On the Typhoid Symptoms of Typhus Fever, and their probable cause.

By James Keith Anderson.
Part I
The subject of continued fevers is one of the greatest importance to the practical Physician. From the great interest of these affections, from the frequency of their occurrence, and from their fatality, they have engaged the attention of the most eminent Physicians of modern times; and, within a comparatively recent period, important additions have been made to our knowledge of their nature, progress, and causes. Without doubt, many important facts still remain hidden from us; and, by the diligent prosecution of clinical re-search, aided by those means of investigation which modern science
has placed at our disposal, we may confidently hope to advance far nearer towards a perfect knowledge of the subject. Since the importance of the study of Pathological Chemistry has been recognised, much has been done, by its prosecution, to advance our knowledge of the Pathology of Fevers. Far more, however, still remains for us to do, before we can congratulate ourselves on our knowledge of the Chemistry of Fevers, and of the influence on the system of chemical changes within the body.

More attention has been paid to the chemistry of the excretions in Syphoid Fever, than in any of the other forms of continued Fever. This is probably due to the study of Pathological Chemistry having been chiefly prosecuted by Continental observers, to whom Syphoid Fever was the most familiar form. The Chemistry
of Syphus Fever has been greatly neglected. At the time when I began to make the observations afterwards mentioned, only one series of analyses of the Urine in a case of undeniable Syphus Fever had been published. Since that period, analyses of other two cases have been published, making in all, only three cases in which analyses of the Urine have been made and recorded. Of course, I exclude all analyses of limited quantities of Urine without reference to the total amount of the excretion, as I believe such analyses to be worthless for all practical purposes.

The most important of the constituents of the Urine is unquestionably Urea, indicating, as it is universally assumed to do, the amount of tissue-metamorphosis within the body. By estimating the amount of this constituent excreted daily during
The progress of a case of Typhoid Fever, we might expect to gain some information as to the changes occurring within the body; and, by carefully watching, at the same time, the symptoms of the case, possibly indications for treatment might be derived from the observation.

With this view, I have carefully estimated, day by day, the amount of Urea excreted in several cases of Typhus, at the same time making accurate notes, by the bedside, of the daily condition of the patients.

The results of these observations seem to me to bear chiefly on the production of the Typhoid symptoms, or Typhoid State, so commonly observed in Typhus Fever. This "Typhoid State", though a condition readily enough recognised, is by no means susceptible of easy definition. Dr. Murchison, in his...
"Treatise on Contended Fevers," defines it as follows: "The typhoid, putrid, or malignant stage is characterized by extreme prostration, great impairment of the intellect, slow, knotted delirium, stupor, and more or less unconsciousness, sometimes passing into coma; not uncommonly by involuntary evacuations, tremors and subcutanea; sordid teeth, dry, brown, crusted tongue; and a rapid, small, soft pulse." In this definition I would be inclined to add the following words: "And, in some cases, by partial paralyses, as shown by retention or incontinence of urine, difficult in swallowing, or difficult of speech."

I believe that the typhoid symptoms in Contended Fever are due to retention in the blood of the waste products of tissue metamorphosis, which may be found stated in the books.
of several recent writers (Murchison, Parkes and others.) As will be afterwards shown, good reasons have been adduced for this opinion in so far as regards Typhoid Fever, and Relapsing Fever; but, from the want of analyses of the urine in Typhoid Fever, the only arguments in support of this opinion in regard to that affection, have been derived from a few analyses of blood.

It was long held as a settled fact that in all cases in which the heat of the body was abnormally increased, in other words, in which a state of Fever or Pyrexia existed, the excretion of Urea was always increased above the normal amount. Dr. Parkes, however, in his Goulstonian Lectures on Pyrexia, in which our knowledge of the Chemistry of Fevers is so admirably stated, showed that the excretion of Urea may be
Diminished below the natural amount, notwithstanding that the temperature of the body is abnormally increased. It is extremely probable that in all cases of fever, the metamorphosis of tissue goes on with unusual rapidity; and, that in those cases in which the excretion of urea is diminished, that diminution is due to a retention of the urea in the system. It shall be my endeavour to show that such a condition occurs in Syphus Fever, and that its results are the Syphoid symptoms before mentioned.

Unfortunately, comparison with analyses of others is not available to any great extent, there being, as far as I am aware, no published analyses of any value, with the exception of those previously mentioned, (viz. of one case by Dr. Parkes (Med. Times & Gazette 1857) and of two by Mr. Bennett (Journ. Lond. Med. Times & Gaz. 1857).)
(Gazette 1854), in Dr. Parkes' case the daily amount of urea was increased by one-fifth, averaging 530 grains. In one of Mr. Spantons' cases, the urea was increased above the normal amount on the 19th day, but, on the previous days on which the urine was analyzed, it was very decidedly below the normal amount. In Mr. Spantons' other case, the urea was below the normal standard on all of the days on which analyses were made. These cases will be mentioned afterwards at greater length. Dr. Murchison alludes to some unpublished analyses by Dr. Buchanan of London, in which the daily amount of urea was much increased. He mentions, however, that, from some isolated observations of his own, he is inclined to think that "the increase of urea is greatest in the early stage, and that, after the 8th day, it decreases..."
Lively diminished. In all probability, the latter statement is correct. It would account very well for any analyses having failed to show increased elimination, seeing that they were usually begun about the commencement of the second week of the fever. In some of my cases, in which the urine was analysed in the latter part of the first week, the amount of urea was comparatively high. The most striking results of my observations were, that a low excretion of urea invariably coincided with severe syphoid symptoms, and, that the smaller the quantity of urea excreted, the more severe were those symptoms. This is, I think, very suggestive of the retained urea having some connection with the production of the syphoid symptoms, and the more so, as I found that, in those cases in which the excretion of urea
was very low during the second week of the fever, it always mounted up much higher for a day or two after convalescence, and then fell once more and during convalescence again mounted up more or less slowly till it reached the normal amount. This would seem to shew that the amount excreted was not small merely in consequence of the amount formed in the system being also small, but that a larger quantity was formed than was excreted, and that it was retained until the system, being freed from the fever, had regained sufficient tone to throw off the accumulatcd effete matter; and that, this having been got rid of, the excretion once more fell to the amount natural in such an unfebrile state of the system, the urea being then expelled as it was formed, and its amount increasing as the physical
condition of the patient improved. In some cases, however, I found that an increased amount of urea was eliminated before the close of the second week, and with marked relief of the typhoid symptoms. These cases were examples of gradual convalescence.

The typhoid state (or typhoid symptoms) occurs in many diseases besides the one under consideration, and, before going further, it will be proper to inquire as to the cause of its production in those diseases, as it most probably has a similar origin in all cases.

It is a striking fact that a large proportion of the fatal cases of typhus terminate by coma, and that this is also a common form of death in cases of Bright's disease. Dr. Christian considers coma to be the "natural termination" of Bright's disease, or the mode in which it proves fatal when
Life is not cut short by some other "incidental or secondary affection." In 40 fatal cases of Bright's disease recorded by Dr. Bright, there were well-marked cerebral symptoms in 30 previous to death. The coma in many of these cases is no doubt owing to the pressure of serous fluid in the ventricles of the brain, but there are many cases in which no undue quantity of fluid is to be found, nor any inodorous appearance whatever, within the cranium, which can account for the comatose symptoms. When we consider the fact that the elimination of urea is very much diminished in the later stages of Bright's disease, it seems reasonable to ascribe the coma and death in these cases to the poisonous influence of the retained urea, or of some modification of that substance.

Now, in cases of Syphilis terminating fatally by coma, it is a very
rare occurrence to find in the brain any morbid appearance whatever, excepting a slight degree of congestion. It is customary to allege that the fever poison is the cause, but if so, why does coma not occur sooner, instead of appearing usually towards the end of the second week? It is true that in some rare cases the patient dies comatose after a very few days, perhaps only 24 hours, and with no morbid appearance detectable in the brain, but in such cases I think it is quite as likely that death is caused by a rapid accumulation of urea in the blood, as by the extreme force of the fever poison, as is generally supposed.

We have quite an analogous occurrence in cases of sudden suppression of urine, where we have the patients dying very quickly by coma, without any cerebral lesion.
Some cases of Kidney Disease to cases of
Continued Fever in the Syphoid stage,
that it is sometimes absolutely impos-
sible to distinguish the one from the
other. Dr. Murchison says that cases
of Renal Disease are constantly being
sent to the London Fever Hospital as
examples of Syphilis, and he adds
that "failing the eruption, a certain
diagnosis is often impossible". Dr.
Murchison also says- "Every practi-
tioner must have been struck
with the remarkable resemblance
between a case of Syphilis in its ad-
vanced stage, and one of Urethra
dependent on Renal Disease; in fact
the two affections are very often mis-
taken for one another. It is highly
probable that the symptoms in both
cases are due to the circulation of the
same morbid Materials in the blood."

In Syphoid Fever it has been
shown by many Continental and British
observers, that the urea though increased above the normal standard is decided
ly lower during the second and third
weeks than it is during the first. It
has been found in some cases that
the urea was, in the later stages lower
than natural, and that delirium,
stupor, coma, convulsions, and the
other symptoms of the lymphoid state
appeared to be consequent on this
condition. Dr. Murchison and Dr.
Sanderson, in some analyses of the
urine of lymphoid fever, made with a
different object, found in several
instances that the quantity of urea
excreted in 24 hours diminished on
the advent of cerebral symptoms, and
increased again on their cessation.
In one of their cases "the quantity, which
was 292 grains when the patient was
delirious and unconscious, rose to
964 grains when the delirium abated
and the consciousness returned."
In another case of Dr. Murchison's, "the quantity, which at first was 422 grains, fell to 357 grains on the appearance of delirium and stupor, and rose to 490 grains when these symptoms ceased." Dr. Parkes has also shown that the urea may be diminished in cases of typhoid fever. He says "the urine (in typhoid fever) is sometimes not only scanty, but deficient in solid matters. This state of things often coincides with what is termed the pathrid, achyric, or profound typhoid state. The lessening of the urea and other urinary ingredients must be ascribed, not to diminished formation, but to diminished excretion."

Of course, although in many cases of typhoid fever the excretion of urea is increased throughout the whole progress of the disease, this does not vitiate against any
argument, as in many cases of true

typhoid fever, there are no "typhoid"
symptoms whatever.

Some interesting cases of relapsing
fever, bearing on the question under
consideration, have been placed on
record. In this disease, the quantity of
bloed formed in the system appears to
be decidedly increased; but, as will
be shown presently, it is sometimes
remarkably diminished, the conseque-
ces being "cerebral symptoms, such
as delirium, stupor, coma, or convul-
sions" (Murchison). Henderson (Edin.
med. & surg. journal) mentions three
very illustrative cases.

In the 1st the patient was seized on the
critical day with uneasy sensations
in the head and confusion of mind,
and passed no urine for 18 hours.
Nitre was prescribed, with the effect
of causing abundant flow of urine,
and at once relieving the symptoms.
In the 2nd, the beginning of cerebral symptoms was accompanied by suppression of urine, and convulsions occurred before death. Dr. Douglas Maclagan obtained urea in considerable quantity from the blood, and in smaller quantity from the serum of the ventricles of the brain.

In the 3rd, the commencement of cerebral symptoms was marked by a diminution of the Urea to half its normal amount. It was ascertained that the Urea did not exceed 109.3 grains, and Dr. Maclagan obtained Urea from blood taken from the arm.

In a case under Dr. Wardell, the occurrence of cerebral symptoms was accompanied by suppression of urine, and abundance of Urea was found in the blood by Dr. Michael Taylor.

In two cases with cerebral symptoms recorded by Mr. Taylor, the urine was
reduced to 16 oz., and in one of the cases the area did not exceed 174 grs. in 24 hours.

Cases of suppression or diminution of urine in Relapsing Fever, followed by cerebral symptoms, are recorded by other writers on the subject.

It may be said that there are merely cases of suppression of urine, followed by the usual consequences of that condition, but it will be noticed that, in one half of the cases cited, there was only diminution of the quantity of the urine. Now, the amount of Urea excreted is, as a general rule, in proportion to the quantity of the urine, and I think it may be fairly assumed that, where the quantity of the urine was not notably diminished, there must also have been a considerable diminution of the quantity of Urea. Therefore, Cohen, in a disease in the course of which Stupor and
come, and other cerebral or lymphoid symptoms are rarely present, we have those symptoms presenting themselves, accompanying or fol-
lowing a diminished or suppressed urinary excretion, it is impossible
to doubt that retention of some of the
primary elements is the cause of those
symptoms, unless we suppose the
suppression to be merely a symp-
tom of some serious lesion of the
nervous system. No such lesion has
been found in any case of this nature.
The fact of Urea having been found
in undue quantity in the blood is a
strong corroboration of the above
pieces.

It may be as well to mention
here, that the mere fact of Urea having
been found in the blood in such
cases is sufficient proof of its having
been present to an abnormal extent.
A short Calculation will show this.
sufficiently well. Assuming that 500 gms of urea are excreted daily in 24 hours, though this amount is rather above the average; let this amount be divided by 24, and the result is that 20.83 gms. of urea are present in the blood in one hour. Now, taking the quantity of blood in the body at 34 ½ lbs, which is Valentine's estimate, the amount of urea which each pound of blood would contain in one hour would be only 0.61 grains. But this quantity of urea would not be present in the blood at any one moment; and, therefore, the fact of urea being detected in the small quantity of blood submitted for analysis, is most certainly a proof of that substance being present in the blood in undue quantity.)

In that affection known as Acute or Yellow Atrophy of the Liver, the Typhoid State is as prominent...
ment a symptom, that it has given rise to the name "Typhoid Jaundice" by which the disease was at one time distinguished. Professor Treverich, in his Clinical Treatise on Diseases of the Liver, from which the following remarks are chiefly derived, states that it is frequently mistaken for Typhus complicated with Jaundice. No complete analyses of the urine during a series of days appear to have been made in this disease, but it has been proved beyond doubt that there is a remarkable diminution in the secretion of Urea, and this substance has been detected in the blood in various instances. The delirium appears to be of two kinds, first noisy and violent, afterwards low, in fact, Typhoid - in the words of Treverich, or rather of his Translator "the patient after a time becomes 1 degrees more and more tranquil;"
The state of excitement passes into stupor, and finally into deep coma.

The pupils become large, react slowly with light, and the respiration is

even, sighing, intermittent, and stertorous." In some cases the deli-
rium is of the latter character throughout.

I think it is probable that this typhoid state is connected with the
retention of urea. With regard to the state of wild delirium, as far as I
know, no analyses of the urine have been made. While the patient was in
that condition of the cases recorded in Freirich's work, in only two was
the urine examined in order to ascer-
tain the amount of urea present,
and in those two the analyses were
made in the last stage of the disease.
In one of the cases, urea was found to be entirely absent from the urine,
notwithstanding repeated and care-
ful analyses. In the other case, the
Wine excreted 24 hours before death contained a "considerable quantity" of urea, but in the wine found in the bladder after death, there was only "an extremely minute trace" of that substance. In this case a considerable quantity of urea was found in the blood after death. Both these patients died comatose, and a typhoid state preceded the coma. In both cases, the urine was free from albumen. In none of the cases was any appearance found after death, which could account for the cerebral symptoms.

In a case of this disease in which the urine was analyzed by Valentine, no urea was found; and, in a case examined by Sander, the urea was lessened.

The urine in this disease only occasionally contains albumen.

Here then, we have a disease exhibiting prominent typhoid symptoms.
and in which the excretion of Urea is diminished to a very considerable extent, and, in some cases, altogether suppressed. The question naturally arises—What connection has the diminution of the excretion of Urea with those symptoms? It may be urged that accumulation of biliary matter in the blood may be their cause, but, from a large number of experiments made by injecting bile into the veins of animals, this appears to be entirely disproved. Fritsch made between 50 and 60 such experiments, and he declares that "no remarkable 'arrangement of the nervous functions, or indeed of any function whatsoever, took place." Fritsch does not seem to have satisfied himself as to the cause of the Sypheoid symptoms. He says that no explanation is furnished by any abnormal condition of either the brain or its membranes, and that he
believed they must be referred to changes in the composition of the blood. He goes on to say: "I attribute the cause of the blood intoxication to the complete arrest of the hepatic functions from the destruction of the secreting cells, and to the derangement of the renal secretion," yet, farther on I find him saying: "It is more probable that they are due to a retention of the constituents of the urine." He explains that the arrest of the hepatic functions from the destruction of the secreting cells includes not only the absorption of bile, and the retention in the blood of the substances intended for its formation, but also, the cessation of the influence which the liver exerts over the metamorphosis of matter, and the simultaneous passage of the disintegrated glandular matter substance into the blood.

Of course, with regard to the
Urea, the question arises whether its disappearance or diminution is due to its retention in the blood, or to suppression of its formation. From the fact of its having been detected in the blood, it would appear to be proved that its formation still goes on, and, consequently, that it must be retained in the system, but, whether or not it is found in normal quantity, it is impossible to say, as the quantity present in the blood has not been ascertained in any case, and, even although we had ascertained this, the knowledge would be of little value unless we knew the period at which retention first began.

It may be said that the Leucine and Tyrosine, which are found in large quantities in the urine and also in the blood and liver of such cases, are complementary of the Urea, but both of these are poor in Nitrogen,
and, though they may be to some extent complementary of that substance (urea),
year, they cannot take its place to any con-
siderable extent. It may be said, also, that Lecine & Tyroline, one or
both, are the noxious agents, but this
has been entirely disproved by in-
jections of those substances into the
vains of animals producing no derange-
ment of the nervous system.

My object in making these
remarks on Acute Yellow Atrophy
of the Liver has been merely to adduce
another instance of a disease in which
Syphoid symptoms are well marked,
and in which there is some reason to
infer that retention of Urea is con-
nected with the production of those
symptoms.

In various other diseases of the
Liver, similar symptoms occur,
and may possibly be due to a simi-
lar cause, but, so far as I am
Aware, no analyses of the urine or blood in those diseases have hitherto been published. It may be, that cholera and uræmia are closely allied, if not identical, conditions.

In the malignant or lymphoid stage of yellow fever a condition of uræmia appears to exist. Dr. Blair pointed this out (Brit. & For. Medico-Chirurg. Review May 1856), and his observations have since been confirmed. Blair and La Fosche showed that the uræa is retained, traces only appearing in the urine. LaFosche states that the uræa is altogether absent from the urine, but doubt has been thrown on the accuracy of his analyses. In some cases the urine is altogether suppressed. Large quantities of uræa were found in the blood by Freche (Freichs) and Ghassainid.

In cholera it is well known that lymphoid symptoms are apt to
be developed in the stage of reaction, and this would appear to be a consequence of previous retention of urea during the cold stage. In this stage there is usually complete suppression of urine, and the danger of the third stage would seem to depend greatly on the manner in which the urea is eliminated. If free elimination of urine and urea takes place, the prognosis is comparatively favourable. During the first 24 hours after the cold stage is past, the urine is usually small in amount, the urea corresponding in quantity; but it gradually increases in amount, the urea rising at the same time, until the excretion of both is much more copious than in health. The latter is no doubt the result of the previous retention. This is the order of events in favourable cases, but, in unfavourable cases, the excretion of both continues low till
death, and such cases usually terminate with typhoid symptoms. The prognosis is favorable according to the freeness of the excretion of urea. Some cases, however, prove fatal, in which the elimination is tolerably high.

A form of pneumonia is of not infrequent occurrence, in which the typhoid state is so distinctly developed as to have given rise to the term typhoid pneumonia. Whether or not this state is coincident with a retention of urea has not yet been shown. So far as I am aware, but as the urea, though usually eliminated in very large quantities in this disease, has been found abnormal low in some cases, I think it may possibly turn out that, in this disease, as in the others previously mentioned, the typhoid symptoms are accompanied by a diminished
excretion of Urea. From the fact of the clinical history not being given in the published cases alluded to, no reliable inference can be drawn from the analyses.

Syphoid symptoms also occur in the course of Pyaemia, Dysipelas, Puerperal Fever, and other diseases, at least, in some cases of those diseases, but I do not know of any published observations bearing on the cause of the production of those symptoms.

In Syphus Fever itself, the presence of Urea in an abnormal amount in the blood, coincident with marked Syphoid symptoms, has been repeatedly demonstrated. Mr. Michael Taylor found Urea in considerable quantity in the blood of a man who died of Syphilus, death having been preceded by Stupor, low muttering Delirium, and Retention of Urine.
The Kidneys in this case were perfectly healthy. Dr. Christian in his work on Granular Degeneration of the Kidneys has recorded the case of a man who died on the 10th day of Syphilis from sudden coma and convulsions, and in whose blood Urea was found in large quantity. In this case the Kidneys were merely congested. Dr. Murchison obtained Urea from the blood in several cases in which death had been preceded by profound stupor. In his book on Continuous Sorens, he had given the clinical history of two of these cases, showing that very strong marked Syphilitic symptoms existed before death.

Could both the urine and the blood be examined for Urea in any one case, it would be of the utmost value in determining the question. Only one of my cases having proved fatal, and a post-mortem examination...
having been refused by the deceased's relatives, I was unable to make an examination of the blood in any case.

Another argument may be derived from the effects of diuretic treatment, in cases where lymphoid symptoms are present. In such cases the standard authorities on fever recommend measures which have a derivant action on the kidneys, such as powerful diuretics, dry cupping and mustard poultices over the loins, etc. Dr. Murchison says that he has reason to believe that a dangerous degree of stupor is often prevented by the early adoption of such treatment. Strong tea and coffee have long been recommended in the stupor of Syphilis, and from the case of Dr. Parkes, previously mentioned, it would appear that their value is due to their power of causing elimination of the retained urea.
Probably this is brought about by their improving the "tone" of the nervous system, and thus enabling the body to throw off the accumulated matter; perhaps they act in some degree by lessening the metamorphosis of tissue, as the well-known experiments of Schumann have shown that they do in health, and thus helping to prevent reaccumulation of the noxious matter. Common salt has also been long used in syphilis, particularly when syphilitic symptoms are present, and this salt has been shown by Bischoff, Roussingault, and others to increase the elimination of urea. J. Hutchinson says: "Every remedial agent which shall be found hereafter to promote the elimination of urea, without increasing the destructive metamorphosis of tissue, will deserve a trial in syphilis." In Relapsing
Fever diuretics were considered very valuable, particularly in averted or treating head symptoms. Dr. Henderson believed that these symptoms might be averted by the use of Nitre and other saline diuretics. Dr. Hardell and Bonnack expressed a similar opinion.

In Syphoid Fever, diuretics have also been found useful. I believe that I have seen very good results follow the use of diuretics in cases of Syphus where the stupor was unusually profound, and threatening to pass into coma.

The theory that retention of urea is connected with the cause of Syphoid symptoms, accounts well for the greater mortality in cases of Syphus complicated with old-standing Bright's Disease, or with inflammation of the Kidney coming on in the course of the disease. Anyone who has had any experience of such cases knows
how much more unfavourable the
prognosis is, how surely the patient
falls into a condition of profound
stupor, and how very probable it is
that this stupor will terminate in
coma and death, possibly ushered in
by convulsions. Of course, it is rea-
sonable to suppose that the retention
of urea is more complete in such
cases than in those in which the
kidney is healthy.

It does not appear that positive
organic change of the structure of the
kidney is at all essential to retention
of the urea in the blood. In many cases,
albuninuria was of rare occurrence,
and, from a large number of obser-
vations on cases of typhus in the
Royal Infirmary, during the winter of
1863-64, and since, I satisfied myself
that it was of infrequent occurrence.
It would appear, however, that the
proportion of cases in which albuminuria
exists, varies considerably in different epidemics. It is very difficult to say why, failing organic lesion of the kid-
ney, the urine should be retained to a greater extent in some cases than in others, or why it should be re-
tained at all. Probably it is due to defective innervation, or, as it may be phrased, from "a want of tone" on
the part of the nervous system. The present theory, that in fever there is a degree of paralysis of the nervous system, would appear to favour this view. If the retention is due to such
a cause, it follows that no mere diuretic treatment will give thoroughly satisfactory results, but that we
must look for some agent which primarily affect the nervous system.

Why the Urea should be thrown off after the 14th day of the fever, or earlier in some cases, it is impossible
to say.
It is important to note that, where convulsions have occurred in the course of Syphus, organic Disease of the Kidney has been found in nearly every instance. This is not an invariable rule, however, the Kidneys being in some cases, as in the previously mentioned one of Dr. Christie's, healthy. Probably the convulsions are due to the urinary ingredients being retained more completely than in other cases; but possibly, in such cases there may be a predisposition to convulsive attacks. In these cases, as in those in which milder cerebral symptoms appear, as a rule, no appearance is found within the cranium which can account for the symptoms.

With regard to the question whether Cerebro can cause cerebral symptoms or convulsions without undergoing change in the system, I shall say nothing, as it is too diffi
cult and complex a subject to be taken up in the present paper. I shall merely remark, that the experiments of Kuhn have satisfied me that carbonate of ammonia is not the cause of the symptoms, and that I think my experiments tend to show that the urea in any cases could not have undergone decomposition to any great extent. The conclusions drawn from injections of urine into the veins of animals are, I think, worthless, as I have no doubt that the kidneys were merely thereby stimulated to increased action, and that the accumulated urea was at once expelled. The fact that, in cases of puerperal eclampsia, urea may accumulate in the blood for a considerable time before the occurrence of convulsions, would seem to indicate that some change, at present unknown, must take place in the composition of the blood or in the
condition of the Nervous System before any morbid effects can manifest themselves.

The whole question must remain an open one until further researches have furnished us with much more complete evidence of the conditions necessary for the production of Chronic Poisoning.
Part II
The following observations were made during the winter session of 1863-64, when, as Clinical Clerk in the Royal Infirmary, I had constant opportunities of observing the phenomena of Typhus Fever in cases of all degrees of severity. By the favour of Dr. Sanders, and of his House-Physician Dr. D. J. Simpson, under whose care the patients were, I had every facility possible afforded me in observing and recording the cases. Through the great kindness of Professor Macalagan, I had the valuable privilege of performing the analyses in his Laboratory in the University, under the superintendence of Dr. Arthur Gangee, to whom I am indebted for my knowledge of the
processed required. I was thus placed in the most favourable circumstances for making my observations. They were made with great care, and I have great faith in their accuracy. As already stated, they have, to a great extent, failed in the object for which they were begun, viz., to ascertain whether or not the urine excreted during Typhus is in excess of the natural amount. They show, however, that this excretion falls, during the second week of the fever, to an amount decidedly below the natural standard. As I have stated in the former part of this paper, I am inclined to think that the Urea is, during the first few days of the fever, increased beyond the natural amount, but this is by no means proved by my observations.

The principal difficulty, under which any one must labour, is the idea of trying to investigate the amount excreted from day to day of any constituent of
The Urine, in that of obtaining the whole quantity of urine passed during each day, as it is obvious that no analyses can be of any value, unless the whole quantity is obtained, and that without the possibility of any doubts. This difficulty is much increased in Typhus from the condition of the patient, and, towards the end of the second week, it becomes in many cases impossible to obtain the whole quantity. With the aid of a careful nurse, I was very successful in obtaining the whole of the Urine, but in most cases, as the crisis was approached, or immediately after it, and just when the results of analyses would have been most interesting, I failed in securing it.

The analyses I found to present no special difficulty. They were performed by Davy’s method, somewhat modified so as to secure great accuracy in the results. Instead of a bath of salt and
water, I used Mercury, and, instead of measuring the Urine by drops, I carefully weighed it in a flask in a delicate balance, afterwards re-weighing the flask, and calculating the difference between the weights. The specific grav.-ity of the Urine, by means of a Sp. gr. Bottle at 60° Fahr.

In addition to determining the Urea excretion and the quantity of the Urine, I have kept a careful record daily of the progress and symptoms of each case, including, in some instances, notes of the Temperature.

In none of the cases was there any question as to the diagnosis, a distinct Syphils eruption being present in all of them, and the disease running the usual course of Syphilis. The date of invasion was ascertained in all cases with scrupulous accuracy.

Before proceeding to inquire into the amount of an excretion in an abnormal
State of the system, it is necessary to have the healthy standard properly defined. Parker, by tabulating the results of a number of different observations by various chemists, and taking the mean of those results, has defined the average amount of urea excreted in 24 hours by healthy adult males, between the ages of 20 and 40, to be 33.18 grammes, or 517.4 grains. Other writers have placed it still higher, Haughton at 545.84, and Hammond at 670 grains. The amount excreted varies also according to the weight of the body, the nature of the diet, the amount of exercise; and it may also vary according as more or less is excreted by different organs.

Highly puriﬁed diet has been proved by the experiments of Lehmann, Bidder and Schmidt, Bischoff, and others, to increase the excretion of urea, and a spare diet has been shown by Moos, Schneller, and Bretler, to
diminish it very materially.

The statements as to the effects of exercise are very conflicting, but ac-
ccording to Speck, Beneke, and others, it decidedly increased the elimination of
the Urea.

It appears to be proved, that an increase in the amount of fluids drunk
causes an increased excretion of Urea, besides the increase in the quantity of the
 Urine. Usually, when the quantity of the Urine is increased, the amount of Urea,
and of the total solids of the Urine, rises at the same time.

Possibly too, it may vary according as more or less is excreted by different
organs. Perhaps an increased amount
may at times be eliminated by the skin,
but, from the dryness of the skin in
Syphilis, this is not likely to affect
the results. It may also be excreted by
the bowels, but, from some observa-
tions of Dr. Parkes, it would appear
That this can only occur to a very slight extent, at least in Typhoid Fever, the disease in which this mode of excretion might be expected to be most active.

The amount of Urea excreted in health also varies according to the weight of the body, being large in proportion to that weight. Unfortunately, I have neglected to ascertain the weight in any of my cases. Probably, I would have found considerable difficulty in doing so.

It varies also according to age and sex. It is less in females, but probably this is entirely accounted for by their lighter weight, by the smaller quantity of nitrogenous food which they consume, and by their taking less exercise than males. Parkes lays down the usual excretion of Urea in women at from 16 to 28 grammes (246.9 g to 432.1 g) per diem, but he says it may vary from 12 to 30 grammes (185.2 to 463 g). He gives the mean
result of a number of analyses by different continental observers as 390 grs. The number of experiments on boys and girls is too small to allow of any definite conclusions being drawn regarding their renal excretion, but it is unquestionably lower than in adults. It falls after 40 years of age, but the rate of decay has not been satisfactorily determined.

With regard to the quantity of urine excreted in health, it varies greatly in different persons, and has been variously estimated by different authorities. Parker, by taking the mean of a number of observations by different authors has given 52½ ounces as the average, and probably this is about correct. Berquere has stated that women excrete a larger quantity of urine, but less urinary solids, than men, but this appears to be incorrect. A number of observations by Kischoff, Juster, Beigel, and others, have proved
that they excrete, as a rule, less urinary water and solids than men do. Some women, however, may excrete a larger quantity of both, than is the average in men, but this is quite exceptional.
Case I. aged 19, a Domestic Servant, was admitted on the 3rd day of the fever. Her case was a serious one, the nervous symptoms being very severe, as shown by extreme restlessness, panting respiration, moaning and crying, during the first week; and afterwards by an extreme degree of depression and stupor, by very violent tremors and subsutarea of both hands and feet, in the later stages the feet jerking up and down continually, and by retention of urine at one time, and its involuntary emission at another, and by fumbling at the bed clothes. She took very little food during the continuance of the fever, and her thirst was not so great as is usually seen in fever. She got no stimulants during the whole course of the fever or during convalescence.

Convalescence occurred on the 14th day, but a considerable degree of depression and stupor remained for two days after that date. Her urine was carefully
collected and examined, with the following results.

The quantity of the urine was much diminished during the fever. The largest quantity passed on any one day during the fever was on the 9th, when it reached 43 oz., but the usual quantity varied from 19 to 32 oz. On the 16th day, it rose to 41 oz., next day it fell to 18 oz., but steadily rose afterwards as convalescence advanced, till it reached 58 oz. While the amount of urine was low, the specific gravity was comparatively high, varying from 1028 to 1018, but, on the amount rising, the sp. gr. fell, its lowest being reached on the 20th day, when it was 1013. The chlorides appeared to be much deficient, and the sulphates to be about normal, but I did not estimate them quantitatively. On the 15th day, there was a copious deposit of urates. Phosphates were occasionally noted. Albumen was present in very slight amount on the 9th day,
but on no other day was it detected, though carefully looked for. The amount of Brea collected daily was very much lower than natural. On the 5th day, the first on which the Brea was estimated, it amounted to 24 grammes (422.9 g), but it fell sud-
denly next day to 5 grammes (8.9 g), and continued below that quantity during the whole progress of the fever. Unfortu-
nately the whole urine could not be collected on the 15th day, but on the 16th the urine rose to 18 grammes (288.9 g), and on the 17th it fell to 2 grammes (3.5 g). Next day it reached 8 grammes (131.9 g), and continued to rise steadily till it reached 23 grammes (361.9 g) on the 28th day.

Daily Notes of the Case.


Rales over the chest. Tongue red, with white fur. Pupils large, eyes suffused, light and hearing impaired. Headache gone. Very restless through the night, moaning and crying. A considerable degree of oppression.

5th Day. Pulse 104. Tongue dry in centre, white at edges, yellow at back. Restless through the night, but slept in the morning. Delirious and wandering through the night.

Urine 20.4 oz. - neutral - sp. gr. 1026.
Urea 4.22. 3 grs.

6th Day. Pulse 106. Slight subsultus. Stupid, but understands when spoken to. Inclined to sleep. Restless and wandering through the night. Did not know the nurse at times. Had retention, and urine was drawn off by catheter.

Urine 32.2 oz. - neutral - sp. gr. 1028
Urea 89.2 grs.

7th Day. Pulse 106. Slept well last night, after two doses of Linet. Hyoscyamus, Fench. Restless and delirious towards morning.

8th Day. Pulse 90. Tongue dry & brown at centre, white at edges. Slept at beginning of night, but talked and "rambled" later. 11th Hour. Inclined to sleep. Subsultus of hands. Unwilling to speak. Takes nothing but milk and water.


Urine 29.8 oz. Slightly acid. Deposit of phosphates.
on boiling. Sp. gr. 1020. Color 52. 3 gms.


12th Day. Pulse 84. Tongue still dry in centre but the moistness of the edges appears to be extant. Less soreness on teeth and lips. Was wildly delirious last night, and very anxious to get out of bed. Still much nervous agitation, her hands trembling and her manner agitated. Speaks sensibly enough, but is very confused. Says she has a difficulty in speaking. Appears to be getting the expression of convalescence. Taking a little gruel and porridge.


13th Day. Skin moist. Eruption gone. Sustamina on the skin. Tongue still dry and brown. No headache. Dreams a great deal. Muttered much during the night. Languid
and stupid, but answers correctly. Tremors and substis of hands and feet, and twitching of facial muscles. Slept very little during the night. Ordered gr. x of Nitrate of Potassa three times a day. Eating very little.


Had a drachm dose of ipecac. Hysteria last night. Eating very little.

Urine 22.5 oz. Acid. Sp. gr. 1.024. Elcer 41.3 gr.


Urine—slightly acid. Slight deposit of urates.
16th Day. Pulse 72. Tongue moistening, still fissured. Bowels constipated. Slept well, and is inclined to sleep. Is very confused, and contradicts herself when answering questions.


17th Day. Pulse 76. Tongue moist and covered with white fur, still fissured in the centre. No tremor. Sleep disturbed by a purgative. Still very languid. Eating arrowroot and beef tea, but takes very little.


20th Day. Pulse 83. Tongue moist, whitish. Bowels inclined to be costive. Didn't sleep so well rather restless.

_urine 40.5 oz. Slightly Acid. Up. gr. 1013.

Urea 15.0. 3 grs.

She continued rapidly to improve from this date, regaining her appetite very quickly and being found sitting up in bed reading

on the 25th day from the commencement of her illness.

I have placed the main facts in connection with the urine, in this and the following cases, in a tabular form, conceiving that the chief points will be more readily perceived under such conditions.

I have calculated the total solids by an empirical formula given by D. Golding Bird, and the results of which are usually a very close approximation to the real amount.
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<th>Date</th>
<th>Palin</th>
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**Table of Condensation of Urine and in Lead T**
Remarks on Case I.

In this case, the very small quantity of urea secreted daily during the progress of the fever was very remarkable. Nothing but perfect confidence in the accuracy of my analyses, and of any having got the whole of the urine, could have saved me from the conviction that an error had crept in somewhere. It will be observed that the daily excretion of urea is not only very low during the second week of the fever, but that it diminishes towards the end of the week, and then suddenly rises in the beginning of the third week. Unfortunately, the urine of the 15th day was not obtained, in consequence of its having been passed involuntarily, but that of the 16th shows a very marked increase both in its own quantity and in that of the urea. Judging from other cases, I think that probably the excretion of urea was as large, or larger, on the preceding day. The largest excretion of urea on any day during the fever occurred on the 5th day.
This having been the first day on which the urine was analyzed, it is impossible to say whether this urea was excreted as formed, or whether there had been a previous retention of it in the system, but, considering the period of the disease, I think the latter is improbable. I think it is much more likely that this comparatively large excretion was the consequence of an increased metamorphosis of tissue in the first stage of the fever. As stated previously, Dr. Murchison is of opinion that the increase of the urea is greatest in the early stage of the fever. I have been unable to draw any fixed conclusions as to whether or not the excretion of urea is increased in the early stages, but this case would seem to favour the idea that it is, as when the patient was nearly well she was found to excrete only 3.61 grains per diem, the excretion on the 5th day having been 4.22 grains.

On comparing the symptoms with the quantity of urea excreted daily, it will
be observed that there is a remarkable connection between them. As the daily
excretion of urea became lower, so did the
Syphoid Stupor become more profound.
The Syphoid state very early manifested itself, stupor and depression being
strongly marked before the termination
of the first week. Retention of Urine also
occurred at the same period. These symp-
toms appeared just when the analyses
showed that the excretion of urea had
fallen from 422 to 89 gs per diem. The
daily excretion of urea continued low,
and on the 14th day was only 111 gs. At
this period, her stupor was so profound
that she paid no regard to questions
addressed to her. The muscular tremor
and subcutaneous tenderness were the
most violent that I have ever seen in
Syphus, the hands and feet jerking
continually, and there being almost twitching
of the facial muscles. She had also diffi-
culty in speaking. Her tongue was dry,
brown, glazed, and picciuied, and her teeth and lips were covered with scories. Part of the urine of the 15th day was obtained, and was found to deposit urates largely. On the 16th day the urinary amounted to 288 gts, a very much larger excretion than had occurred on any day since the 5th. Had the urine of the 15th day been all procured, I have no doubt that it would also have shown a comparatively large excretion of urea. This large excretion of urea on the 15th day was no doubt caused by a previous retention in the system, its elimination taking place when, from some mysterious influence unknown to us, the system was enabled to free itself of the noxious matter which had been oppressing it. Immediately after the occurrence of this high excretion, the urine fell to 33 gr. the next day, but rapidly rose as convalescence advanced. The large excretion on the 15th (2) and 16th days would therefore appear to have been a critical, or rather,
An after-critical discharge. Probably, as Kraube has endeavoured to show, all critical discharges are in reality after-critical.

During the 15th and 16th days the patient though manifestly much improved, remained in a very stupid and confused condition, but, after the 16th day, her intellect was perfectly clear.

The low excretion of urine on the 17th and several subsequent days is of course an indication of a retention of fluid having occurred on those days, there being undoubtedly a deficient formation of that substance within the system. This is shown by the fact of its elimination increasing in proportion as the patient regained her health and strength and began to exercise herself and to take nutritious food.
Diagram of the daily Excretion of Urea in Case.
Case II. Aged 30, a strong, tall, man. He was admitted to Hospital on the 8th day of the disease. The case was one of moderate severity. A considerable amount of albumin was present in the Urine when first examined, and this continued up to the 13th day. On the 14th it had disappeared and it never returned.

The Quantity of Urine was low during the Fever. It increased on the 13th day, and continued considerably higher than before. When the patient was fully convalescent, it amounted to 93 ounces in 24 hours.

The Quantity of Urea eliminated during the Fever was also very low, ranging from 15 to 35 grains per diem. Its rise corresponded with that of the Urine, its excretion being very much increased on the 15th day. It continued comparatively high during the 16th and 17th days, and then fell on the 18th to 82 grains. Next day, it was lower, being only 72 grains, but after that period, it rapidly increased, till
on the 27th day, it had reached the amount of 575 gts, a large excretion for any man, and much larger than one would expect in a patient convalescing from typhus. The specific gravity varied very little during the fever. It rose somewhat after convalescence was fairly established, but the rise was very slight, and on some days it was lower than during the fever. This was no doubt owing to the water in the Urine being so largely increased.

Daily Notes of Barrett

9th Day. Temp. 105° Pulse 107. Slept very little but was not delirious. Slight tremor of the hands. Great thirst and no appetite.
Urine 40.3 g. Sp. gr. 1.020. Neutral.

toms as before.

11th Day. Temp. 100° Pulse 112. Small and sweat. Great headache. Slight tremor of hands. Slept pretty well, but was delirious
During the night: Answers intelligently. Eats very little.


14th Day. Temp. 104° Pulse 108, weak. Has a very stupid Typhoid appearance, but answers correctly. Delirious during the night. The urine was unfortunately thrown out by the nurse.


(14th) Urca 35.0 gts.

15th Day. Appearance much improved.
Temp. 102° Pulse 96, fuller and softer than before. Pain in head. Slept well, and was not delirious.


Urea 194.9 grs.


Urine 57.1 oz. Sp. gr. 1014 Acid. Urea 257.5 grs.


19th Day. Temp. 98° Pulse 66. Slept very well. Head quite clear. Wishes to get up. Diet full, with exception of meat.

Urine 33.7 oz. Sp. gr. 1023. Acid. Urea 72.6 grs.

From this date he rapidly improved, the urea increased.
Daily, as convalescence advanced, he was dismissed from Hospital on the 37th day from the commencement of the fever.

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After the lengthened remarks which I have added in Case I, I do not consider it necessary to say much with regard to this case. The same extraordinary diminution of the urine excreted during the second week occurred in this case, and the same symptoms, though in a minor degree, also coincided with that diminution. In this case, also, there was a greatly increased elimination of urine immediately after the occurrence of convalescence, and the typhoid stupor also continued to some extent while this increased elimination was taking place. After the cessation of this increased excretion, the daily amount of urine fell to a very low standard, but rapidly increased till it reached to a very high amount.
Days of the Fever.

Diagram of the daily Excretion of Urea in Case II
Case III aged 40, a Labourer, a tall, very powerful man, who had never been ill all his life before. He had continued at work five days after he had rigor and headache. This case was a mild one in many respects, the patient being singularly intelligent for a case of typhus, uniformly sleeping well, and never having any nearer approach to delirium than a slight wandering of the mind, and that only on a few occasions. On the other hand, the pulse was rapid, the temperature high, and there was considerable subsiutus from the time of his admission (8th day) till an advanced period of convalescence.

Daily Notes of the Case.

9th Day. Eruption fully out and very exposed.
Severe frontal headache. Confused but answers intelligently. The urine of the whole 24 hours was not obtained. Probably the
wine of 12 hours was got. It amounted to
19.0 g. was acid. Sp. gr. 1073. Ellor 165.2 gds.
9th Day. Pulse 130. Tremors and subsultus
of hands. No delirium. Headache as before.
Slept pretty well. Eating very little, but very
hungry.
Wine 32.4 g. Acid. Sp. gr. 1071. Slight deposit
10th Day Temp. 103°. Pulse 128. "Wandering"
a little, but intelligent at visit. Tongue dry,
glazed at tip, brown and furrowed at back.
Bowels regular. Great thirst.
Wine 54.3 g. Sp. gr. 1015. Slight cloud
of urates. Ellor 3.69.1 gds. Acid.
11th Day Temp. 106½°. Pulse 114. Great tremors
and subsultus. Bronchitic rales over both
sides of chest, but not to a greater extent.
Headache on coughing. Tongue dry and brown.
Bowels regular. Ordered 8 oz wine per diem.
Slept pretty well. No delirium.
Wine 44.7 g. Acid. Sp. gr. 1013. Blouded
with urates. Ellor 3.32.7 gds.
12th Day Temp. 103°. Pulse 110. Great tremors
and subcutis. No delirium observed. Tongue dry, brown, and pilocereous. Bowels regular. Left well.


Dear intelligent. No wandering. Slept very well. Eating little.

Urine 72.9 oz. Acid. Slight cloud of urates.  48 gr. 1024. Urea 180.5 grs.


Urine 21.6 oz. Acid. 48 gr. 1027. Urea 165.7 grs.


Tongue moist.

Urine 21.0 oz. Acid. Large deposit of urates.  48 gr. 1025. Urea 122.5 grs.


Urine 27.1 oz. Slightly alkaline. 48 gr. 1024. Urea 207.

Urine 29.9 oz. feeble, Acid. sp. gr. 1023. Urea 3304 gr.


Urine 29.9 oz. Acid. Large deposit of urates. sp. gr. 1023. Urea 172.8 grs.

He continued steadily to improve, and soon regained his strength.

Table of Condition of Urine re in Case 114

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Remarks on Case III. This case was one of those in which there is a gradual improvement for a few days before actual convalescence takes place. It will be seen that, on the 12th day, the pulse began to abate in rapidity, coming down from 160 to 110. On the 13th it was up to 120, but on the 14th it felt tires, and about that time an imperceptible convalescence occurred. Simultaneous with the improvement on the 12th day, the elimination of Urea decreased not from a low amount to a lower, as in the corresponding period of the former cases, but from a comparatively high amount to one rather moderate. On the 15th day, it had fallen very low, but, after that time, it rapidly increased in amount. The largest secretion of Urea occurred on the 16th and 17th days, in consequence, I imagine, of complete elimination not having been effected during several days previously, and the urea so retained having been completely, or to a great extent, secreted on.
Those days (10th and 11th). No delirium was observed after the 10th day, but headache was unusually prolonged, not having disappeared, as usual, on the advent of the delirium.

I imagine that accumulation of fluid in the blood must have taken place to only a slight extent in this case, but from the analysis not having been begun till the 8th day, no positive information could be gained. I do not think that I ever met with a syphilitic patient who was more clear-headed during the fever, and if retained fluid is the cause of syphilitic symptoms, this is just what might have been expected. The fact of the symptoms improving after the large evacuation of fluid on the 10th and 11th days, though actual convalescence did not occur till the 14th, is a strong argument for this theory. Altogether, I think this case bears as strongly for this theory, as do those in which the retention took place to a much greater extent.
Case 17. A Baker, a very weakly lad, who had just recovered from typhoid fever, having been up only a week or two, he took syphilis. The case was by no means a very severe one. He always slept tolerably well, and the nervous symptoms were not strongly developed. Albumen was present in the urine on most of the days on which it was examined, but no tube-casts were found. The urea excretion was remarkably low throughout the whole course of the fever, with the exception of the 4th day, when 335 grs. were excreted. In a case like this, where the patient was so very weak and debilitated, one would expect a much slower excretion of urea than in a previously healthy, robust, man. The age of the patient must also be considered. From some analyses by Ehle and by Bischoff, it would appear that the natural excretion of urine in boys from 13 to 16 years of age is about 25 or 26 oz. and of urea, from 160 to 170 grs.
Dail Notes of the Case:

Slept well. No delirium. Tongue dry in centre,
with white creamy fur. Urine 26.1 oz. Acid.
Sp. gr. 1075. Elrea 118.2 gds.

6th Day. Temp. 105°. Pulse 112 (very variable)
Slepting well. No wandering. Eating pretty well
(for fever). Urine 15.8 oz. Acid. Slight cloud of

7th Day. Temp. 104°. Pulse 108. Tongue quiet,
yellow, fissured in centre. Slepping well, but
eating very little. Urine 32.4 oz. Acid. Albumen

8th Day. Temp. 103°. Pulse 110. Slept well but
was delirious during the night. Delirious
at visit. Urine 23.1 oz. Acid. Albumen

9th Day. Temp. 103. Pulse 104. Had a draught
of spirit. Hypoey last night, and slept well
and without delirium. Eating little.
Elrea 68.8 gds.

10th Day. Temp. 103°. Pulse 110. Slept well,
Albumin: 66.6 grs. No albumen.
11th Day. Temp. 102°. Pulse 100. Slept well.
No delirium. Urine: 20.8 oz. Slightly acid.
Sp. gr. 1010. Urine 118.3 grs. Albumen considerable.
Appearance much improved. Eating well.
14th Day. Temp. 102°. Pulse 86. Slept well.
Eating well. Tongue moist, white, flushed.
Pulse nearly gone. Urine not collected.
Urine: 34.9 oz. Alkaline. No albumen.
Sp. gr. 1012. Urine: 247.0 grs.
He continued to improve for sometime,
but, having caught cold about the 27th day,
his feet became adenomatous. Under proper
treatment this was recovered from, and he was discharged from hospital in a very debilitated condition.

Table of Condition of Urine in Case 18

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<tr>
<th>Day</th>
<th>pH</th>
<th>Urea (mg/dL)</th>
<th>Urea in urine (g)</th>
<th>Creatinine (g)</th>
<th>Albumin (g/L)</th>
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I believe that in this case the retention of bile was slight, and that the loss of secretion of bile was, in a great measure, owing to its deficient formation within the body. The quantity, secreted on the 15th and 16th days was not great, but there may have been a considerable secretion on the 14th day, the urine of which was not obtained. The case resembled Case 7 and 17 in the stupor continuing to some extent during the 15th and 16th days, when the urine secretion was comparatively high, though convalescence occurred on the 14th. The urine secretion gradually rose after convalescence as in the previous cases.

Case V at 46, a sailor. This case was towards the crisis, complicated with pneumonia. After the 12th day the urine became alkaline and deposited phosphates, and this condition continued till he had fully regained his health. He made a very tedious convalescence.

Daily Notes of the Case.

1st Day. Eruption evident. Temp. 104° Pulse 95. Tongue moist, with white fur. No
appetite. Great thirst. Bowels loose (from purgation)

Tongue dryish, with yellowish white fur.
Urine 20.1 oz. Acid. sp gr. 1027. Urea 44.8 pts.

9th Day. Temp. 104° Pulse 96. Headache better

10th Day. Temp. 103° Pulse 100. Did not sleep well
Headache bad. Delirium during the night.
Urine 27.4 oz. Acid. Deposit of urates. sp gr. 1025.
Urea 140.6 pts.

11th Day. Temp. 104° Pulse 96. Slept well.
Headache bad. Retention of urine. Delirious
during the night. Tongue dry and brown.
Urinal 36.9 oz. Acid. Deposit of urates. sp gr. 1031
Process for Urea spoiled.

12th Day. Temp. 103° Pulse 100. Headache bad.
Frequent and laboured. Slept well. Urine 31.79
Acid. sp gr. 1017. Urea 266.1 pts.

13th Day. Eruption distinctly petechial. Temp. 103°
Pulse 88. Slept well. Bad headache. Tongue dry
and brown. Eating very little. Urine 43.3 oz.
Alkaline sp gr. 1019. Urea 283.6 pts.
14th Day. Temp. 103°. Pulse 88. Headache better.

Tremor and subcutaneous Papils Contracted.

Slept pretty well. Tongue moist, getting clean.

Urine 32 oz. Acid. sp. gr. 1019. Urea 279.6

15th Day. Temp. 104°. Pulse 84. Bronchitis rales

over chest, and Crepitation at right base.

Slept pretty well. Beginning to show appetite.

Urine 40.5 oz. Alkaline. sp. gr. 1020. Urea 374.3 grs.

16th Day. Pulse 76. Fair strength. Physical

signs much the same. Slept well. Headache

on coughing. Tongue moist, with yellow fur.


Not examined.

He gradually improved from this
date, making very slow progress

towards recovery.
Table of the condition of Bellingre-à-l'Îlot

<table>
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<th>Skin temperature</th>
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This case was another of those in which the stupor and other nervous symptoms continued for a day or two after the 10th, though convalescence occurred on that day. As in the previous case of the same character, the largest evacuation of urine occurred...
immediately after convalescence. Probably there was a large excretion of urea on the 16th day, the urine of which was not examined. The quantities of urea excreted during convalescence did not rise regularly as in the other cases, and possibly the pneumonitis may have had something to do with this. The pulse was singularly low during the fever, never having risen above 100.

It is curious that pneumonitis should have occurred on the 14th or 15th day, when the accumulation of urea was greatest. Mr. Parkes believes that local inflammations are often caused by a check to the elimination of urea, and this case may bear on the subject. However, as other and more probable exciting causes of pneumonitis were at work, I think its advent can be more readily accounted for than by this theory.
Case VII. A. J., a Baker, a Stout Young Man.
This was a very mild case, convalescence
which occurred imperceptibly about the
14th day. Previous to that date, however,
the symptoms underwent a marked
improvement. On the 14th day, the pulse
fell from 104 to 84 beats per minute, and
never again rose to 100. The nervous symp-
toms were markedly improved on the
15th day, there being neither delirium nor
subcutaneous, and these symptoms never
recurred. The patient also slept well after
that date. The temperature, however, con-
tinued high till the 15th day.

Daily Notes of the Case.
Severe headache. Quite intelligent. Tongue moist
covered with yellowish-white fur. Great thirst.
Bowel loss (from purgatives) now normal.
Urine 44.4 gr. Alkaline - Sp. gr. 1029. Color 328 gr.
7th Day Temp. 105½° Pulse 92. Headache a little


all over. Eating rose. Urine 41.8% alkaline.
14th Day. Temp. 102°. Pulse 76. Slept well.
Sore mouth. Urine 36.5%. Feel alkaline.
Phosphates as before. Sp. Gr. 1074. Urce 264.8 g.
He continued rapidly to improve from this state.

**Table of Condition of Urine in Case:**

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<th>Date</th>
<th>Temp.</th>
<th>Pulse</th>
<th>Urine</th>
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<th>Phosphate</th>
<th>in.</th>
<th>Grams</th>
<th>in.</th>
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Days of the Fever.

6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23

Diagram of the daily excretion of Urea in Case VI.
Remarks on Case VII.

In this case, the largest excretion of urea during the fever was on the 11th day. From that date, the nervous symptoms, as before stated, improved, but convalescence did not occur till the 16th day, as usual. On the 16th day, the nervous symptoms were more strongly marked than on any other day during the fever. The marked subsidence of the nervous symptoms after this elimination, is possibly of note, particularly in connection with the fact that the lowest excretion of urea took place on the two days immediately preceding the 16th.

Case VII at 18, attendant performer in a circus. This was a fatal case, death being caused by pneumonia on the 16th day. The temperature was high and the pulse rapid, varying during the height of the fever, from 120 to 136 or 140. The delirium was, at one stage, very wild, the patient attempting at one time, to leap over the window. The patient was very confused, and in the second week...
Exhibited the "low, muttering delirium" in an extremely manner. Unfortunately, from the confusion and delirium of the patient, the whole quantity of the urine was only obtained on 14 days. The quantity of the urine was large for fever. The excretion of urea, though considerably higher than in some of the previous cases, was much lower than natural. Had the patient recovered, a more definite opinion as to whether or not there was attention of urea might have been obtained by observation of the quantity of that substance excreted on the occurrence of convalescence, as in the other cases, but failing that, we must look to the symptoms, and to the quantity of urea excreted during the fever. The symptoms were such as, according to the received ideas on pyrexia, to indicate great rapidity of tissue change; (the inference is, that) yet the excretion of urea was lower than natural. The inference is, that there must have been retention, and coincident with that,
we have, as in the other cases, the development of the typhoid condition.

Table of the condition of the Chinese in Lecce.

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Having given in detail the results of my own observations, I shall mention, as briefly as possible, the cases by Dr. Parkes and by Mr. Dunnett Franton, previously referred to. From the great length to which this paper has already reached, I shall confine myself to giving the results of their analyses, and then making a few allusions on the cases.
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Remarks on Dr. Parkes case.

This case appears to have been one of those in which the symptoms improve for several days before convalescence actually occurs. On the 11th day, the temperature and rapidity of pulse both began to abate. The excretion of urine was very much greater than in any of my cases, and there must undoubtedly have been increased tissue-change in this case. A retention of urine would appear to have taken place; however, as, on the 10th day, there was a very large evacuation. The results of this large evacuation seem to have been the same as in my cases, as, in the report of the 11th day, it is stated that the "head symptoms" are much less. The case resembles case 2 of my series, in many respects, and seems to have been of a similar character.
Mr. Burnett's Urine Cases.

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From an amount of confusion attending on the periods of the disease in both these
Cases, the date of invasion seeming not to have been properly made out, it is impossible to draw any definite conclusions from them. In both, however, the excretion of urea was, during the second week, lower than natural, and, in both it rises after the occurrence of convalescence, so that a retention would appear to have occurred.

The above observations show that in Syphus Fever, as well as in other diseases, there is a remarkable connection between the retention of urea in the system, and the production of Syphoid symptoms. Their results are, briefly, as follows: In Syphus Fever, the excretion of urea diminishes, during the second week, to an abnormal amount, not as consequence of diminished formation, but from its retention in the system. The urea thus accumulated is, in most cases, eliminated on the occurrence of convalescence, forming an after-critical discharge, but, in
other, and milder, cases, it is discharged several days before convalescence. In all cases, the effects of this elimination are an immediate relief of the typhoid symptoms, this relief being completed only on the cessation of the increased discharge. The evocation of urea falls, from diminishes formation, to a very low amount after convalescence, and increases as the patient regain health and strength.