoneum of a rabbit in health and disease. These observers found that if the blood were injected directly into the veins, the result was invariably fatal; but if it was transfused into the peritoneal cavity, no evil result followed. They found that from 50 to 500 grammes could be safely borne; 70 gr. being the maximum.

The effects produced were intense polyuria, polydipsia, and lowering of the temperature by 2°C. They then found that if 36 hours later a culture of Staphylococcus pyogenes (a micro-organism which produces leukocytosis, edema,...
with invariably fatal results in death, were injected, scarcely any ill effect followed, beyond slight edema, and the animals remained alive. The transfusion of dog's serum had conferred immunity to the rabbit to the action of this particular micro-organism.

They were then led to try its effects on the development of tuberculosis in the rabbit, more particularly as cases of spontaneous tuberculosis in the dog are exceedingly rare. It has been stated that such cases are unknown, but this seems not to appear to be the case. At the "Congrès pour l'étude de la Tuberculose" held last summer in Paris, a case of spontaneous tuberculosis in the dog as recorded by M. Dr. Chaumontesse and L. Dautre; while M. Thomaszen of Utrecht related three cases that he had observed in that town alone. It seems consequently appear that though tuberculosis is rare in the dog, it is by no means unknown; that in this breed, the dog is not absolutely insusceptible.
The tubercular series

M. Richet inoculated six healthy rabbits with the bacillus of tuberculosis, giving each the same dose. Of these six he injected intraperitoneally a certain quantity of dog's blood in two; in a third he injected a decoction of a dog's liver, keeping the remaining three as control animals. Those which had received the injection of dog's blood remained quite well, and showed no signs of tuberculous infection at the period of the report, 93 days after the injection. The animal that had received the decoction of liver showed signs of tuberculous infection but was not nearly so ill as the control animals. The three control animals were all infected and two of them were extremely ill, and the third was also.

The three protected rabbits had gained an aggregate of 1260 lbs. in weight; while the three unprotected had lost 1460 lbs.

The experimenters then turned their attention to the effect of the blood of tênure of a dog already infected with tuberculosces. They made a large number of experiments.
of which the following is a sample. 5
of six rabbits previously infected with
Tuberculesis, three received intravenous
injections of serum from a healthy
Tuberculous dog. Twelve days later two of the
unprotected animals were dead, and
the third had lost 22% in weight;
while of the three protected one had
gained 8%., one 170 and one had
lost 170 in weight.
The following are the conclusions arrived
at by M. Ricet and Sericourt as a
result of their experiments: 6
1. When the Tuberculous is very virulent
the injection of dog's blood retards
its evolution, without going so far as to
arrest it.
2. When the Tuberculous is moderately
virulent, the injection of the blood not
only retards but arrests the evolution.
3. It is in the serum that are found
the substances which cause this
action, and a very small dose suff.
1 per cent. (1/20 c.c. of serum per kilo. of rabbit)
4. The blood (or serum) of Tuberculous
drops is more efficacious than the blood (or serum) of normal drops.

5. The action of "tuberculous hemoglobin" (serum of a tuberculous dog) if given in large single doses and after tuberculous inoculation, accelerates the march of the tuberculous.

6. The action of normal hemoglobin in large quantities when the injection is made after the tuberculous inoculation.

It is necessary to try in the human subject. The purely local action of hemoglobin (and certainly of tuberculous hemoglobin), an action which appears to be more powerful than its therapeutical action.

It cannot escape notice that the clinical practice has been very far from fulfilling the conditions that these conclusions would imply. To all the records which we shall consider later, the serum was taken from a healthy, and not from a tuberculous dog; it was used not as a prophylactic but as a therapeutic agent.
With these preliminary remarks, we proceed to consider first the use of
the serum of dogs' blood, and secondly
the serum of foals' blood.

A. The serum of dogs' blood.

Nature and preparation of the remedy.
It consists of the pure serum of a
dog's blood; it is a clear fluid, more or
less coloured by haemoglobin. It is prepared
as follows.
The blood is taken aseptically from a
strong healthy dog, and received into
vessels, which have been carefully sterilised
and are then closed with cotton wool.
The serum is allowed to separate, and
on the following day it is drawn by
suction into small glass tubes, each
containing 3 c.c., which have also been
sterilised. These are then closed at
each end by boiling in a few buns.
The tubes are kept at 38°C for 48
hours to test their purity. If no change
occurs in them at the end of that period
The serum is considered pure and free from contamination.
It may be added here that from a single drop enough serum may be obtained for 60 or so tubes.

Dose and mode of administration.

It is injected subcutaneously into the tissues of the limbs or of the trunk.

S. Borelli recommends that 1 cc. of the serum be injected every 2 days, with strict aseptic precautions, by means of a Prouve syringe.

It has been given by the mouth, but the effects are much greater when it is injected subcutaneously.

Rectal injection was found to be quite useless in rabbits.

Mr. St. Hilaine advocated intra-tracheal injection. He and Dr. Comput proved that in rabbits 4 cc. could be injected in 2 minutes without causing the least respiratory trouble, and no cough. Their experiments on dogs were equally successful. In some they found their injection
quite harmless. At six different trials
they injected into the back of a man
aged 22 $00$ of leucium and with an
accident. They injected it by means
of a puncture through the integuments into
the anterior part of the back, with a
Poupart syringe,
defining however, questionable the value of
this method of injection.

Action and Therapeutic Application
in Phthisis.

The temperature is as a rule slightly
raised after each injection. A peculiar
local swelling sometimes appears, which
is accompanied by redness, sometimes
by pain, and even by slight fever, but
without suppuration. (M. Fournier
had one case of suppuration, but the
serum used was not above suspicion
as to its purity).

Unfavorable effects are occasionally
seen, - urticaria being the commonest.
M. Berel Lavallée - mentions a case
of urticaria and another of nausea.
implicity, in both of which auricaria appeared, "with purpura, palpitation, dyspnea, and hematuria."

Beyond this there are no records of any adverse results; indeed all observers are agreed that in treatment patients either no effects at all, or a beneficial effect is produced. According to Dr. Rees to one third of the cases the results were imperfect, while in two thirds they were beneficial. He found that, in cases in the first stage of pulmonary consumption, the appetite was recovered, strength and power of movement returned, and the weight gradually increased. "As a rule," he says, "after a few injections the patient sleeps better, the digestive functions become more regular; in some cases we find that coughing, expectoration, swolyness, hemoptysis are diminished. Lastly in a number of cases there has been a local improvement of the anatomical changes in the lungs, the lungs, the skin.
cases, suppuration, etc. The favorable modifications were well maintained in several patients. These patients were in the first stage or at most in the beginning of the second stage of the tuberculous condition. Unfortunately in most of the other cases the wonderful effects of the first days were not durable, and the tuberculous condition has only been delayed for a few months."

This was a summary of his observation of a large number of French observers, as well as his own, by Berell, himself, on patients at the Paris Hotel Dieu, in Prof. Veneri's department. Dr. Veneri's results in 53 cases, in a communication to the "Comité pour l'Étude de la Tuberculose" held in Paris last summer. He divided his cases into two groups:

1. Cases of Intestinal Tuberculosis of the 3rd degree, in which the lesion was not beneficial action.

2. Cases of Pulmonary Tuberculosis of the 2nd degree, lesions of the face, and
advanced caseous tuberculosis. In these there was an appreciable amount, which he ascribed mostly to the restoration of the digestive functions. He was able to demonstrate on many occasions diminution of casei in the sputa.

He could now claim to have cured cases in the early stages of pulmonary involvement, whether the case was of their tuberculosis origin (the tuberculous bacilli) or not. The following are notes of four cases, presented to the Société de Théologie, on January 26th, 1891.

1. M. W. Man, 50. Prescribed by Dr. Keir. Court. Condition before the treatment as follows. Dullness was left lung, especially at the apex, dulness and subcostal and subcostal dullness from apex to base with a region of coarse rales, under the clavicle.

On the right side there was some dulness on percussion under the clavicle; inspiration produced, and some distant crackling under the clavicle. Pleural friction at the angle of the Scapula.
Spotted yellow. Chest, pneumonitis, containing many bacilli.
Diagnosis: pulmonary tuberculosis of 2nd degree, in form of cases lungo pneumonitis cariee in course of formation at both apices, were advanced on left side.
First injection given Dec. 6th 1 cc. 0.5% somatone.
He had injections at intervals of from 3 to 2 days of 2 cc. increasing up to 4 cc.
By Jan. 24th (50th day) his weight had increased from 55 kilogrammes to 59 kil. 570.
Cough had nearly ceased. Night sweat had ceased. Perspiration—only some transparent macchie in the morning. Locally fine ripples and some expectorations in upper pole on left side; the ripples on the right had disappeared. The appetites had returned. Bacilli still found in the sputa but it was furnished to appear that the process was arrested.

2nd M. V. Man. 41. Present by Mr. Campell.
Intermittent of 12 months standing. Very much existent. Abundant mucous purulent expectoration, right: 35ths. and right rise of temperature. Voice
horse, could only sustain a conversation for a few minutes. Dullness and "finghip" under clavicle and signs of Carotid on left side. On right course limited nodule and cracklings, with impairment of voice.

Weight 76 kilos. Under ordinary treatment he got worse.

First injection December 16th. 1 c.c. of Bromide.

And so injections between that and 2nd January. Then (70th day) general state much ameliorated; voice clearer. On right side still some cutaneous nodes and some cracklings at apex. On left singing almost disappeared; a Cavernosus blowing perceived; dulness less in certain points. Appetite (which had fine) quite returned, and "he ate more than before his illness." Weight 93 kilos, increasing 1 kilo. in ten days.


night. Arreti, severe attacks of couple. Euph considerably affected. Limps.
right, dulness complete for clavicle to 2 fingers. Breaths above mammary, and
behind to 1cm. above angle of scapula. Careg.

No audible breathing, in the upper part of lung.
no left raunsonment of voice in 2 parts in bed.

Spares, respiration, mouth breathing: inspiration
just strangled. Some cut crepitation of voice.

He had injections every 3-4 hours, in decors
from 1cc. to 2 with to 3cc.

On other much worse, close of arsenic.

My 28th. January his strength was greater.

The right. Arreti had disappeared. Weight
(60kg, 570) increased by 3 kilos in 19 days.
Deflection no longer painful. Couple
and protrusion unaltered.

Lungs had much improved, but the
lungs show no alteration.

H. Caversal, From. Oct. 52. Presented by Mr.

Saint Hilare. Pulmonary and long apert.

Very ill indeed. The least upset, and least
change of temper caused violent couple.

Very infected. Couple prevented sleep. Affection


Liver and spleen. Auscultation: Cardiac sounds heard. Many basal in lung.

Weight 52 kilos.

From the 5th to the 23rd January he had 8 injections of 1.52 cc.

At that date (29th January) the tongue had improved considerably. Cough did not disappear. Bowels regular. Respiration did not lessen. But became thinner. No bed, much stronger; could mount 3 flights of stairs without stop.

Appetite better.

Physical signs: Same as before, but worse.

Lungs on left side less numerous.

Weight 54 kilos—an increase of 2 kilos.

These results would seem to justify the favorable verdict given by Dr. DeClerck at Thimmechs last summer.
As regards the way in which these beneficial effects are produced, it is not claimed that the serum of dog's blood has a specific action on the tuberculous process. "It seems to act as a powerful tonic, and indirectly by improving the general condition puts the patient in a better condition to overcome his terrible disease.

This view of its action is very distinctly borne out by two cases reported from Professor Fournier's clinique in the Hôpital St. Louis in Paris. One was a case of malignant syphilis of ulcerating type, which necessarily relapsed under ordinary treatment. Weekly injections of karnosyne (all other treatment being suspended) the ulcer healed. In the second case, one of relapsing pneumonia with ulcerating syphilis - the result was the same. Improvement in general condition and pain in weight points to the tonic action of the karnosyne.

Dr. Fournier of Paris reports a case of tubercular meningitis in a
Child, in whom operation and looking round the abdomen had no effect in stopping the course of the disease; but under treatment by bromide of sodium, all the symptoms ceased and the child completely recovers.

M. Pluot found the effect to be beneficial in two incarcerous children (who nevertheless died) that he determined gave it in all mới born children that weighed less than 2 kilograms.

He reports its use in 7 such children with the most satisfactory results.

M. Jourdain reported ten cases in Médicins Cliniques, 6 women and 4 men, - two of them never cases of phthisis. All showed improvement and gain in weight.

These cases appear to support the proposition that the action is not specific.

A possible explanation of its action has been advanced by M. Romanus of Turin: viz.

He finds fluorine in bromine, in the form of fluorides of cobalt, 20 cc. to 1,000 gr. of blood. He suggests that this is the beneficial action of the bromine, may be done.
73. The serum of foal's blood.

Nature and preparation of the serum. 15
A foal in perfect health being chosen, a cannula is inserted into the jugular vein, and the outflowing blood is caught in a vessel half immersed in cold water. The blood is defibrinated, filtered through sterilised muslin, and then put into "bricks" attached to the circumference of a disc, which is made by steam power to revolve at the rate of 1000 revolutions per minute. This is continued for 40 minutes, by which time the separation of corpuscles is complete. The serum is then transferred to a sterilised vessel provided with an inlet and outlet tube, running from the bottom, and closed at the top with cotton-wool.

The same foal may be used many times, it may be bled four times in ten days, and at the extent of 400 cc. each time. After the third bleeding it is desirable to inject an equivalent amount of saline solution.
Use and mode of administration.

Originally Dr. Cépines injected the
serum subcutaneously, and found that
the maximum amount that could be injected
during almost inconvenience was 8 c.c. He
then introduced the injections preferably
under the skin of the abdomen, he used a very
fine needle and a Plunger syringe, which
was adapted to some tube of Caroteline
about one metre long, being in a recipient
of flask, held 50 centimetres above the
abdomen. In this way the introduction
of serum was very slow, and the subcutaneous
"bulla" very slight.

Prepar Klém and Rieh of Cantor 16
injected into the subcutaneous region, in doses
of 15 g.p. at an interval of between
the injections being a fortnight.

M. Cépines however later found
that subcutaneous injection caused
too large a surface to become painful,
and that therefore it was impossible to
repeat the injections frequently.

When the intramuscular and subcutaneous injections
were employed, they could be repeated...
every two or three days, 50 or 100 c.c. being given each time.

The arm is chosen for the injections; it is carefully disinfected and tied as for phlebotomy; a prominent vein is selected, and a fine silver cannula, armed with a bevel, is inserted. It is inserted for 1/2 centimetre into the vein, - of course towards the heart. The cannula is depressed for a moment so as to fill with blood, and the index finger (which connects the cannula with the vessel containing the serum) is allowed to fill with serum before lifting it out of the cannula.

About 100 c.c. are allowed to flow slowly into the vein; if any discomfort is experienced by the patient, the flow can be instantly stopped or regulated by turning the apparatus. The vessel containing the serum is suspended above the arm at a height of considerably less than a metre.
Action and Therapeutic Application

* Phthisis *

Locally, the injection causes no trouble. Berlin and Pfeif have two cases in which intracutaneous injections caused suppuration.

In a fatal case it was found on autopsy dissection at the site of injection that there was no trace of the injected blood either in the subcutaneous connective tissue, or in the adjacent muscle, thus proving that the whole of it had been absorbed.

The 22 cases, the results of which were published by Berlin and Pfeif, included 17 cases of internal tuberculosis, in one case complicated with lupus of the face. In 11 of these cases (55% per cent) marked improvement followed the injections. Temperature fell; night sweats and expectoration ceased or diminished to a marked degree; physical signs cleared up; appetite was recovered and weight was gained.

In the cases complicated with lupus, the
的进步非常之大，但就治疗肺结核病情而言，一切仍难言乐观。少数患者康复，但就其中的多数，病情在治疗开始前已十分严重。

一些案例由R. Caprotti报告，病情有所改善，但注射后数日体温未见异常，除了注射部位发红。D. Reffye报告了数例成功案例，但未提及治疗结果。

M. Benjamin在Société de Thérapeutique（13th June 1871）中报告了其治疗经验，未发现任何危险。数例病例在注射后病症有所改善，但未提及被治愈。他建议将此方法与其它传染病如伤寒、鼠疫、风水等疾病治疗。

从现有临床记录来看，根据所有已知数据，从现有记录来看，
opinion as to the value of goat's serum in pulmonary phthisis.

It has been stated that the goat is an animal that never suffers from spontaneous tuberculosis.

Dr. Berlin, at the Congress in Paris last summer, stated that in the normal condition of its resistance the goat was absolutely immune to spontaneous tuberculosis, and that in his opinion its blood contains "a substance having a vacciniferous property."

Dr. Benke also approved the same thing; he based his statement on the fact that he had made 48 autopsies on goats and had never found tuberculous lesions.

Mr. Beard and Mr. Cartier, both veterinarians of high standing and long experience, had also never seen a spontaneous case. The evidence of the goat's susceptibility to the artificial inoculation of tuberculosis is convincing. Dr. Benke also tried unsuccessfully to inoculate the disease, but Dr. E. C. Ellis had succeeded in one case.
The proposition of Mr. Bertini that fresh blood contain some special "vacuinsiferous" substance is not borne out by the fact that the blood of steers (tried by Mr. Bertini and Prig) and the serum of sheep (tried by Professor D'Alberti) had equally beneficial effects.
Koch's Intercalera.
Tuberculosis.

It is not without great hesitation that I have ventured on giving any account, however brief, of what has been universally known, for nearly two years, as Koch's Tuberculosis and its use in Pulmonary Consumption.

So much has been written on the subject, such a cataract of literature has inundated the medical press, and even the lay press (if it be not hyperbolic to say the press literature to hunt of the communication that appeared in The Tablet) that it would be a disservice to this document to require some review for its justification.

My claim to this justification is perhaps little, for that in writing of recent methods of treating pulmonary tuberculosis, it was scarcely possible to leave out the most important - from the scientific point of view - that has yet been introduced. That I do not here add any matter that can in any sense be called controversial. I have endeavored to select from the
Considering most of communication bearing on the subject partly which appears to have been established beyond dispute, and they rise so clearly before the reader as follows.

I proceed to treat of the remedy in the same method and under the same headings as the previously discussed.

I must add here that I have not ventured to give even a brief outline of the principal oppressors in its therapeutic value in pulmonary consumption; as I have been unable to do with the other remedies. Such a colossal undertaking is practically impossible; and, had it been possible, none in all probability prove to be in vain, if the results anticipated by Dr. Hunter for his modifications of the original fluid should be borne out by further experience. Should that prove to be the case, clinical opinions as to the value of the original lake water and Kech will have no meaning but an historical value.
Nature and preparation of the remedy.

Tuberculin (i.e. the fluid prepared by Koch, and not the active principle alone) is a concentrated glycemic extract of tubercle bacilli, containing all the substances developed from the bodies of the bacilli, by the action of a 4 to 5% solution of glycine, together with the chemical products formed by the action of the bacilli during their life. It is prepared as follows. An infusion of yeast is prepared in the ordinary way, and made weakly alkaline; to this are added 1% of glycine and 4 to 5% of glycemic sugar. 20° to 30° C. of this mixture are placed in a flat bottomed Schlenkner flask, and is inoculated with a small scale of a seed culture of tubercle bacilli, the scale being allowed to float on the surface of the fluid; the culture is then incubated at 38° C. In a week or two the bacilli grow into a thick, dry, white crust; after 5 or 6 weeks they become moist and sink. The cultures used for injection are kept for 6 or 8 weeks, and must be absolutely
pures cultures. At the end of that time they are evaporated over a water bath to a tenth the original bulk, and then kept for an hour at a temperature of 100° C., so as to completely kill the bacilli. The fluid is then filtered by pressure through a silicea or clay filter. The dead bacilli being thus removed, the fluid contains 30 to 50 per cent.

It is a clear, clear, coloured, transparent fluid, of specific gravity 1.150.

For the further analysis of the fluid we are indebted to Dr. William H. Parish, whose investigations have been considerably further than those of Rokitansky -- which is known from the latter's published communications.

The results of Parish's analyses are in brief as follows. The fluid contains:

1. Albumoses, 91 parts of which is nutritive albumose; some denatured albumose; occasionally a trace of dypalbumose; and a body that is partially heteralbumose with a trace of dypalbumose adhering to it.

2. Alkaloidal substances, two of
which can be obtained from in the form of
its platinum compound. Their hydrochloride
salts.

3. Atractyl, small in quantity, and
of unrecognized nature.
4. Phere.
5. Sugarine.
It does not contain serum albumin, &c.

Dose and Route of Administration.

It is given by hypodermic injection
usually in the dorsal region between the
shoulders. Dr. Heron stated that after a time
a sort of local tolerance is established, and
that if the site of the injection were changed
an increased effect was obtained. It seems
therefore best to inject the
fluid always at the same spot.

An ordinary flowing syringe is usually
employed. Various modifications of this syringe
have been introduced, of which one invented
by Dr. Strakelein (and fully described by S.}

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guarantor in the British Medical Journal of Feb. 7th 1871) seems to present some un-
just advantages, particularly as the time with which it can be kept clean.

The dose is an increasing one, as each succeeding dose produces less of the character-
istic reaction. As susceptibility to the action varies, the maximum extent, even in people apparently in the same stage of tubercular disease, it is generally agreed that the first dose should be a small one, not exceeding one
milligramme, or (as is generally stated) one hundredth of the fluid; as a
matter of fact, 100 c.c. weights slightly more than 1 milligramme (Dr. Henry Campbell, Bsc.
Birmingham, in the British Medical Journal, Jan. 10, 1871.)

The fluid is generally used in a 1 per cent solution with distilled water, of which con-
teguously one c.c. would be the amount for a
first dose.
Effects of the Injections

Locally a certain amount of pain is caused by the injection, some from that part of the skin became indurated to the pain, but that in some cases it relieved in from 3 to 72 hours, beginning at the beginning of the reaction. As a rule the pain is of slight character, but it may be very great.

Some slight redness and swelling may occur at the site of the injection. Suppuration is of very rare occurrence.

Professor Salmeure of Copenhagen says skin at the pain caused, which may be considerate.

Constitutionally the Interferin produces on the healthy subject a well defined group of symptoms, which were first brought in his original communication as follows:

"Three to four hours after the injections there came on pain in the limbs, fatigue, in.

eciation to breath, difficulty in breathing which quickly increased, in the fifth hour a hemmorhoidal violent attack of pain followed, which lasted almost an
hour, at the same time there was sickness vomiting, and rise of body temperature up to 39.6°C. After twenty hours all these symptoms abated.

Briefly remarking that the febrile disturbance varies with the dose, that all patients, even with well developed tuberculosis disease, do not react, and that occasionally a fall instead of a rise of temperature is observed (Adamsen and Venner and others), I proceed to give in detail the action of the drug on the various systems.

The circulatory system. The heart's action is quickened, the pulse becomes soft, delicate and irregular. The diastole bears a close though not always an invariable relation to the rise in temperature (S. Sinclair Crichton). The pulse becomes very compressible.

So powerful has the depressing action of the drug been in many cases that collapse has frequently and death has been arrested by the free use of stimulants. The pulse has even failed completely, and
and the patient passed into a state of
prolonged syncope; while more than
once death has appeared to result from
this cause.

The rise in pulse rate, while proportionate
to the rise in temperature after the first injection,
would appear not to be so great as subsequent
injections. Sir Walter Frohse attributes
this to the effect of the tachycardia in
increasing the vascular time, slowing the
pulse, and increasing the degree of vascular
tension. On this point Dr. Robertson
of Ventnor pointed out that its effect
on the pulse was much more quickly like that
of digitalis.

A case of heart disease following the
use of the injection was attributed to
them by Dr. Hardman (Hospital St.
Louis, Paris) — in short periods it is
not stated.

The effect on the blood appears to
be chiefly marked by a diminution in the
amount of hemoglobin. This effect
was noted by S.A.T. Archibald and
the Pennsylvania Commission on Tuberculosis.
The latter observers found that it was diminished by 10 per cent on an average. On the other hand B. Hébrard found that in 13 out of 22 cases there was an increase in the amount of leucocytosis, while in 3 there was decrease at first, followed by an increase, in 3 there was no change, and in 3 there was an increase of from 10 to 14 per cent.

It has been stated and is implicitly denied that tubercle bacilli appear in the blood after the injection. The importance of this question is obvious, and space does not admit its full discussion here. Doctor Victor Hektor of Crick, to first drew attention to the subject (Berliner Klinische Wochenschrift, Jan 24, 1891), and states that he found bacilli being demonstrable in the blood after one or more injections. On the other hand P Guttmann and Schlich failed to find their presence in 28 patients, whose blood they carefully examined (British Medical Journal Feb. 7, 1891, p. 313).

A study of the blood in crystalline form after it is withdrawn from the body has never been made, except of hemoglobin appearing in the capillaries, and in the lemm...
The Respiratory System

The chief symptom produced on the respiratory system is an acceleration of; and sometimes a difficulty in breathing. The dyspnoea is not often great. Cough is increased at first, and the amount of expectoration is generally much increased at first, whatever may be the ultimate effect. Undoubtedly, in favourable cases, the cough and the expectoration diminish, but as this borders closely on the aspect of the question that I have declined to discuss, viz. the Therapeutic Value of the queue — I must limit myself to this statement.

The same remark applies to the very question of the effect on the bacilli. Many observers have noticed an increase at first in the number of bacilli, which might be expected to occur with an increase in the amount of expectoration. In the subsequent effects on the bacilli observations differ widely. In favourable cases they have undoubtedly disappeared
at least decreased in number; since
many observers have observed a change
in them; that they sometimes become
stunted, smaller and thinner as if
starved; sometimes broken up or apparently
partially disintegrated (Fraenkel,
Livy, Jolles, Mantzka, Sherrill and
others). On this point the remark of
Mantzka, Sherrill is worth noting, that
"all these variations may be met with
apart from any special treatment,
and often without any definite sign
ificance." (Lect. Section of Therapeutics
at meeting of Brit. Med. Association
Nottingham, July 1871).

Occasional results noticed
are quite fatal and heemophilic, the
former seems rare, and the other rather
in children than in adults (F. B. W.
Phillips 1st).

The occurrence of haemophilid is of
much greater importance, and has
been constantly referred to in the dis-
cussion on the therapeutic value of
interlectin.
The Cardiac System

Nausea and vomiting are such frequent accompaniments, as to be almost considered normal effects of the injections. Jaundice has been observed to a very occasional to follow the injections, varying in degree from a slight icteric discolouration of the skin to a well-marked condition of jaundice.

Dr. Cavallers, in my opinion, that changes were produced in the liver by the use of mercuric chloride, similar to those observed in acute infective diseases.

Diabetes has frequently been seen, often severe during the period of reaction, especially in children.

In one case (case 11, Table 11.6) a diabetes was "sudden" and accompanied by total collapse after a dose of 2 milligrammes. The case however was one of advanced phthisis
The Nervous System

The occurrence of pain at the site of the injections has been referred to before. When the reaction begins there is always acute aching pain in the limbs and often in the back while headaches is frequently complained of. The pain in the limbs may last for only a few hours, or it may be prolonged for a few days. 

Cerebral apoplexy and delirium has supervened in not a few cases.

In some cases the nervous system appears as much depressed, the patient becoming almost melancholic, while a less degree of mental depression is often seen.

Cases of loss of consciousness and delirium, followed by somnolence, sometimes lasting many hours, have been recorded. In some cases this somnolence has occurred apart from the other cerebral condition. (Philip)

There is undoubted affection of the vascular system, as evidenced by the dilatation of capillaries. Ferrans comes near all the nervous phenomena & a paralysis of the cerebral capillaries.
The alimentary system.

Swelling is a very frequent accompaniment, — indeed it would appear to be almost a normal result of the injections, — or at least a very frequent feature of the period of reaction.

Some form of it is in fact at all infrequently seen. Many different varieties have been noticed, the commonest being a scarlatiniform eruption, appearing first in the chest, spreading over the whole trunk and disappearing in the course of a day or two. In one case the scarlatiniform rash desquamated as in scarlet fever. (Yes)

In others a rougher raised and papillary eruption has been observed. (Yes)

In others a distinct purpuric rash (O.T. Williams and a murbilliform rash. (Yes)

A purpuric rash has been seen to follow the injections. (Abercrombie). It began thus: —

Appeared on the 6th day, recurred on the 7th, and several times subsequently.

Melancholic symptoms in the lips may supervene.

We. Our observers. (Heberden)
Greifswald) with herpes on the lips and eyelids in about one third of his cases.

In one case, inflammation of the conjunctiva and connecting tissues of the eye followed the injections, and was attributed to them (Köhler).  

Genito-urinary System

Normally, the effect of tuberculin on the genito-urinary system appears like this: that in a certain number of cases, some renal disturbance appears, these have been set up. Thus albuminuria is of frequent occurrence, and called by most observers, it is generally temporary and asso-
ciated with the period of reaction. Proteinuria has been observed (Lüigi Dezzo) 31. Hematuria has rarely occurred, while "hyaline fibrinous cylinders" full
of deformed red blood corpuscles were seen in two cases (Comrie). Acetanilid, a yellowish and granular
crystalline substance, has also been seen (Comrie). Acetanilid has been tested (Bizzotto). Ur
tobilinuria was observed by D. G. Cavallaro in three cases; whether associated
with jaundice is not stated.
In a case of phthisis associated with diabetes, the curious result
was noted of complete disappearance of sugar from the urine, after the use
of tuberculin.
Special action of Intercurrent tissues.
Having detailed the action of Intercurrent at the site of injection, and its con-
nstitutional effect after absorption, it is necessary now to turn to its special
action on tissues affected by the
action of the tubercle bacillus.
Where these tissues are external and
visible during life, the effect of Inter-
current is shown in the appearance
of redness and swelling of the affected
tissues, - special signs, which it is
claimed do not occur in healthy
parts of the body, and thus constitute
a certain means of diagnosing and
delimiting the sites of the tubercular
process.
Where the affected tissues are internal,
post-mortem examination has shown
that the effect of Intercurrent is the same.
Briefly stated, the effect is to produce a
species of inflammation - as evidenced
by the occurrence in more or less degree
of the four classical signs of that
process. In some instances the
inflammatory process may be of great and even of dangerous severity.

In his first historical communication of Professor Virchow to the Berlin Medical Society, he stated that he had found "actual inflammatory processes, and especially active proliferations occurring to an intense degree. These changes were shown in the edges of ulcers, and in neighboring lymphatic glands, which showed medullary swelling characteristic of acute inflammation." He found in addition a caseous pneumonia or hepatisation of a very great extent and of recent origin (in five out of six cases); and in others an "infection pneumonia" quite characteristic, presenting a diffuse soft hepatisation; the juice squeezed out being thick, and turbid instead of watery, "reminiscent of a phlegmonous condition." This latter condition was found in 7 out of his 16 cases.

His other results and conclusions...
I do not refer to. The above are facts beyond dispute, and are confirmed by many observers who have examined cases post-mortem. They prove beyond a doubt that Koch's tuberculin has a selective effect on tuberculous tissues so that the effect may be extremely powerful.

As to the frequency or rarity of such severe effects after the use of the injection, I can say nothing here. Without doubt, stepping the limits that I have fixed for my consideration of the subject.

It was to this special action in tuberculous tissues that Koch originally attributed the beneficial action of the remedy. He "does not kill the tubercle bacilli" he said "but the tuberculous tissue ... It can only influence living tuberculous tissue; it has no effect on dead tissue, as for instance necrotic cheesy masses, necrotic bones etc.; nor has it any effect on tissue made
acetic by the remedy itself. In such cases of dead tissue, living tubercle bacilli may possibly still be present, and are either thrown off with the necrosed tissue, or may possibly enter the neighbouring still living tissue under certain circumstances.

If the therapeutic activity of the remedy is to be rendered as fruitful as possible, this peculiarity in its mode of action must be carefully observed. In the first instance the living tuberculous tissue must be caused to undergo necrosis, and then everything must be done to remove the dead tissue as soon as possible, as far as possible, by surgical interference. Hence, where this is not possible, and the organism can only help itself in throwing off the tissue slowly, the endangered living tissue must be protected from fresh incursions of the parasites by continuous application of the remedy.

In his second Communication Koch
Still further developed his idea of the exact manner in which the remedy produces its beneficial effects. I shall perhaps be pardoned for not going at length into details of explanation, briefly his view seems to be as follows.

The tubercle bacilli in their growth produce substances deleterious to the cells surrounding them. One of these substances produces the special process known as "conglutination necrosis." The necrose cells cease to be favorable to the growth of the bacilli. Diminution in the growth of the bacilli causes diminution in the production of the necrose-causing substance, and thus a sort of mutual compensation is set up. "Now if," he wrote, "the necrose-producing substance were artificially added to that contained in the tissue surrounding the bacilli, then the necrosis would extend further, and thus the conditions of nutrition of the bacilli would be much more unfavorable.
Then is usually the case. Then not only would the more completely necrosed tissues disintegrate, slough, and, were this possible, take with them the included bacilli, carrying them outward; but the bacilli might also be disturbed in their growth to such an extent that they would die much sooner than in the case under ordinary conditions. It is in calling forth such changes that to my mind the action of the remedy seems to consist. It contains a certain amount of the specific producing substance, of which a corresponding large dose has a deleterious influence, - even in healthy persons, - on certain elements of the tissues, probably on the white blood corpuscles or cells closely related to them, thus giving rise to the fever and the whole peculiarity of the complex symptoms. In tuberculous persons, a much smaller quantity suffices to cause, at certain points, - that is where the Intercle bacilli vegetate and have already impressed their surroundings.
with the necrosis producing substance, a
more or less extended necrosis of cells,
with the accompanying symptoms affect-
ing the entire organism.

Such was the pathological expe-
ation of the action of the remedy ad-
vanced by Koch. Further investigations
in this country have however thrown
considerable doubt on the tenability of
these views, and it becomes necessary
now to present the results of the careful
researches of Dr. W. Hunter, more espe-
cially as they appear to have gone con-
siderably further than the researches
of Koch himself — as given in his later
Communications.

It will be seen that the most important
points on which Hunter's conclusions
differ from those of Koch's are as follow:

1. The action of the remedy does
not lie wholly in the substance, but in
a exceedingly complex, involving at least two
substances, and probably more.

2. The fever and constitutional
disturbance are not essential to the
beneficial action of the remedy.

2. The term "hecrizia" used by Koch is a most unfortunate term, indicating the action of the remedy in poison cases instead of in medicinal cases.

Hunt finds that in all probability the action is a much more complicated one than Koch at first supposed. That it is at least threefold, and that his experiments point to the conclusion that each special action is associated with a particular class of chemical bodies contained in the fluid.

In brief he considers that the fluid owes its action to the following three (and possibly more) modes of action:

1. Remedial.
2. Producing local inflammation.
3. Producing fever and general constitutional disturbance.

The first two actions appear to be connected with certain albuminoids, the third chiefly with the albuminoid substances.
By certain carefully conducted chemical processes, which were explained in full in Hunter's Communication to the British Medical Journal of July 25th 1841, he has been enabled to obtain in various combinations the substances associated with each of the three named modes of action.

These processes due to quote these processes in full, and it is quite impossible to give them in brief.

The results arrived at are the fol

owing. He obtains four modifications, which he designates by the letters A, B, C, and D.

Modification A contains all the com

stituents of the original fluid, but in different relative proportions; the album

oses being relatively increased, the salts relatively decreased in amount. Thus it contains the remedial and anti-inflammatory substances, and the fever producing substance, but in slightly diminished quantity.

Modification B contains the same constituents, but in reverse proportion, the
Salties and other soluble substances being relatively in excess, while the amount of albumenes is relatively small. In this therefore the fever-producing substance is in excess.

Modification B contains none of the salts (and therefore of the fever-producing substance) but retains those albumenes which have the beneficial and the inflammation-producing actions.

Modification C contains some (or only a trace) of the fever-producing substance, but differs from B in containing more of the inflammation-producing substance, while at the same time retaining the beneficial albumenes.

Turning to the clinical results obtained by the use of these modifications, Hühne laid down three essential conditions which any substance that claims to possess remedial powers in tubercular disease, should fulfill viz.:—

1. Its action must be a suitable projection of cases be beneficial.
2. In competent hands its action must not at the time produce any immediate ill effects.

3. Its action must not be followed by remote ill consequences directly accessible to it, still less by consequences which may endanger the life of the patient.

Iiated by these considerations he found the modification B and C, which have been named Detercinina B and C, of decidedly greater value than the remaining two.

His clinical experiments, which led to these conclusions, were conducted jointly with Professor Watson Cheyne, and were fully given at the discussion at the meeting of the British Medical Association at Bournemouth last July.

As a result of these experiments, Solutions A and C were found to be suitable for ordinary use, the former containing both the substance that produces a general disturbance and that producing local inflammation.
As latter containing the fever-producing substance, and probably also the one which is opposed to the remedial action.

With regard to the relative value of *A* and *B* Professor Cheyney came to the following conclusions.

"In the albumen *B* as prepared by Dr. Hunter, we have a substance which has been freed from the temperature-producing agent, and from that which causes the depression and illness. Whether at the same time the substance which precipitates the body to relapse, if such a material exists separately, is also lost, we cannot as yet say, but we think it probable that the main part of this action resides in the alkaloidal salts themselves or in some other substances removed along with them. Our chief reason for this view is the fact... that when these substances were employed in the treatment of tuberculosis..."
jigined. The disease seemed to progress more rapidly than in those not so treated. B. B. however, at will retain the substance which produces the local inflammation, and there are circumstances, especially in connection with internal tubercles, in which this inflammation is most undesirable. On the other hand, in external tubercles, the transient acute inflammation in the first six to eight weeks is sometimes a good thing, so that there are certain cases where B will be of greater use than CB for this very reason. Where no primary inflammation is permissible we have in CB a substance in which this has been reduced to a minimum, and from which, as far as we can judge, all the other harmful properties of tuberculin can be removed. The disadvantage of CB is that, as compared with B, it has a much slower remedial action; and this is a doubt partly
due to the absence of the primary inflammation, and partly also to the fact that a considerable amount of this substance is lost in the present method of preparation.”

Such is briefly, here the clinical results arrived at by these observers up to last July.

Pathologically, as Hunter stated, the question remained to be fully probed out, but he was inclined to think that the remedial and the inflammating actions were due to two distinct pathological processes. “So far as he could yet judge,” he stated, “the difference in the action of these two substances would probably be found to be that, while the remedial substance acted mainly on cells, and only to a slight extent on the vessels, the substance which caused the inflammation acted more directly on the vessels, favouring not only chiasmatosis but also stimulation. The slight degree of emplastration occasionally observed
to accompany the action of the Bunsen. A neutral substance for the first few days was quite different from the reddening, swelling and irritation which marked the action of the inflammatory substance.

He added that the remedy is not one that confers immunity against tubercle, as all observers who had used it with this object had failed. This idea underlying much of Koch's system of treatment had led him erroneously to push the treatment as rapidly as possible with increasingly large doses. But the same advantage could be obtained with much less risk by the use of C13 and 13, in small doses but repeated twice or three daily. In this way the dose need rarely exceed 20 milligrams at a time.

Since last July when these results were briefly summarised, no further information has appeared on the subject. In a private communication, Dr. Hunter assures me that
he has collected a considerable number of further data from clinical observers on the use of the solutions B and C3, and that so far the results have been either favourable or negative. He is still working on this subject experimentally and his next communication will be awaited with interest.
IV.

Quinaeol and Iodoform.
Guaiacol and Iodoform

For the introduction of the use of this combination of drugs he is indebted to Dr. Pirot, Professor of Clinical Medicine in the Faculty of Medicine of Bordeaux.

Both of these drugs had long been used in the treatment of pulmonary consumption, and their use in combination had no new idea. In 1887 Dr. Strehler prescribed the following pills:

\[
\begin{align*}
\text{Guaiacol} & \quad 5.0 \\
\text{Iodoform} & \quad \text{Benjoin pulverized} \\
\text{Crescol} & \quad \text{Boume de Volu pulverized} \\
\end{align*}
\]

Two to four of these pills were to be taken daily.

Last year Dr. Pirot in an article in La Semaine Médicale again drew special attention to this combination as being of great and decided benefit in the treatment of tuberculosis; and the success of many other patients, supported as it is by the experience of Dr. Robertson at
The National Hospital for Consumption at Ventnor renders the subject worthy of some consideration.

The nature of the remedy.

It consists of a combination of the active principle of creosote with oils from, given hypodermically in solution in sterilised olive oil and vaseline.

Taking each constituent separately we find that:

**Creosote** is the methyl ether of pyrocatechol, with the formula 

\[ \text{C}_7\text{H}_4 \text{O}_3 \text{H}_4 \text{C}_6 \text{H}_3 \cdot \text{CH}_3 \]

in each creosote it is far and away the largest constituent, forming 60 to 70 per cent.

Then pure it is a colourless, non-volatile, liquid of specific gravity 1.171 (b. p. 200°C), boiling at 200°C.

It is soluble in alcohol, ether, fats and oils, but only slightly soluble in water.

Its taste and odour resemble, but are more agreeable than those of creosote.

Creosote has first definitely employed in the treatment of phthisis by W.M.
Bonchard and Gimbret discovered in 1830 it was experimented on by
Reichenbach in tuberculos. It had a very varying reputation until M. M.
Bonchard and Gimbret published the results of their experience of its
use in 93 cases. They found that in from one to two weeks after beginning
its use there was a marked lessening of tuberculation, and secondarily a
elimination of cough. This was followed after a few days by an amel-
oration of appetite, lessening of fever, and then cessation of fever, and general
improvement in all the symptoms, with accompanying amelioration in the
physical signs in the lungs.
These results were confirmed by the
observers, its most enthusiastic supporter
being Professor Summerbrodt, who in
1847 stated that he had treated every
case of consumption that came under
his care by creasote, — the number
of about 5000 — and with such success
that he looked upon it as almost a
specific.

Other observers were not quite so fortunate. Freiherr von Follmann, Zöllner, and Löscheck found it useful only in cases that had not advanced beyond the first stages of the disease.

Iodoform occurs in the yellow crystals as a powder, so familiar that any account of its chemical or physical characteristics is unnecessary here. Its use in phthisis has been attributed to Balch, but Italian physicians claim the priority for Dr. Ruggiero; this in 1852 announced that he had had great success from the use of iodoform either by means of inhalation and by internal administration. So soon has since been highly praised by many Italian observers.

In 1879 Professor Semmke at the International Medical Congress held at Amsterdam spoke very favourably of its effects, when used in doses of from 5 to 40 or 50 cent.

He noticed the following effects:
1. Diminution of expectoration and cough, which he thought might possibly be due to a sort of local anaesthesia.
2. Disappearance of accumulated products in the bronchi or in cavities.
3. Progressive diminution of fever. Which he thought due in great part to the disinfection of the septic matters absorbed by the centres of softening.
4. Favorable modifications in the pulmonary lesions.
5. Amelioration in the general state.

Many others have spoken of the good effects of this drug. Deschfeld urged its claims in 1882.

D. Strangeways Smith of Bristol gave the results of its use in 46 cases, at the International Medical Congress held at Copenhagen in 1884. In 29 cases he found a notable increase of weight, in one case as much as 32 lbs in 94 days, and in another 33 lbs in 110 days. In the other 17 cases the loss of weight was small, and in many it lasting was more or less completely arrested. He recommended
that it should be injected into the lung tissue in a state of solution in ether.

He pointed out that Eosinum contains 96 per cent of arsenic iodine, and that 35 grains given daily would represent enough in a man weighing 150 lbs to render the blood germicidal. This would certainly be a very large dose; Desscheld only gave 1 grain doses. Randone 1/2 grain; but Smith gave 6 grain doses without any toxic effects whatever, and he has given as much as 25 grains in one day frequently, with no ill effects.

But it is to the use of these two drugs in combination by hypodermic injection, and in small doses, that Priest called attention; and he claims that under no other treatment has he obtained such satisfactory results.

Dose and Route of Administration

Priest recommends that a solution be used in completely sterilized olive oil and turpentine, of such strength that each cubic centimeter of the solution...
contains .01 grammes of borax and .05 grammes of phrassociated. The purity and transparency of the liquid should be as complete as possible.

It is given by means of hypodermic injection, generally in the supra-spinous fossa. First close this position for the injections, as it is subject to only slight movements, and in the dorsal depilating it is free from the weight of the body.

The face doses are from 1 to 3 cubic centimeters of the solution, which would represent from .01 to 3 grammes of borax, and from .05 to 15 grammes of phrassociated.

J. Robertson of Kenton has used the same solution to start with, and has gradually increased its strength to a solution twice as strong, and finally to a solution three times as strong, as the original. He follows the plan of using the weakest solution first, at the 7th injection using the second strength, and at the 24th using the third; all injections
being discontinued at the 30th.

In a few of his cases after a short interval without injections, they were resumed at
the request of the patient. In some cases less than the full number of injections
were given owing to the bitterness of the treatment.

Shingle in Smith and Mathews

Sherwill have pointed out that much
larger doses might be administered by
the mouth than by hypodermic injection;
but S. Robertson asks very appropriately
if 1/6 of a grain of iodin will accomplish
so much as 30 grains. Why give 30 grains?

Effects of the Injections

Locally the injections are without effect.
There is no production of reddness or of swelling.
There is slight local pain only momentary
and only such as is inevitable in all
hypodermic injections.

There may sometimes be felt a certain
numbness in the shoulder on the same
side as the site of injection, but it is
very rare, only about once in twenty cases,
and always disappears in five or six hours.

Dr. Price had the opportunity of determining just within the cellular tissues of the infraorbital fossa in a case that had received 30 injections of 2 cubic centimeters of 1 solution, and could discover no trace of alteration — no reduction nor swelling nor edema.

Glycerine — both of the drugs are really absorbed. The regimen is found as such, and the endoporens areioxide of potassium in the urine of patients undergoing the treatment. The presence of the endoporens salt could be proved on the third day after the injection, if the dose were one cubic centimeter; while of three times that dose were employed, it could be demonstrated on the same day.

The injections are followed by no general reaction. If the patient has already the feverish temperature, there is no alteration observed in his temperature.

In certain patients and more frequently, those who had already some degree of fever, whether in pulmonary
laboratorium, in tubercular phlegm or in simple phlegm, suppose perspiration followed the injections, covering the whole body, but more particularly the chest and face. The perspiration generally appeared in from twenty minutes to half an hour after the injection and lasted from from one and a half to two hours. It appeared to cause no trouble to the patient, and in ceasing left rather a feeling of well-being, and was followed by a drop in the temperature of from 1° to 2°C.

The injections exert no influence on the digestive functions. They cause no nausea nor desire to vomit. In certain cases when the injections had been continued for eight or ten days (i.e. about 3 cubic centimeters) some colic and slight diarrhea appeared, but these ceased on discontinuing the injections for two or three days. But the occurrence of these symptoms was exceptional. In many cases daily injection were given for 20 or 25 days with no diarrhoea,
for rather a tendency to constipation.

On the urinary system no effect is produced. Petit insists particularly on the absence of hematuria or albuminuria.

**Therapeutic application in Phthisis**

Petit in his original paper gives the 25 cases of the treatment in 25 cases, 15 men and 10 women.

Of these 25 cases died from the 25 cases of pulmonary tuberculosis in its last degree. Of these the fever had not been modified in any way by the injections, though all these patients felt a subjective improvement. In two of them the expectoration was notably diminished —in one from an amount that oscillated between 100 and 120 grammes daily down to from 25 to 30 grammes. In the third the expectoration was not diminished.

On post-mortem examination of these cases, Petit made some important observations. He found that...
The lungs contained no cavities; dry, and even as liquids, such as are almost invariable found in the pulmonary cavities of those who have died of phthisis, or sort of drying up of the respiration had been produced.

In the interior of one he found tubercular ulcers, such showed changes indicative of a healing process having begun. Such were the observations made in the three fatal cases. In the 22 other patients that had been under notice for two month or less he was able to record very distinct improvement. Not only was the general condition much improved, but the cough and expectoration were much lessened, and in some cases ceased altogether. At the same time the number of cavities in the sputa lessened; the physical signs were much improved; the fever was diminished; and the body weight increased.

These conclusions were supported by the experience of Dr. Robertson at the National
Hospital for Consumption at Vienna.

In 26 Cases, — 3 of pneumonia and 25 of consumption — he found benefit.

cold effects follow the injection in
efficient. He divided the cases into hypostatic of
which there were 18, and apoplectic, of
which there were 7.

In all the hypostatic cases save four,
the patient a fall of temperature
after a longer or shorter period of treat-
ment. Two of the four in which the
fall of temperature was recorded had
not submitted to the treatment long enough
to come to any conclusion.

It is remarkable to note in his cases
that even the most advanced were two
fitted by the treatment; and it is of
interest to remark that when the use of
quinine and copper was discontinued.

marked. The improvement was less
maintained. He gives two cases in
which temperatures of 104° were reduced
to the normal, in the case after nine
and in the Other after sixteen injections.
One very advanced case is of particular interest. The patient had pyrexia, large canthi, and much expectoration in both lungs, with a pulse rate of 140 to 150 and diarrhoea. Under ordinary treatment with rest in bed, use of ice bags, stimulants and quinine, continued for fourteen days, he showed no improvement, the temperature remaining at 103.4° F. He was then put on the pronounced and prolonged treatment, and in the course of five weeks the pyrexia had quite disappeared; he was able to be about; his cough and expectoration were much reduced and his appetite and strength improved.

In all the cases save one the amount of expectoration diminished. Dr. Robertson found, like Dr. Pierson, that the injections were entirely without danger and produced no local trouble whatever. In only one case did any untoward symptom appear; in this patient after the seventeenth injection there was a slight attack of hemoptysis.
Dr. Sinclair Crichton of Dundee states that in the case of double pneumonitis that had come under Dr. Robertson's care, nothing could have been more remarkable than the effects of this method of treatment, for the patient who had been almost moribund before the injection was made, at the time he spoke alive and well.

The original 25 cases of Dr. Priest were further supplemented by a communication he made to the "Comité pour l'Étude de la Tuberculose" (Paris 1871), Séance du 1er Avril. He then gave the results of 42 cases, of which would appear to include the 25 before recorded. Of these 7 were in the last period of stage, how in there an appearance of improvement was obtained; "but," Priest adds, "all the intercurrents are capable of preventing, by a sort of anto-suggestion, an appearance of amelioration, whatever may be the medication."

In others in the third degree there was amo- liveration with diminution of excretion.
and number of times, augmentation of weight and important modification of local signs.

In 20 cases of the second degree the results were variable. In those whose lungs were involved in their worst extent, the injection were powerless on the lungs. Many lesions, though, however at least 20 remained almost stationary. In other less extensive cases after 12 or 15 injections had been given, the local signs materially improved.

The remaining cases were of the first degree. In all these after 15 or 20 injections the injection notably diminished, appetite appeared, fever vanished. In 3 cases he saw rapid consumption converted into the chronic form.

In 12 cases of pleurisy with effusion the effusion disappeared; once only it reappeared, but under a second dose.
I injections it again manifested.

With so much positive evidence in its favour it indeed, I think, be granted that a very strong case is made out for the further trial of this combination of drugs in the treatment of pulmonary consumption. One, Dr. Bauer, Mr. Pignot used a further combination of Eucalyptus with the principal and iodine. He employed a solution of sterilised thyrify oil, or oil of sweet almonds, of such a strength that each cubic centimetre contained 16 centigrams of Eucalyptus, 5 of principal and 1 of iodine. He experimented for three years and had excellent results.

I am not aware that any feasible attempt has been advanced towards the double action of principal and iodine in beneficially affecting the course of phthisis in the very small doses in which they are administered; it is impossible to suppose that either of the constituents can have a direct bactericidal action, or even
a checking action on the growth of the 
beetle. It is inconceivable that 

that, after the injection of less than one minin 

of poison and the death of a grain 
of beetles into the subcutaneous tissues 

of the dorsal region, any quantity of 

other drug can reach the beetle in 

sufficient concentration to exert an influence 

mimetical to their growth. 

All that Dr. Roberton ventured to ad 

ance in explanation of their action was 

that "the checking of these cases is that 

the drugs acted upon the host, and all 

benefit in the treatment of phthisis afar 

were to result from this action upon 

the host, not from the action upon the 

parasite."

The German observers would attribute 

the benefit derived to a combination of the 

principle with the toxic albuminous 

bodies - the products of the growth of the 

beetle - which occur in the blood of 

the phthisical, and which are the direct 

cause of the constitutional disturbance 

and all the secondary troubles incident
to this disease. Thus the practitioner does not act as a specific against 
Tubercle bacilli in the sense of hindering the growth of, or killing the 
Tubercle bacilli, as it does outside the body; for pyridate acts as 
it does in combination in the blood has been 
proved to have such action. It is 
eliminated, they point out, as a salt of 
Lugol's solution, and thus when 
absorbed into the blood it must have com-
bined with albuminous bodies and chief-
ly through the sulphur present in the 
albumen molecule. In the blood of 
the patient they are in addition 
combined with albuminous bodies, namely the 
products of the growth of the bacilli 
and the authors say that the absorbed 
pyridate combines with these products 
and renders them harmless; and that 
they are further changed by oxidation, 
the pyridate being liberated as a 
salt of allyl.sulphonic acid, and the 
other decomposition products being eli-
minated in the breath, urine, the products 
of the bacilli, they proceed to state, being
about the fever, sweating, disturbed digestion, etc., and with their destruction the ill effects pass away.
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