On Scurvy

With an Account of an Outbreak of Scurvy at Thull in the Kuram Valley

By

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"One of the most important preventive measures to be adopted in war is the prophylactic treatment of Scurvy. If Scurvy could be prevented, every other war disease would be comparatively trifling. Injuries from exposure, exhaustion from fatigue, and gastro-intestinal affections from improper food and atmospheric vicissitudes, would still occur; but the ravages of typhus, typhoid fever, malaria and dysentery, would be trifling and easily prevented." Parker.
To

The memory

of

Edmund Alexander Parkes
Introduction.

So much has been written about delirium, and so many accounts have been published of its outbreaks, that it would seem as if nothing new could be said on the subject.

But the outbreak recorded in the second part of this Thesis appears to me to have one or two points worthy of notice.

1. It was on a more extensive scale than is often witnessed in modern practice, affecting, among others, nearly all the men in a regiment.

2. It occurred among men who, although not conscientiously abstainers from meat, are practically so as a rule, and were wholly so during the period in question.

3. It occurred in a most malarious district, and coincidently with a severe endemic of malarious fever.

4. It occurred at the hottest time of the year in an extremely hot country, the thermometer during a great part of the time averaging 112° F. in the shade at noonday, the extreme heat in this case acting as a nervous depressant and playing the same part as is played by extreme cold in outbreaks of delirium in the Arctic regions.

5. It occurred and continued in spite of a small issue of limejuice, and appeared to be little affected, after it had commenced, by the administration of large-
quantities of limejuice. There was some doubt however as to the quality of the limejuice.
I think that these and other points which will be brought out in the course of the narrative, combine
to render the outbreak of scurvy in question worth recording, and I trust that my observations will
not be found devoid of interest.

In the following paper I have endeavoured to give
(in Part I) a short account of scurvy generally,
embodying the principal known facts and theories
regarding this disease; and in the second place,
(in Part II) an account of the outbreak of scurvy
which I witnessed and of which I had close manage-
ment, as complete as possible, under the circumstances
in which the observations were made, viz., much
overwork and prostration from fever and the effects
of the sun, making observation and recording a work
of great difficulty.
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Part I.

Scurvy.
Chapter I.

General Pathology of Scurvy.

The early history of scurvy lies buried in obscurity. We have no record of its existence in ancient times except a doubtful passage in Pliny. It is probable that the disease he describes was scurvy, from his mention of the teeth dropping out and the knees being affected, but if we except this passage not a single writer of antiquity appears to allude to it even in the most casual way. Neither the Greek nor the Latin language contains any equivalent word for scurvy, our so-called Latin word "Acubitus" being of Mongol origin and not dating back even to the older Hunnish days.

Yet there is every reason to suppose from the nature of the affection that scurvy must have existed from time immemorial. It is impossible to believe that the vast armies which were brought together in ancient times can have escaped the ravages of this disease, at a time when vegetables were little cultivated and their dietetic necessity was unknown. There can be little doubt that scurvy must in all ages have been one of the most powerful factors in producing that mortality which we know always accompanied the congregation of large bodies of men, and which, as it was due to neglect of the laws of nature, sanitary or dietetic, was with grief and...
unreasoning fatalism ascribed to the arrows of an angry Phoebus or the wrath of an offended God, according as the historian was a Pagan or a medieval Christian.

Even in ancient days however we notice one or two facts, which seem to indicate at least a due perception of some dietary truths. It is probably to some such perception that the free use of vinegar in the diet of the Roman troops was due, and fruits are always spoken of as health giving, although their relation to the prevention and cure of this particular disease remained unknown.

Although Paracelsus was described in A.D. 1260 by the Sieur de Joinville as appearing in the army of Louis IX in Egypt, and from various accounts would appear to have existed for a long period in the North of Europe in an endemic form, it is not until after the invention of the Mariner's Compass that it seems to have attracted much notice. The ancient voyagers were probably pretty free from its ravages. They had small faith in getting out of sight of land if they could help it, and constantly skirting the coast as was their custom, they were nearly always in favourable circumstances for procuring suitable supplies of provisions. But when the invention of the compass tempted men to forsake the old paths of navigation and venture boldly forth on
unknown seas, making voyages that lasted for years, all this was changed, and the way in which ships were accustomed in those days, taking little else on board than salt pork, biscuit, and water, was eminently calculated to bring out scurvy in startling proportions. And thus through all the accounts of our early voyagers there runs a constant note of lamentation over the scurvy, sometimes subdued and hardly heard when they are cruising among islands of the Shephasines and reveling in tropical fruits, at other times rising loud and wailing, when men are rotting and dying in scores, and ships are abandoned because the crews are no longer able to navigate them. On board the vessels of these early explorers, where the men were fed on the most scurvy-producing diet it is possible to imagine, while the provisions, however suitable as they were in their nature, were often rotten and disgusting besides, and the water foul and full of organisms that required no microscope to reveal them, scurvy displayed itself in the most typical form, attaining a height and showing a virulence seldom seen on land. And nothing is more remarkable in connection with these voyages than the fact that although the antiscurbic properties of vegetables and fruits were very early recognized, yet the owners or captains hardly ever made
the slightest effort to provide any stock of stores for succeeding voyages, even although they often lost their ships as a consequence of their neglect. As early as 1601 Captain Lancaster preserved his crew in health by taking lemon juice in bottles with him and giving each man three spoonfuls daily. His crew escaped entirely, while the crews of the vessels along with him suffered severely. One would suppose that the publication of a single instance like this would have been sufficient to induce every one to take similar precautions, and yet we find after more than two centuries have elapsed that Acts of Parliament and stringent penalties are required to force people to a simple measure of health preservation like this. It would seem almost incredible and lead us to form a very low estimate of the wisdom and humanity of our ancestors, were it not that unfortunately cases still occur to make us humble, and Captain von Fries' able and earnest efforts furnish a melancholy proof that in regard to health matters the non-medical public of the present day is still often very ignorant. The history which I give of Scurvy in the Kuranai Valley will furnish another instance of how the danger of Scurvy is still ignored by our authorities.

**Proximate Cause of Scurvy**

From the earliest times of which we have any record...
down to the present, writers on scurvy have nearly all agreed on one point, viz., in attributing the disease to an altered condition of the blood; but as most other diseases have also been attributed to this cause, and as we find the writers utterly at variance as to what this altered condition consists in, there is little profit to be derived from the majority of their speculations. Almost every alteration to which blood is actually or hypothetically subject, acidity and alkalinity, humidity, viscosity, putridity, and a host of other conditions, has had innumerable changing on it, until confusion has become twice confounded.

Modern theories do not differ very materially from the more ancient ones, except that, in the first place with the advance of chemistry they have become a little more precise, and in the second place while the older physicians most usually attributed the altered condition of the blood to the addition of something to its normal elements, our modern writers assume rather that something is subtracted from it, that the diet which causes scurvy fails to supply some element usually present and essential to health.

There can be little doubt that this is the correct view, although there is still a good deal of obscurity as to the substance wanting in the blood. The principal
Modern theories as to the alteration in the blood will be mentioned further on.

_Predisposing Causes._

Cold and Damp have always held a prominent place among the causes assigned as predisposing to Paralytic. Nearly all the earlier recorded cases of Paralytic occurred in the North of Europe, where the climate is both cold and humid, and when Paralytic first attracted much notice in our own country it was in connection with our sailors, whose profession peculiarly exposes them to cold and wet. Our Arctic expeditions too, where although there was little damp there was intense cold, have always down to the very latest, contributed their quota of cases of Paralytic.

From these data there would seem to have sprung up an idea that there is something in cold as cold that tends to dispose to Paralytic. I think there can be no doubt that this is a mistake, and that when cold influences the attack of Paralytic it does so only in virtue of the power of depressing the system which it possesses in common with many other influences. That excessive heat has an exactly similar action is very clearly shown by the account which I give in the second part of this paper.

_Season of the Year._

The winter season has been usually assigned as the time when Paralytic is apt to make its worst ravages. This has generally, and with justice, been ascribed to...
the want of vegetables at this season, continued with the cold. Numerous instances however were to show that when vegetables are wanting, scurvy is just as liable to occur in the summer season as in the winter. The scurvy in the Kurna Valley was at its worst in the height of summer.

Mental State
A cheerful state of mind has generally been said to act as a prophylactic to the attacks of scurvy, while a gloomy one encouraged its onset. In proof of this Van der Iluy relates that at the siege of Breda our troops lying near the French were severely attacked on account of their gloomy spirits, while the French escaped on account of their more cheerful dispositions and having drier quarters. Putting aside the fact that the British soldier, though addicted to grumbling is not otherwise a particularly morose personage, it is probable that if there was any difference between the nationalities not due to the drier quarters the true explanation would be found in the greater power of the French soldier of adapting himself to circumstances, better cooking, greater use of vegetables when procurable and greater skill in improvising substitutes.

There can be no doubt however that a state of chronic depression of spirits has an influence on the bodily health generally, and may thus predispose to scurvy.
A life of inactivity in a standing camp or of anxiety in a besieged garrison, or life on shipboard on a long voyage with baffling head winds or still and keel-operating calms, all these are circumstances eminently calculated to depress the spirits, and it is precisely under such circumstances that the worst outbreaks of scurvy have occurred in all ages.

**Bad Water**

This, although insufficient of itself to produce scurvy, may unquestionably act as a predisposing cause by affecting the general health. In nearly all the accounts of scurvy among the early voyagers we read of foul water as an accompaniment to their other troubles, and they evidently looked upon it as helping to contribute to the disease. That scurvy may occur along with the finest water supply there is abundant evidence to show, but it will probably occur more quickly and with greater severity when the water supply is bad. Many of the early writers on scurvy lay much stress on this point.

It is interesting to note, although of course proving nothing, that the seamen at this time always blamed the drinking water, which they justly described as very bad, as being the chief cause of the sickness among them.

**Malaria**

Of all the predisposing causes of scurvy this is the
Most important. Its connection with scurvy was noticed at a very early date. Wierus, who published his work "De Scorbuto" in 1567, remarks the frequent connection of scurvy with acute and malignant forms of fever. Brunner (1658) insists upon the influence of damp marshy localities and other sources of malaria in producing scurvy.

Subsequently this factor seems to have been a good deal overlooked by our writers. There is little malaria in Great Britain and none on the sea which has always supplied the majority of our cases, so it is natural that little attention should have been directed to the influence of malaria. But lately several writers, among others Dr. Parke and Aitken, have done good service by calling attention to the great influence exercised by scurvy on malaria, and on malaria by scurvy. The outbreak which I have endeavoured to record furnishes a most facible example of this.

**Exciting Causes of Scurvy.**

Salt meat has always held a prominent place among the alleged causes of scurvy, and it is probable that at the present day it would be found that a majority of even educated persons if asked what caused scurvy would answer off hand that salt meat was the cause. It is not difficult to explain this. Except in some of our campaigns, of
the medical history of which the public is unfortun-
ately profoundly ignorant, rancor has for the
most part confined its ravages to our seafaring po-
pulation. Every one knows that sailors live chiefly on
salt meat, and that salt meat is generally blamed
for attacks of scurvy on board ship, and every one
has read the accounts of our early voyagers and
been struck with the vivid descriptions of the attacks
of scurvy, and the terrible suffering and mortalit
from them; while in no historical account of campaigns
is any prominence given to the fact that a far greater
mortality has resulted from scurvy and septicemic
diseases than from the fire of the enemy. This is
greatly to be regretted, for were the public once aware
of the enormous amount of suffering and mortality
that thus occurs, there can be no doubt that a weight
of public opinion would be brought to bear upon
the authorities such as would make scurvy in our
armies a thing of the past. But as the matter stands
at present, and "salt meat" still represents the or-
dinary popular idea of the causation of scurvy.
That a diet of salt meat will not cause scurvy, pro-
bided it is accompanied by a sufficiency of bege-
tables or linie juice has been proved in numerous
instances, and that scurvy will occur without any
salt meat being eaten at all has also been abundantly
proved. Numerous instances have been recorded.
of campaigns where armies have been well supplied with fresh meat and have nevertheless been stricken with scurvy. Copland instances several such cases, as the Russian armies in 1736, which had abundance of fresh meat; the French prisoners in the middle of last century, who had no salt provisions; the regiments at the Cape in 1836, which had an ample supply of fresh meat. To these might be added any number of more modern instances, one recent one being the Penang during the American war. Other instances, such as that of our native regiments in the Burmese war, and in our last Afghan war, show that scurvy will occur without the introduction of any meat diet, whether fresh or salt.

It may still be asked, however, whether people on a diet of salt meat are not more prone to contract scurvy than on a fresh meat diet, the other conditions being the same. As a rule it would seem that they are. Perhaps if the salt meat were of good quality originally, and recently salted, there might be little difference; but since salt meat, especially as supplied by contractors, is not often of this description, this supposition may very well be left out of the question. That scurvy is likely to appear sooner under the use of ordinary salt junk than under the use of fresh meat is unquestionable. So markedly is this the case that fresh meat has been put forward as an
actual antiscorbutic. Dr. Kane, in his account of his Arctic voyage, speaks of raw walrus meat as an absolute specific for scurvy, and is quoted on this head by so high an authority as Dr. Parke. But it is evident from Dr. Kane's narrative generally that the specific was of limited efficacy, and it seems to have really done little in the way of checking the disease.

It would seem not unlikely, however, that an abundant supply of good fresh meat will at least delay the advance of scurvy for some time if it does not ward it off altogether. The evidence on this head is rather conflicting, and the question is still involved in a good deal of obscurity. On the one hand there is, as before remarked, ample evidence of scurvy having attacked men who were well supplied with fresh meat, but on the other hand there is the fact that many races, as for instance the hunter tribes of both North and South America and the Gauchos of the latter continent, subsist almost entirely, if not entirely, on animal food, and are not so far as is known liable to scurvy. Hamilton indeed mentions in his Military Surgery that the American Indians put up for winter quantities of dried plums, buffalo berries and choke berries and thus escape scurvy, and it is possible that those who have written about savage tribes, being chiefly non-medical men, have overlooked and thus omitted to notice their consumption of
fruits, but it is also possible, as I shall have occasion to remark further on when speaking of milk, that there may be this to be said; that certain articles of food such as fresh meat and milk may be sufficiently antiscorbutic in their properties to preserve from scurvy when used as the sole or chief article of diet, but not sufficiently so to protect from the disease when they are merely used as adjuncts to other articles of food. Starvation, simply as starvation, i.e. want of or deficiency of food in general, has been put forward as an exciting cause of scurvy. Many medical men who witnessed the scurvy which followed the failure of the potato crop in 1847, came to the conclusion that starvation and nothing else was the cause of it. That it did occur to a large extent among the starving people is undoubtedly, nor is it to be wondered at. If a man's supply of vegetables is cut off, it is hardly probable that he will be rendered unavailable by scurvy simply because other provisions are at the same time denied him. But the well fed Irish in this country, who were earning high wages as navvies and living on the best provisions they could get for money, suffered also to a great extent simply because the supply of potatoes, the only vegetable they were used to, was cut off, and numerous instances occurred among our own countrymen, not starved in any ordinary sense of the term,
but deprived of potatoes and too ignorant to know the necessity of providing a substitute.

In most campaigns too where scurvy has occurred, the troops have been well fed on the whole, the only deficiency being in the supply of vegetables. Want of fresh vegetables was shown by Backstrom as long ago as 1794 to be the real exciting cause of this disease, and the use of them the chief prevention and cure. Although this opinion but slowly gained ground, and many writers, down almost to the present day, persisted in looking away from the real cause to the mere concomitant, the use of salt provisions, still its advance if slow has been steady, and it is almost the only view now entertained among scientific men, however much they may differ as to the nature of the essential principle contained in the vegetables.

The proof that fresh vegetables and fruits contain the necessary principle, the want of which occasion scurvy, is that while a sufficiently lengthened privation from them (or their salts as in limejuice) invariably causes scurvy, no matter what the diet otherwise may be; on the other hand no single instance has ever been recited of scurvy occurring where they have been supplied in sufficient quantity.

The observations of scurvy have been so numerous, the printed records alone amounting to thousands, that we have here as complete an inductive proof
as could be desired, and a few cases of scurvy occurring under the use of lime juice prove nothing, were it for no other reason than the uncertainty as to the nature of the lime juice or whether it was lime juice at all. In my own experience the lime juice furnished by the Commissariat was certainly not pure lime juice, and much of it I believe had not a single drop of lime juice in its composition.

I come now to consider the modern theories as to the nature of scurvy, and as these are all based on the hypothesis of an altered state of the blood, I shall endeavour to state briefly in the first place what is known as to its condition in this disease. This is unfortunately very little, although the amount of conjecture has been enormous.

The Blood in Scurvy

From an early period observers have remarked that the blood was altered in some way. Indeed this could hardly escape the observation even of the most careless, as extravasations and hemorrhaps play such a prominent part in the disease.

The blood was noticed to be altered in colour; to be darker and to have less of the red element in it.

It was also noticed as having greater fluidity - Rouffe described it as appearing often as a mere gore, not separating into Wassermann and alemum, and putrefying soon. It appears to be stained in some
essential ingredient. It flows with difficulty from the veins, and after standing some hours, deposits a thick muddy sediment, which subsides from a reddish tinge, and in the last stage of the disease it becomes quite black. Notwithstanding this passage however we find that the blood is generally mentioned as retaining its power of coagulation, and Poupart makes note of large coagula being found after death in the heart's cavities.

In Dr. Bush's analyses, which I quote, the fibrin is shown to be in larger quantity than in normal blood, and other observers (Strohler and Audial) have corroborated this.

Chattel and Bouvier made the important observation that the albumen of putridic blood requires a higher temperature to coagulate it than is required by normal blood—from 5° to 8° F. higher. This looks as if the albumen in blood underwent some change increasing its solubility.

These observers also found that the cohesion of the fibrin was so much lessened that they were unable thoroughly to isolate it from the red corpuscles. This attraction between the fibrin and the red corpuscles is what early writers on seury described by such names as "agglutinated blood," "viscid and thickened coagulation.

There seems to be no more recent reliable analysis of the blood in seury than that of Mr. Buck.
General Pathology

Published in Dr. Budd's article on Scrovy in "The Library of Medicine." It is as follows:

In 1000 Parts of Blood

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<th></th>
<th>Water</th>
<th>Red Corpuscles</th>
<th>Fibrin</th>
<th>Albumen</th>
<th>Salts</th>
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<tr>
<td>Normal Blood</td>
<td>788.8</td>
<td>133.7</td>
<td>3.3</td>
<td>67.2</td>
<td>6.8</td>
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<tr>
<td>Scrovy Case 1</td>
<td>849.9</td>
<td>47.8</td>
<td>6.5</td>
<td>64.0</td>
<td>9.5</td>
</tr>
<tr>
<td>&quot;</td>
<td>835.9</td>
<td>72.3</td>
<td>4.5</td>
<td>76.6</td>
<td>11.5</td>
</tr>
<tr>
<td>&quot;</td>
<td>846.2</td>
<td>60.7</td>
<td>5.9</td>
<td>74.2</td>
<td>10.9</td>
</tr>
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</table>

According to these analyses, there is a diminution in the red corpuscles in all the three cases of Scrovy, with an increase in the water, fibrin and salts, while the albumen is in one instance slightly diminished, and in the other cases increased.

Unfortunately Mr. Bush made no analyses of the salts, which are now regarded as the most important element in the disease.

Dr. Garrod in 1848 found that potash existed in smaller quantities in the blood and urine of Scrobutic patients than in health, and on this fact he based his celebrated theory of the causation of Scrovy, which will be referred to further on.

Dr. Ralfe in the Lancet of 1877 stated that he found the alkalinity of the urine decreased, a fact that had been previously observed, and arguing from this and from analyses of scrobutic and anti-scrobutic diets and the known physiological effect on animals of
induced hyperacidity of the blood, resembling in many points the phenomena of scurvy, he comes to the conclusion that the blood of scrobutic patients is deficient in alkalies. He gives no analyses of blood, however.

It seems quite certain that the blood is altered both chemically and physically, but whether the phenomena of scurvy, nearly all of which can be referred to some altered relation between the capillaries and the tissues, permitting some or all of the constituents of the blood to pass into the latter, are due to the altered chemical or physical nature of the blood, or to both, our present knowledge does not enable us to say.

Modern Theories as to the Proximate Cause of Scurvy.

Deficiency of Vegetable Albumen or Animal Casein in the food was supposed by Dr. Christian to be the cause. He maintained that scurvy was due to deficiency in the azotized element in food and consequent insufficient nourishment. Milk was the remedy he proposed, and a striking instance which he relates of the effect of milk being introduced into the diet of the prisoners in the State Penitentiary, would seem to lend some support to this view.

But, on the other hand, peas contain a large proportion of vegetable albumen, and are utterly useless as a preventive against scurvy, peascod being a staple article of diet on shipboard, and having been repeatedly
used in cases where scurvy appeared, sometimes almost to the entire exclusion of meat, but without any effect on the disease. And even milk itself has been found in many instances powerless to prevent the disease. My own experience of milk is not favourable to the idea of it having any powerful antiscorbutic properties.

It is extremely probable however, that milk has some antiscorbutic virtue, but due rather to lactic acid than to casein. It is easily conceivable that a small quantity of milk added to a diet may produce little or no effect, while on the other hand a diet consisting largely, or as is often the case almost wholly, of milk, may. So far as we know scarcely any of the nomad races of Asia use any vegetables, yet we hear nothing of the existence of scurvy among them, and it will be seen that I attribute the non-appearance of scurvy among the inhabitants of the Kumaon Valley to their free use of curdled milk.

A deficiency in Sulphur, Phosphorus, Lime and the Alkalies is supposed by Dr. Aldridge to be the proximate cause of scurvy. Probably he is correct in supposing that some or all of these salts are deficient, but mere deficiency in them will hardly account for the disease, as all these substances are contained in sufficient quantity in many articles of food, as for example the dry leguminosae, which are never
the less useless as preventives of scurvy.
Deficiency of Potash Salts was brought forward
in 1848 by Dr. Garrod as the cause of scurvy. He
asserted that the malady was due to nothing else
than want of potash, and that antiscorbutics acted
as much simply in virtue of the potash they contained.
He arrived at the following conclusions:
1. That in all scorbutic diets potash exists in much
smaller quantities than in those which are capable of
maintaining health.
2. That all substances proved to act as antiscorbutics
contain a large amount of potash.
3. That in scurvy the blood is deficient in potash,
and the amount of that substance thrown out by the
kidneys is less than that which occurs in health.
4. That scorbutic patients will recover when potash
is added to their food, the other constituents remaining
as before, both in quantity and quality, and without
the use of succulent vegetables or milk.
5. That the theory which ascribes the cause of scurvy
to a deficiency of potash in the food is capable of
rationally explaining many symptoms of that disease.
The first of these propositions is absolutely incorrect,
many scorbutic diets containing more potash than
diets which will preserve health; and although the
second proposition is perfectly true, it is capable of
proving nothing unless, as Dr. Buzzard points out,
the converse is also proved correct, and it is shown that all substances containing a large amount of potash are capable of acting as antiscorbutics. This is pretty nearly what is asserted in Dr. Garrod's proposition, but it is unfortunately not in consonance with known facts. The Carbonates of Potash and Nitrate of Potash have been given repeatedly in remedy without effect, and even a stronger evidence against the theory is the well-known experience of Dr. J. D. Grant, who in an outbreak of scurvy among lumberers on the Ottawa, found 25 men out of 36 in one shanty affected by the disease, although living on pork salted with Nitrate of Potash.

There is one point however in connection with Dr. Grant's case, which seems to have escaped notice. Soda is such a universal constituent of ordinary diet that the idea of a deficiency of this substance causing scurvy does not readily occur to us. Yet it is quite as likely that scurvy might arise in connection with a deficiency of Soda as a deficiency of potash. The fact of the meat used by Dr. Grant's lumberers being salted with Nitrate of Potash shows that Chloride of Sodium at all events was scarce, and it is in consequence probable that Soda was deficient in their dietary. Might not the scurvy in this case be connected with deficiency of Soda in the blood? I do not say it was caused by this, any more than I would say that
ordinary scurvy is caused by a deficiency of potash, but it is not highly probable that it was connected with it in the same way as ordinary scurvy is often at least connected with deficiency of potash, and that the blood of these patients of Dr. Grant's been analyzed it would have been found deficient in soda rather than potash?

I think this is a point of some interest, and I do not remember having seen it noticed before.

Deficiency in the salts whose acids form Carbonates in the System

By exclusion, we are led to the opinion that if the cause of scurvy is to be found in the deficiency of salts, it must be in the salts whose acids form Carbonates in the System.

For, if we are right in looking to a deficiency in the fourth class of alimentary principles (the salts) as the cause of scurvy, and if neither the absence of soda, potash, lime, magnesia, iron, sulphur or phosphoric acid can be the cause, (and it is probable it is not so) then the only mineral ingredients which remain are the combinations of alkalies with those acids which form Carbonates in the System, viz., lactic, citric, acetic, tartaric and malic.

This, which is the conclusion come to many years ago by Dr. Parke, represents pretty accurately, I believe, the opinion of most medical men of the present
The influence of the citric acid of commerce is by no means certainly proved. Statements and opinions upon this point are very contradictory, but the bulk of evidence is certainly opposed to the utility of citric as well as of Tartaric and Acetic Acids. There seems reason to believe that the bitartrate and Citrate of Potash have some influence as astringent, though their power is certainly less than that of fresh vegetable juices. It is probable therefore that although the organic acids and potash separately do not represent the required material, it is to be found in the chemical combination of the acid and base.

That these salts should act more powerfully in their natural combinations in vegetables and fruits is only consistent as Dr. Parker points out with our knowledge of the action of many other remedies. The Materia Medica gives numerous analogous examples of the superior efficacy of a medicine in its natural combinations.

Deficient Alkalinity of the Blood.

In 1877 Dr. Ralfe published two papers in The Lancet in which he adopts the conclusion come to by Dr. Parker, whom however he entirely ignores in connection
with it, speaking of it as a "suggestion of Dr. Burrell". Dr. Ralfe aims however at carrying the theory further and showing that the primary alterations in Reuxy seem to depend on a general alteration between the various acids, inorganic as well as organic, and bases found in the blood, by which (a) the neutral salts, such as the Chlorides, are either increased relatively at the expense of the alkaline salts, the Carbonates or phosphates, or (b) that these alkaline salts are absolutely decreased.

After reviewing what is known as to the blood in Reuxy, he passes to the analysis of the urine, our knowledge of the condition of which is still, strange to say, very imperfect. Dr. Garrod as we have been found that the potash in the urine of Reuxy was diminished. Heber noticed increased Ammonia and earthy phosphates and a diminution of Chloride of Sodium, while Martin has given an analysis in which the earthy salts consisted mainly of Chloride of Sodium. It has generally been observed however that the urine when passed was only slightly acid, and rapidly decomposed and became ammoniacal.

Dr. Ralfe first investigated the "physiological effect of the withdrawal of vegetables on the urine" as seen in the analysis of the urine of a patient kept for 18 days without vegetables, and he found that there was:
Increase of free acid (more than double)
" " area (one third)
" " uric acid (double)
" " chlorine (one third)
" " sulphuric acid (one sixth)

While phosphoric acid in combination with the alkaline bases is diminished one third.

Passing on to the examination of the urine of recent patients he finds:

Increase of urobilin
" " chlorine

Decrease of free acid
" " area

" " alkaline phosphates

This diminution in the quantity of free acid and alkaline phosphates is due according to Dr. Ralphe to the want of carbonic acid (derived from the vegetable acids) in the blood; this carbonic acid in healthy blood combining with an alkali in the form of bicarbonate and then acting upon neutral phosphate of soda to form carbonate of soda and acid phosphate of soda.

Bicarbonate of soda + Neutral Phosphate = Carbonate of soda + Acid Phosphate

NaHCO₃ + Na₂HPO₄ = Na₂CO₃ + NaH₂PO₄

Dr. Ralphe comes to the following conclusions:

1. That the primary change that occurs in scrofulous is a chemical alteration in the quality of the blood.
2. That the chemical alteration, so far as can be judged from inferences drawn from the analyses of urine of patients suffering from rachitis and analyses of zonotic and antizonotic urine, points to a diminution of the alkalinity of the blood.

3. That this diminution of alkalinity is produced in the first instance (physiologically) by an increase of acid salts (chiefly urates) in the blood, and finally (pathologically) by the withdrawal of salts having an alkaline reaction, chiefly alkaline carbonates.

4. That this diminution of the alkalinity of the blood finally produces the same results in rachitic patients as happens in animals when attempts are made to reduce the alkalinity of the body (either by injecting acids into the blood or feeding with acid salts) viz., dissolution of the blood corpuscles, ecchymoses, and blood stains on mucous surfaces, and fatty degeneration of the muscles of the heart, the muscles generally, and the secreting cells of the liver and kidneys."

The diminished alkalinity of the blood is a very old hypothesis, and is also a very probable one, but it can hardly be said to be established conclusively by Dr. Ralfe's paper, although this is undoubtedly a valuable contribution to the pathology of rachitis. Even if future observations and researches should prove its correctness, it will in all likelihood be found to be only part of the truth. The problem to be
solved is most probably vital as well as chemical in its nature, requiring for its solution greater knowledge of vital laws and forces than we at present possess.

But it is with dury as with smallpox. Although pathologists may dispute as to the nature of the case, physicians are at one as regards the antidote, and we may confidently look forward to a period when with increased knowledge on the part of the public, this disease will become almost if not wholly a thing of the past.
Chapter II

Morbid Anatomy of Scurvy

The body is usually emaciated, but not necessarily so. If the supply of food during life has been ample, there may be no appearance of emaciation. Externally the body presents the same appearance as during life. There will be a greater or less amount of ecchymotic patches and blebs on the skin, and other appearances such as swellings ulcers etc, according to the extent to which the disease has advanced. Blood will often be noticed flowing from the mucous passages.

Blood or fibrinous effusion coloured by blood will be found extravasated under the skin into the subcutaneous cellular tissue and into the aponeurotic sheaths of muscles, sometimes infiltrated between the muscular fascia and bruising and breaking the muscular fibres. The lower extremities, particularly the hands are found most severely affected in this way, after them the arms, particularly at the bend of the elbows, and the region of the jaw under the stylo-mye muscle. These effusions when they occur under the periosteum, not infrequently lead to necrosis of the bone, and this has frequently it is said, occurred in the case of the jaw, which from its structure is very liable to necrosis under unfavorable conditions.
effusions of an acedematous nature are also often noticed, particularly about the feet and ankles. The texture of the muscular tissue of the body generally would appear to be more soft and flabby than in health.

Poupart says that on moving the limbs of some scorbutic patients a noise was heard, and that on examining the joints the epiphyses had entirely separated from the bones; and in other cases that the cartilages of the sternum had separated from their bones, and bones that had united after being broken by often separated again at the site of fracture. He said that if he squeezed the ribs which had thus begun to be separated from their cartilages, there came out an abundance of corrupted matter, so that nothing was left of the rib but its bony plate.

The brain is sometimes found normal. Sometimes there is effusion of serum under the arachnoid and into the ventricles, while the vessels on the surface of the brain are empty and its substance pale. At other times the cerebral vessels are found gorged with dark fluid blood or coagula.

Sometimes there are ecchymoses on the surface of the brain and sanguineous effusions into its substance. Adhesions often exist between the corporal and pulmonary pleura, and the pleural cavities sometimes contain serous, at other times sanguineous effusion.
The lungs vary much as to their condition. Sometimes they are pale, shrunk and bloodless; at other times more or less gorged, sometimes with serous, sometimes with bloody fluid. Occasionally motlings or violet-coloured marblings like those on the skin during life have been found on the surface of the lungs after death. On cutting into these they are found to be superficial in character. The lungs have also oft times a serous or bloody fluid infiltrated into the interstices of the bronchioles, especially at their bases. Sometimes the lungs are completely engorged, but this never occurs to the same extent as is seen in Acute Pneumonia. This engorgement is most marked at the diaphragmatic aspect of the lungs anteriorly and posteriorly. Small ecchymoses occur frequently at different parts of the lungs, little deposits of uncoagulated blood. These may be of larger size, or several may coalesce and form fluctuating tumours of large size contained in cavities of irregular form without any lining membrane. These tumours may burst into a bronchus and give rise to considerable haemoptysis. Decomposition of the fluid in these tumours may give rise to a state simulating gangrene of the lung or it may actually pass into gangrene. The affected portions are then greenish-grey, mixed with dark
fragments and containing air bubbles and an ichorous bloody fluid. The lungs break up on slight pressure and have a most offensive odour.

The heart seems generally to be pale and flabby. It sometimes has its cavities empty. At other times they are distended with dark fluid blood, or with fibrinous clots.

Sometimes the lining membrane of the heart as well as that of the aorta and pulmonary artery is stained of a reddish colour, but more frequently this appearance is wanting.

Patches of echymosis have been found under the pericardium covering the heart. Occasionally, the muscular substance of the heart itself has been found to be echymosed.

The cavity of the pericardium has occasionally been found to contain dark fluid blood.

The stomach and intestines may have echymotic patches in their coats, having the appearance of small bruises. These are generally more marked in the intestines and increase in frequency towards the lower part. They are not a constant phenomenon, and Pocock and Land say that in cases where flux or dysentery is absent the intestines have been found perfectly sound, however copious the hemorrhage from them may have been.

Dr. Ritchie has noticed an enlarged condition of the
Solitary glands in the ileum.
The herring is often enlarged and gorged with dark blood.
The spleen is almost always enlarged, and often so soft as to break down on being handled.
The kidneys are less often altered, but coaguloses into their substance are occasionally found.
Sanguineous effusion into some part or parts of the body is the one constant and invariable appearance met with, but the heat of this as we have seen varies extremely.

Nature of the effusions. "These are essentially fibrinous in character, more or less coloured by blood corpuscles. They are sometimes gelatinous in consistence, marked with streaks of a pale yellow colour, somewhat resembling the fibrinous clots so often seen in the heart. They occasionally exhibit a higher degree of organisation. Deposits of this kind occur in the form of layers of from a quarter of a line to a line in thickness, composed apparently of fibrin of a bright yellowish red colour, firm and elastic, as if taking no fluid on pressure; they are in fact false membranes, and are quite distinct from the surrounding muscles to which they adhere. This kind of deposit has been termed 'areseniciform'. The stiffness of the joints and especially of the knees, appears to be caused by the firm consistence of these effusions.
Upon injection capillary vessels have been discovered, which in their character and mode of distribution are similar to those met with in other recently organised adventitious tissues. It seems most probable that the hypertrophy of the gums proceeds from the deposit of a plastic material."

In some epidemics (if I may use the term) of fever there would appear to be a marked tendency to the effusion of dark liquid blood into the various cavities and synovial membranes, the most common site being the pericardium and after that the peritoneum. The blood is altered as we have seen during life, and this alteration is still more marked after death. This was noticed early in the history of the disease, and Despout and other observers remarked that the blood was more fluid than usual, and was broken down and of a more or less greenish black hue. More recent observers have noticed a deficiency of colour and staining power and attributed this to a deficiency of red corpuscles. These are very much lessened in number and are in all probability altered in composition as well as in quantity.

A brief summary of what is known as to the blood in fever has been already given in the Chapter on the General Pathology of the Disease.
Chapter III.

Symptoms of Scurvy.

The earliest symptom of Scurvy is usually said to be a change in the colour of the skin, which becomes pale or sallow or greenish, according to the complexion. This change is usually first noticed in the countenance. The skin at the same time becomes harsh and dry, and generally continues so throughout the disease. Sometimes it is rough, like "nitio anaemia," but more commonly it is shining and blotted—shortly after or simultaneously with this appearance of the skin there comes on a feeling of listlessness and disinclination for exertion. The patient ceases to take an interest in anything, and wishes only to be let alone.

Petechiae generally soon make their appearance, usually beginning about the legs and thighs. These petechiae are at first of small size, of a reddish brown colour, fading away at the edges. They are said to be specially liable to occur where hairs pierce the skin. The gums have generally been described as being among the first portions of the body to alter, but recent writers seem to throw doubt upon this. Dr. Blizzard, writing in Reynolds' Medicine, says that his experience does not agree with the view that the alteration in the gums is an invariable early symptom, and that all the phenomena of Scurvy may be present.
and the gums be unaltered save that they are paler than usual. In support of this he cites Dr. Bellingham (Dub. Med. Pap., Vol. 74), of Skinner on Remoy in Exeter, and Frank writers. What I have myself observed is in support of the old view, but it is possible that the phenomena may vary to some extent in different outbreaks.

All are agreed that as a rule the gums begin to alter early, the first indication being pain to be a swelling at the free margins. This gradually increases, and the gums become spongy and fleshy and overlap the teeth. Their colour is described as dark red or livid. They are much disposed to bleed, usually on very slight provocation, such as chewing or brushing the teeth. The bleeding is commonly trifling, but may be to a large extent.

As this swelling of the gums increases the teeth become loose in their sockets and in advanced cases may drop out.

The eye and its surroundings are said to be at times the only parts exhibiting signs of decay. The integument around the orbits is puffed up like the result of a bruise.

What must be a very characteristic appearance when observed, but which does not appear to be of very frequent occurrence, has been described by some writers. This is a turbidity and brilliant red colour of the conjunctiva covering the sclerotic.
This is raised "about the eighth of an inch in thickness or elevation above the cornea, leaving the cornea at the bottom of a circular trench or well" (Bird on Scurvy quoted by Dr. Buzzard). This condition is said to have nothing inflammatory in its nature, resembling very violent ophthalmia in colour, but without discharge or pain. Dr. Buzzard says: "We have been many cases in which this appearance together with pallor of the complexion and listlessness constituted the only evidences of scurvy, and they have generally been of the most serious character, often terminating fatally."

The essential feature of scurvy is the altered quality of the blood leading to extravasations, and as the disease advances these extravasations become a marked characteristic of the disease. Dr. Atkin divides them into:

1. Superficial, (a) Dermic (b) Subdermic
2. Deep-seated (a) sub-aponevrotic (b) Parenchymal

But these distinctions are rather pathological than clinical.

Swelling in the flexures of the joints is one of the most frequently observed results of extravasation. This is most frequently observed in the hand. The hollow between the insertions of the flexor muscles is filled up more or less completely by a hard mass, not putting up gentle pressure like oedema but requiring firm pressure to make it yield. Its resiliency
is less also than that of edema so that when it has been pitted the pitting remains longer.
These swellings are usually described as of a dark purple colour, but according to my experience these may or may not be discoloration. This will depend on whether there has been extravasation into the subcutaneous areolar tissue or not.
Although occurring with greatest frequency in the hand these swellings may occur at other points, as the bend of the elbow and the submaxillary region. With the increase of the swelling in the hand the limb becomes more and more flexed, and the patient becomes almost wholly unable to use the limb. Walking gives great pain. There may or may not be pain during rest, as this will depend a good deal on the amount of pressure on nerves.
When the swelling is at the flexure of the jaw, the patient experiences pain on attempting to move it. These swellings are very persistent and resist treatment to a great extent. They may terminate either by resolution or in an unfavourable case by ulceration forming a sort of indolent boil with a deep red base and black summit, accompanied by edema of the surrounding connective tissue.
When extravasations occur beneath aponeuroses they are bound down by the strong fascia and the swelling often develops at a distance from the actual seat.
of effusion; thus an extravasation beneath the fascia late may give rise to a swelling in the leg. Sometimes there is subperiosteal effusion, and such effusion in the front of the tibia may simulate syphilitic nodules.

Scorbutic Ulcers are very characteristic accompaniments of the disease. They may develop from petechial or from any of the more superficial extravasa-
tions, or they may be the result of any scratched or wounded in a scorbutic subject. In far advanced cases a very slight pressure may be sufficient to develop a scorbutic ulcer.

Scorbutic ulcers exude a thin foetid jaunty fluid, instead of pus. Their edges are of a livid colour, and as if puffed up: a coagulum soon forms on their surfaces, which is separated or wiped away with difficulty. The parts underneath are soft, spongy or putrid. When this coagulum is removed, the same change again occurs after a few hours, forming a soft bloody fungus, resembling boiled bullock’s liver. This fungus exudation, Dr. Reid states, sometimes rises in a night to a great size, and although cut off, in which case a plentiful fulminating hemorrhage ensues, at the next dressing is as large as ever.” (Copland).

Digestive System.
The lips are pale; the tongue generally clean and
Symptoms

Moist, often flabby and showing marks of the teeth. Sometimes it is red, and sometimes pale with a violet tinge.

The breath is often very offensive, a result most probably of the state of the gums, which are frequently blooming.

Sometimes there is ptosisism with swelling of the parotid and submaxillary glands.

The appetite is fair as a rule at first. Further on in the disease it becomes impaired, as a result of the general impairment of health.

Emaciation is not a necessary concomitant of Scurvy unless there has been actual deficiency in the quantity of food. The patient it is said may actually gain in weight while becoming rachitic. This however probably applies only to the earlier stages. As the disease advances and is accompanied by disordered nutrition and excessive, above all, discharges, there must necessarily be loss of weight.

Constipation has usually been noticed at first, or at least a sluggishness of the intestinal system. As the disease advances there is very commonly diarrhoea and often dysentery.

Dr. Buzzard says that although the diarrhoea of Scurvy may be bloody, it is painless and never sepulchre, and he does not consider true dysentery a symptom of Scurvy although it may be a concomi
Symptoms

I trust this may hold good as far as this country is concerned, but it is otherwise in countries where dysentery is more common. There if dysentery be a concomitant merely, it is a very frequent concomitant.

There is often a fatal result from exhaustive diarrhoea or dysentery.

Respiratory System.

Breathlessness is always an early and constant symptom of severe. Auscultation reveals nothing beyond a slight increase of the respiratory murmurs.

Further on patients often have an affection of the chest simulating pneumonia, but without the physical signs of that disease. This is due to effusion of serous or sanguineous fluid either into the pleura or the parenchyma of the lungs. In the latter case it is usually a circumscribed tumour, but may burst into a bronchus and cause haemoptysis. There are many of the symptoms of pneumonia, rigor, followed by acute pain in one or both sides, and difficulty of breathing.

There is expectoration of a very viscid mucus. After a time, as the effused fluid decomposes, symptoms may set in which resemble those of gangrene of the lung, the expectoration becoming dark and fatty, and a horrible foetor being also present. Cold sweats may now come on, with increased difficulty of breathing, small frequent pulse, sinking and death—sometimes
without any premonitory symptom the breathing may suddenly become short and laboured and the patient die.

There are usually no well marked signs of mischief to be detected on examination. Now and then over the spot where there is an effusion there may be a little localized dulness on percussion, or there may be some unusual rales or gurgling, but this is rare. Sometimes dulness on percussion may be due merely to effusion into the muscles of the chest, and totally unconnected with lung mischief.

The diaphragm is occasionally the seat of effusion, and this may give rise to great difficulty of breathing and be mistaken for effusion into the lung.

Lung complications are of evil omen in burns.

Circulatory System.

The pulse is generally not much affected at first. If anything it is slower and feeblest than in health. Later on, when there is much debility accompanied by a certain amount of subacute inflammation, the pulse is more commonly frequent but small and weak.

The old writers distinguished between "cold seury" and "hot seury", the former being when the pulse was slow and feeble, the patient chilly and the skin cool and moist, the latter when some febrile action accompanied effusion rendered the pulse more rapid and the skin hot and dry.
The action of the heart is weakened in all cases of saturn, and in advanced cases is so much so that fatal syncope frequently occurs. This has been described from the earliest times as one of the most characteristic features of saturn; that a patient, apparently far from moribund, will on making some trifling exertion suddenly drop down dead. We are far from being able to account for this satisfactorily as yet. Decoyses on the surface and extravasations into the substance of the heart are sometimes found; it is true, but no connexion has been established between these and the syncopeal attacks, and it is probable that the latter are due to something wanting in the nutritive quality of the blood impairing the nutrition and function of the heart.

The condition of the blood has been already described; we have seen that one of the most manifest and certain changes was a decrease in density. It is quite conceivable says Dr. Buzzard, "that the exudation of languid serous fluid may depend upon the increased tendency to exudation which such an alteration would naturally produce."

Here was also, it will be remembered, an altered state of the albumen, apparently an increase of solubility, which caused it to require a higher temperature for coagulation; and the fibrin, which was increased, seemed to have its vital cohesion impaired in some
way. Probably all these changes have a share in producing the extravasations which characterize scurvy.

**Gastro-Intestinal System.**

The urine is generally high coloured, even dark or almost black. It is slightly acid when evacuated, but soon decomposes and becomes alkaline, and emits a strong fetid ammoniacal odour. Sometimes it contains blood.

The urine seems to be diminished, while the uric acid is increased.

The free acidity is diminished, hence the rapidity with which it becomes alkaline.

The chlorides are increased, and the alkaline phosphates diminished.

**Nervous System.**

Sleep is not much affected at first, but later on there is a tendency to sleeplessness or broken sleep.

The mental faculties are not much impaired, except that the patient is listless and apathetic.

**Nystagmus, or Hemeralopia, or if it is perhaps more properly called, is not uncommon.**

Limitus aurium, dizziness, vertigo, and deafness, are all of more or less frequent occurrence.

Some old writers speak of palsy of the lower extremities. The loss of power in the limbs produced by the infiltration of the brains is sometimes so great that a non-medical observer might mistake it for paralysis, but I cannot
find in recent writers any reference to the anaesthesia of
the lower extremities described in the following extract,
which I give entire as a very graphic description of an
outbreak of scurvy by an old writer. It is from an ac-
count of Commodore Roggewein's Voyage in 1721. ("World

"The scurvy spread so fast that it began to carry off four
or five of their best hands every day, so that though
they had already reduced three ships' companies to two,
they more than once deliberated whether they ought not
at present to burn one of the remaining vessels, and
the only argument that restrained them from doing it
was that in case any accident befell one, there was still
a possibility of escaping in the other. There was nothing
to be seen on board but sick people struggling with
inexpressible pains, and dead carcases that were
just relieved from them, whence arose so intolerable
a stench that such as yet remained sound were not
able to endure it. Cries and groans were perpetually
ringing in their ears, and the very sight of those who
were able to move about, was sufficient to move at
once terror and compassion; for some of them were
such perfect skeletons that their skin seemed to cleave
to their bones, in which sad circumstance they had
this consolation that they felt no pain, but gradually
consumed away. Others again were swelled and puffed
up to a monstrous size, and were troubled with such
violent pains as frequently rendered them delirious. Others were worn away by the dysentery, while many suffered the most excruciating tortures from the rheumatism, and others dragged their dead limbs after them, the feeling of which had been taken away by the palsy, while others again were carried off so suddenly that in the midst of their discourse they stopped short and were found to be dead. Even such as were reputed in health were low and weak, and our author says that although he was as well as any on board yet he had the rheumatism to such a degree that his teeth were all loose, his gums inflamed, and his body covered with spots of different colours. Added to this distress, their salt meats were corrupted, their head was full of maggots, and their water stunk to an intolerable degree.
Chapter IV.

Prevention and Treatment of Scurvy.

I shall not occupy much space with a consideration of the prevention and treatment of scurvy, as the essential points have been sufficiently indicated in what has been said as to the general pathology of the disease.

The main point is to have a sufficiency of fresh vegetables or fruits in the dietary, and if this is accomplished nothing else is required.

The most important natural orders are the Cruciferae for vegetables, and the Aurantiacae for fruits, but all fresh vegetables are useful, and potatoes, onions, leeks and garlic, although not belonging to the Cruciferae order are almost or quite as useful as the plants that do.

So with fruits, although lemons, limes and oranges are the best known and most popular remedies, all acid or subacid fruits are useful, and the sweeter kinds of fruit, although not of so much use when thoroughly ripe, are very useful when ripening.

Many plants not popularly known as vegetables are of great efficacy. Scurvy grass (Cochlearia officinalis) is the oldest of all known remedies for scurvy, and is still used, along with sorrel and other plants, by the dwellers in the Arctic regions. The leaves of the dandelion are a useful and widely spread substitute for vegetables, and one that I have used myself and recommended to others with profit. Watercress is another very useful
wild plant, and seems also pretty widely spread. Considerable quantities of it were found in the ditches in the neighbourhood of Kurau.

Probably almost every wild plant that is green and non-poisonous may be used with a certain measure of advantage.

Sauer Kraut was used with success by Captain Cook, and is no doubt still in use as an antiscorbutic on board German vessels. It is little known or used in this country, but it would unquestionably be valuable where fresh vegetables could not be procured.

A decoction of fritops has been used successfully, and spruce beer has long been a favourite specific.

 Wort or infusion of malt was recommended more than a century ago as a remedy for scurvy, and after falling out of notice for a time has again become a popular remedy in the shape of extract of malt.

Malt liquors are very useful, and so are wines, cider and perry.

Vinegar is useful, although not a very powerful antiscorbutic.

The same may be said of milk when not used in large quantities. In large quantities it is probably more powerful antiscorbutic.

Fresh meat is of some use as a preventative, but probably of very little as a remedy - I have elsewhere discussed the subject of the antiscorbutic properties of fresh meat.
and milk.
Far water and molasses are two substances which have been much vaunted as specifics in their day, and molasses has been brought forward again recently in connection with the famine in India. It is not probable that either of these substances is very efficacious, but they may be of some use. The green leaves of the teak, birch-tree order are useful beyond all doubt, and the "Ananda" tree which Carter described as of marvellous efficacy in restoring his crew to health is supposed to be the American Spruce. But whether the same virtues are possessed by tea is a little more doubtful. So with molasses, while it is undoubtedly that the fresh juice of the sugar cane has antiscorbutic properties, it is not so certain that these properties are possessed by molasses. The bulk of evidence is rather against the idea of molasses being of much use. But it would be right to try this if it were procurable, and other antiscorbutics could not be had.
The Mineral Acids are generally admitted to be of little use.
Citric Acid has been the subject of much dispute. For a time much faith was placed in it by many. I well remember hearing in my student days two lecturers in the University discussing on this subject, the late Professor Henderson laying down that it was a most perfect remedy, while Professor Chrétien maintained...
that it was next to useless. The general impression now seems to be that the latter is the more correct view, but I have no experience of the remedy myself.

Tartrate Acid, the Tartrates, Citrates, &c. have all been repeatedly tried. Opinions differ a good deal as to the results, but on the whole they appear to be of slight efficacy, the salts having more virtue than the simple acids.

I cannot do better than conclude this subject with the admirable and concise rules laid down by Dr. Parkes (Hygiène, 4th edition, p. 464).

"The measures to be adopted in time of war, or in protracted rejoyns on board ship, or at stationary where fresh vegetables are scarce, are:

1. The supply of fresh vegetables and fruits by all means in our power. Even unripe fruits are better than none, and we must risk a little diarrhoea for the sake of their antiscorbutic properties. In time of war every vegetable should be used which it is safe to use, and when made into soups almost all are tolerably pleasant to eat.

2. The supply of the dried vegetables, especially potatoes, cabbage and cauliflowers; turnips, parsnips &c. are perhaps less useful; dried peas and beans are useless. As a matter of precaution these dried vegetables should be issued early in a campaign, but should never supersede the fresh vegetables.

3. Good lemon juice should be issued daily (1 oz)
and it should be seen that the men take it.

4. Vinegar (½ oz to 1 oz daily) should be issued with the rations and used in the cooking.

5. Citrates, tartrates, lactates and malates of potash should be issued in bulk, and used as drinks, or added to the food. Potash should be selected as the base, as there is seldom any chance of the supply of soda being lessened. The easiest mode of issuing these salts would be to have packets containing enough for one mess of twelve men, and to instruct the men how important it is to place them in the soups or stews. Possibly they might be mixed with the salt and issued merely as salt.

Precautions with regard to the general health should always be observed, and wet or damp and extremes of either heat or cold should be guarded against whenever possible.

The local manifestations of scurvy must be treated as they appear in accordance with ordinary medical and surgical principles.
Part II.

Account of an Outbreak of Smallpox at Hull in the Humber Valley.
Chapter I.

Description of Thull and its surroundings.

I saw a good deal of plague at all times during my service across the Frontier, but the worst outbreak of it that I saw or of which I heard was at Thull during the months of June, July, August and September 1879. It is now well established that an outbreak of plague is influenced by the character of the country where it occurs, not merely in so far as this modifies the animal and vegetable productions of the country and consequently affects the supply of food, but also with regard to climatic and other influences, particularly those which produce the contagium known as malaria.

As the attack of plague which I witnessed was complicated by an endemic of malarial fever more severe than ever I saw elsewhere, (and I have been stationed at Peshawur and at Dacca in Eastern Bengal, two places which are infamous for malaria), I think a description of Thull and its surroundings will be of special interest in this respect.

Thull is, or was, a place of considerable strategic importance, lying as it does, roughly speaking, about half way between Kohat and Kirani, and commanding the road between these two places. It was a great depot for Commissariat stores during the war, and was always occupied by a strong garrison. This was
Necessary from its position, as on the North and West it was in close proximity to ranges of hills inhabited by numerous and hostile hill tribes. To the West lay the Waziris and Khootis, and to the North the Zainukhtes, the last mentioned of whom gave a great deal of trouble. As Civil Surgeon I was often almost daily called upon to make an examination of the body of some unfortunate camp follower or stranger who had been murdered by them within a few miles of camp, sometimes indeed hardly beyond the camp boundary, and two British officers, Surgeon Smyth of the Indian Medical Service and Lieutenant Killock of the Bengal Cavalry, were also among their victims while I was at Shull.

There is a native town or village of Shull, dignified in the native language by the name of Shahi or City. It is of considerable size for that part of the country, having some 1500 to 2000 inhabitants. Like all the villages of the country it is built chiefly of wood and mud, the latter predominating, and surrounded by high mud walls capable of defence against an enemy unprovided with artillery. The sanitary arrangements of the interior are apparently as bad as can be, or more properly speaking there are none, but nevertheless although both cholera and smallpox made their appearance while I was there, they passed off without doing any serious mischief.
This town or village of Thrull is situated about a mile
from the Hunan river, a stream of considerable size
and great rapidity, which at this point debouches
from the narrow gorge in which it has run from Nadish
Kheryl, a distance of 40 miles higher up.
The town stands about 300 or 400 feet east of and
above the level of the river, which here runs from
North to South. About half a mile further east
stood the Cantonment and Commissariat Stores, situ-
ated on a plateau about 200 feet higher than the
town. On the North and West this plateau ran ab-
ruptly down to the plain; on the South the ground
stretched away for a considerable distance, broken
up by small hills and ravines, down to the plain
towards Rawns; on the East the ground rose for
some distance and then stretched away undulating
towards Kohat, communicating by ridges and pla-
teaux with the high mountains on the North.
The boundaries of the Cantonment may be briefly said
to be:
North: A short stretch of plain, and then rising ground
terminating at a distance of two or three miles in a
range of mountains which stretches as a spur from
the mountains of Afghanistan proper from West to
East through British territory as far as the Indus, and
separates Peshawur on the North from Kohat on the
South.
South: Broken ground sloping down into the plain towards Bannoo.

East: Undulating ground stretching towards Kabul.

West: The village of Shull, the Kurnin River, and immediately beyond the river the mountains range inhabited by the Khostis and Waziris, continuous with the mountains of Afghanistan proper, of which indeed the territory of the Khostis forms a part.

The plateau on which the cantonnement stood is, I believe, from 2000 to 3000 feet above the sea level. The mountains all round are basaltic and barren. From them the ground descends in slopes, ridges and plateaux, covered with rocks and stones. The whole aspect of the country is barren and dreary in the extreme. No song of bird is heard, nor insects wing, Hits o'er the herbless granite."

Not that birds are actually wanting, or insects either. But the birds are chiefly of the obscene kind, attracted by the dead camels strewn in thousands along the line of march, and the insects also are mostly of an abominous sort, or rather not insects at all, but that allied class represented by centipedes, scorpions and enormous spiders.

The vegetation of the district consists chiefly of different species of camel thorns. Cultivation there is none, except along the banks of the Kunain river in some places, and in valleys among the hills where there is
some alluvial deposit. The ground is cultivated by
irrigation, terraces rising one above another on the slope,
running down to the river. The water is brought to these
by small canals or ditches, in the construction of
which the inhabitants show considerable engineering
skill, even tunnelling occasionally through a hill of
some size.

The amount of ground under cultivation near Hull
was not large, and there was none nearer the Cau-
tonment than from half a mile to a mile. There was no
cultivation for many miles up the river above Hull,
and none for miles on the Kohat side. Towards
Runnoo along the banks of the Kuram Southwards
there was rather more, but none near the Cantonment,
and I think the amount of cultivated land, even
with the qualification of its being irrigated land and
in consequence marshy at certain seasons, was quite
insufficient to account for the malaria of the dis-
trict. Nor was there any extent of actual marsh
near the river, the bed of which was composed en-
tirely of rocks and stones. A small amount of marsh
might perhaps be found here and there, but it
could not be said that marshy ground was to any
extent a feature in the country.

Cause of the Malarious nature of the district.

Although as I have shown there was nothing on the
surface of the ground to account for malaria, then
was a very sufficient cause at no great distance, as there
no doubt is in every case of malarious attack, although
not always apparent. There was everywhere much water
near the surface. Along the base of the plateau on which
stood the cantonment ran a small stream which never
could dry during the hottest months. It had its origin only
a few hundred yards off in a small spring oozing from
the ground, and all along its banks water might be seen
oozing from the sides, so that in a very short course it
became a stream of some size.

All over the face of the country to the South and East
might be seen similar springs and oozing of water.
The water used in the cantonment was got from a
spring about a mile to the South, which burst suddenly
out of the side of a hill, about the same level as the
cantonment. It was beautifully clear to look at, but
on standing for 24 hours in the heat it became foul
smelling, so that (animal foulings being out of the
question from the position of the spring) it was evidently
impregnated with vegetable matter.

The whole of the soil of the slopes and plateaux around
Hull consisted probably of decaying vegetable matter
mixed up with stones and rocky debris. The hills round
Hull were bare, but at the Pimavtal at the head
of the Kurun Valley, and every where beyond, hills ex-
actly similar otherwise were thickly clad with pines
and cedars, the ground beneath being covered ankle
Deep with their spiracula or needles. Doubtless at no very remote period the hills round Hull were similarly clothed, and the soil of the lower lying ground in consequence impregnated with vegetable matter.

As I have shown that there was nothing in the shape of marshy ground anywhere near to account for malaria, there can be little doubt that this was due entirely to the quantity of subsoil water, combined with the decaying vegetable matter in the soil of the district, and similar causes, combined to produce the same result all over the Kuram Valley and towards Kohat. Everywhere there was absence of marshy ground, but at the same time there was everywhere abundant subsoil water, and a soil largely composed as I believe of vegetable detritus.

I do not consider it necessary here to enter into the question of whether the malarious poison was absorbed from the air or from the drinking water or both. The Natives of India universally believe that water is the chief or only vehicle for malaria, and I am inclined to believe that they are not very far wrong, but it is evident that in the present instance the poison might have been conveyed in either way.

The ground of the plateau on which Hull Cantoument stood was similar to that round about, but, as it had been occupied for some months before I saw it, there was of course a good deal of animal impurities both on and around it.
The vegetation, as I have said, consists chiefly of sand thorns. Not a blade of grass was to be seen anywhere around, except where the inhabitants had ground under cultivation. As a proof of the sterility of the district, the 1st Bengal Cavalry, which was stationed there at the time written of, had latterly to send their grasscutters with their ponies to a distance of 15 miles off in order to get grass for their chargers.

The chief agricultural products of the district were maize, millet and some vegetables. No vegetables were grown in the district. The inhabitants, as far as I could learn, used none, and certainly did not cultivate any.

Unlike the inhabitants of the Kurram Valley further up, they had also no fruit trees, and as a rule seemed to cultivate no fruit of any kind. There was one exception to this, in the case of a village about 4 miles to the South, where we procured a few melons, but the district as a whole may be accurately described as producing neither vegetables nor fruit.

Nor were any natural antiscorbutics to be found anywhere around. At Kurram we used to get some watercresses in the ditches, and both there and at various places further in the interior I have eaten capital salad made of dandelion leaves, the only difficulty being to procure vinegar, but here there was nothing of the sort. Not a single edible green thing of any
Kind was ever discovered round Hull.
A spot better calculated in every way to foster trade,
both from its salubrious nature and its want of vegetable products, could hardly have been selected. It
will be seen further on how admirably the diet of the
men was adapted to the same end.

The Climate of Hull

The climate of Hull was peculiar. During the
summer months the heat was intense during the
day, the sun being usually unobscured by any trace
of a cloud, and its rays reflected with reaching
effect from the stony hills all round. During June
and July the mean temperature at mid-day was 112°
Fahr. in the shade. Sometimes it rose a few degrees
higher than this. Very seldom except on the occasion
of a thunderstorm did it fall much lower.
At night there was usually a little breeze, and the
temperature at the same time fell to below 100° Fahr.,
but still it was excessively hot, and only endurable
on account of the breeze.
The air generally felt very dry, and the surface of the
ground was parched and dusty. Heat, dust and
glare, "the sky brass and the earth iron", these were the
chief features of a day at Hull.
There was no regular rainy season, such as occurs
generally over India, but occasionally, perhaps five
or six times in the four months in question, there was a
thunderstorm of great violence, usually levelling every
thing in the shape of a tent, and accompanied by a
very heavy fall of rain, converting every nullah or water
course into a raging torrent. These storms generally
came on very suddenly, and passed off in the same
manner. They lowered the temperature considerably,
and moistened the surface of the earth, but their visible
effects had all passed off by noon of the next day, though
they must have added largely to the subsoil water.
In Winter there is severe frost at night and even during
the day in every place where the sun's rays do not pene-
trate. The thermometer often falls to not much above
zero at night. Even in Winter however the direct rays
of the sun are very powerful, and render it dangerous
to go about without the head being well covered.
The moment the sun sets in Winter, severe cold sets in.
Chapter II.
The Troops at Thull. The Native Inhabitants of the District.
The garrison of Thull at the time I was there was composed as follows:
1. The 29th Punjab Native Infantry, over 700 strong. My position was that of medical officer of this regiment, and for this reason, and because it also suffered more, from fever at least, than any of the other troops, it is of it I shall chiefly speak. But during the greater part of the time I was the only medical officer at Thull and had medical charge of all the troops and details, besides a Civil General Hospital, and a Civil Cholera Hospital while the Cholera lasted.
2. A wing of the 11th Bengal Native Infantry, over 350 strong.
3. The 1st Bengal Cavalry, over 350 strong.
In addition to these there were numerous Commissariat, Transport and other officials, and a large but varying number of camp followers.
The composition of the 29th P. N. I. was as follows:
Sikhs about one half.
Mohammedans about three eighths.
Dogras about one eighth.
The Sikhs as is well known are a Punjab race, with a religion of their own. They are tall and well formed.
As young men they are as a rule rather defective as
regards chest measurement, and their lower extremities, even when they get older, are usually too thin to please a European eye, but in spite of this they are capital marchers. When fully matured they stand hardship well, and are nearly always cheerful and willing soldiers. In point of manly character, as for example, saying what they think in reply to a question instead of saying what they think will please, they are immeasurably superior to any other Indian race. They are cleanly in their habits, as are also the high caste Hindus. Mahommedans are usually the reverse.

The Sikhs abstain from nothing but beef and tobacco, which are prohibited by their religion. They would eat mutton (or goat's flesh which they prefer) every day if they could get it, but as a rule their pay (for the native soldier finds his own food out of his pay in time of peace) will not permit of their indulging in it. The same may be said of spirits. A Sikh will drink as much rum as is given him, but he is too frugal to waste his money on it, except under very special circumstances.

Most of them use opium and chang, but very seldom in excess. A good deal of misapprehension exists in this country as to the use of these drugs. Their use is as universal in all parts of India where I have been, as that of alcohol in this country, and no more discredit attaches to the practice than to the moderate use of alcohol here. The visible evil result is still less. Not half a dozen
times in the course of my service have I seen a sepoy delirious
from Bhang or stupified from Opium
The Mahommedans I need say little about, as their tenets
and practices are well known.
Two thirds of the Mahommedans in the 29th were Pathan,
i.e. belonging to the Frontier hill tribes. They are shorter
and stouter and have stronger constitutions as a rule than
the Sikhs, but are inferior to them in courage and moral
qualities and do not make such good soldiers.
They abstain of course from pork and alcohol, and are
very strict about the latter, which the ordinary Mahom-
medans of India are not. All Mahommedans are strict
about pork, more from loathing than religious
feeling, for the aversion is equally strong in Mahom-
medans who care little for the trammels of their religion in
other respects.
The remaining third of the Mahommedans in the
regiment was composed of Punjabi Mahommedans.
These as their name indicates are natives of the Punjab.
They were rather inferior in physique to the other races
in the Regiments.
The Mahommedans, like the Sikhs, eat meat when they
can get it, but Mahommedan Sepoys can seldom afford
to buy it.
The Dogras are a Rajpoor hill race, and are generally
high caste Hindus. Many of them will not eat meat
under any circumstances, but Hindu practices vary.
So much in this particular that it is impossible to lay down any rule for them.

The Dogras differ little from ordinary Hindus, but like most hill races they have more warlike spirit than the dwellers on the plains, and make excellent soldiers.

The physique of the men of the 29th Regiment as a whole was remarkably good at the commencement of the campaign. The men were nearly all young or in the prime of life and the health of the regiment was excellent. I have seen a large proportion of the native regiments of the Bengal Presidency and only one or two were superior to and very few equal to the 29th, so far as one can judge from the appearance of the men.

The 11th Bengal Native Infantry consisted entirely of Poorbeaks, i.e. natives of Oudh, and were all Hindus, most of them of high caste.

The 1st Bengal Cavalry were nearly all Mahommedans from the North West Provinces.

The Camp followers consisted of private and regimental servants, who came from all parts of India and were either Hindus or Mahommedans, (no Sikh will ever perform menial duty), and of Cawars or fooly-bearers, who were chiefly low caste Hindus from the North West Provinces.

The Europeans at Hull-

There were not many Europeans at Hull. They consisted of officers, regimental and departmental, and non-
commissioned officers connected with the different departments, along with one or two civilians. There were no British troops stationed at Thull at any part of the period referred to. The nearest were at Kohat and Kurrum, and at the latter place only a small contingent was stationed on account of the heat and malaria, the most of the British troops in the valley being either at the Pinar Kotal or beyond it.

The Native Inhabitants of Thull and the surrounding country are a Pathan race, a little more civilized than the hill Pathans, but not much so. They are inferior to these latter in physical development, being much shorter in stature, and having a sickly pallid appearance where this can be distinguished through the thick coating of dirt with which like all Pathans they are nearly always begrimed. This sickly appearance is due I believe to malarial fever and consequent splenic enlargement, and exactly resembles the appearance presented by the inhabitants of fever-stricken districts in lower Bengal. Like most Pathans they are both pastoral and agricultural, hating the monotony of such employments by robbery and murder. They are however less given to open violence than their brethren of the mountains.

They have large numbers of cattle, sheep and goats, which are driven to the hills to feed during the day time. From their herds they derive large quantities of milk, which is used curdled, and forms one of their principal articles of
food. They may be said to live to a great extent on maize and cultured milk.

Being Mohammedans they have of course no aversion to meat, but this they seldom indulge in unless an animal dies a natural death, as they consider it a great act of extravagance to kill an animal for the sake of its flesh.

None of the Pattian tribes anywhere cultivate vegetables, as far as I know, but in many places they cultivate a large quantity of fruit. Shalozan, which lies in the Kuran Valley not far from the River Kotal, is famous for fruit, especially apples, and the garrisons at the River Kotal and Kuran had an abundant supply of fruit in the season, but none found its way down to Hull. When marching through Kuran in the beginning of October we got some Shalozan apples, which were equal in quality to the best American ones brought over to this country.

But the Pattian of Hull and the neighbourhood cultivate no fruit, and we saw no sign of fruit in the district, with the one slight exception mentioned elsewhere.

Barrack Accommodation.

In the proper sense of the term there was no barrack accommodation. The plateau when first occupied was a bare waste with nothing on it but stones and thorns. During the time that elapsed before the commencement of the hot weather, the Right Wing of the 29th, which was stationed at Hull from the commencement of the year, had time to put themselves pretty comfortably, but as
the whole regiment was out in Cholera Camp during a considerable portion of June and July, of course they lost the advantage of their huts at that time, the hottest of all.

The left wing lived in tents all the time. So did the 11th V.I., the 1st B.C., the Camp followers, and generally speaking almost all in the Cantonment.

I had three huts for my hospital, one of which I made over lately to the 1st B.C., but as the huts did not comfortably accommodate more than from twenty to twenty-four men each, and as my sick of the 29th Regiment alone seldom after the 1st of July numbered less than 100, and latterly were always over that number, a great proportion of the sick was always treated in tents.

At night most of the men whether sick or well slept in the open air. This was bad of course on account of malaria, but the heat was so great that it was almost impossible to sleep inside the tents. I usually slept in the open air myself, although I knew it was imprudent to do so. But it was a case of sleep versus no sleep, and one was willing to run any risk for the sake of coolness.
Chapter III.

Diet of the Troops at Young.

One of the first inquiries regarding an outbreak of dysentery naturally is as to the diet of the men who contracted it. In this chapter I propose to analyze the diet of the Natives who alone showed symptoms of dysentery at Young, and to contrast it with that of the British soldier.

The ration of the Native Troops on service, which never varied during the period I was on service, i.e. from the beginning of the Campaign in November 1878 to the close of the year 1879, was the following:

<table>
<thead>
<tr>
<th>Scale of Daily Rations for Native Troops</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atta = 1 Reer or about 2 lbs.</td>
</tr>
<tr>
<td>Shal = 14 Chattackis or about 8 ounces</td>
</tr>
<tr>
<td>Shea = 1 Chattack or about 2 ounces</td>
</tr>
<tr>
<td>Salt = 1/3 Chattack or about 2/3 ounce</td>
</tr>
</tbody>
</table>

Atta is a coarse description of flour with most of the husk ground in.

Shal is a species of dried pea (Cajanus Indicus) resembling split peas, but smaller.

Shea is usually translated as clarified butter, and I believe this is really its composition when pure, but the expression clarified butter hardly conveys much idea of the nature of the substance to one who has not seen it. As usually sold in the bazaars and supplied to the troops it is a substance at ordinary (Indian) temperatures of about the consistence of lard, of a greyish white colour and a
decidedly strong" odour and taste. When boiled by the application of heat, the way in which the natives always use it, it becomes a clear oily liquid.

In calculating the composition of this diet I find it to be as follows:

**Composition of Diet of Native Troops.**

<table>
<thead>
<tr>
<th></th>
<th>Water oz.</th>
<th>Water-free Albuminates oz.</th>
<th>Water-free Fats oz.</th>
<th>Water-free Carbohydrates oz.</th>
<th>Salts grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atta</td>
<td>4.8</td>
<td>3.5</td>
<td>0.64</td>
<td>22.5</td>
<td>236.8</td>
</tr>
<tr>
<td>Dhall</td>
<td>1.6</td>
<td>1.75</td>
<td>0.16</td>
<td>4.02</td>
<td>84</td>
</tr>
<tr>
<td>Ghee</td>
<td>0.14</td>
<td>0.006</td>
<td>1.8</td>
<td>--</td>
<td>23.2</td>
</tr>
<tr>
<td>Salt</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>--</td>
<td>291.6</td>
</tr>
<tr>
<td>Total</td>
<td>5.256</td>
<td>2.6</td>
<td>26.52</td>
<td>638.8</td>
<td></td>
</tr>
</tbody>
</table>

There is also some Cellulose in peas which is not calculated. I have calculated Ghee as butter. Possibly the small percentage of albuminates and salts should be left out.

The total water-free food in this diet amounts to 34.376 ounces, with 344 grains of salts exclusive of the Chloride of Sodium supplied as salt.

On further calculating the Nitrogen and Carbon in grains I get the following:

<table>
<thead>
<tr>
<th></th>
<th>Nitrogen grains</th>
<th>Carbon grains</th>
<th>Salts grains</th>
</tr>
</thead>
<tbody>
<tr>
<td>Atta</td>
<td>241.5</td>
<td>5306</td>
<td>236.8</td>
</tr>
<tr>
<td>Dhall</td>
<td>120.75</td>
<td>1288</td>
<td>84.0</td>
</tr>
<tr>
<td>Ghee</td>
<td></td>
<td>630</td>
<td>23.2</td>
</tr>
<tr>
<td>Total</td>
<td>361.5</td>
<td>7224</td>
<td>344.0</td>
</tr>
</tbody>
</table>
This it will be seen is far from being a starvation diet. Parker calculates the average daily waterfree diet required for an adult man in very laborious work, or of a soldier on service and in the field, as follows:

<table>
<thead>
<tr>
<th></th>
<th>6 to 7</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminates</td>
<td></td>
</tr>
<tr>
<td>Fats</td>
<td>3.5 to 4.5</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>16 to 18</td>
</tr>
<tr>
<td>Salts</td>
<td>1.2 to 1.5</td>
</tr>
</tbody>
</table>

Total waterfree food 26.7 to 31.0.

The diet of the native soldier gives a higher total of waterfree food than this, viz. 35.8 ounces.

It has less albuminates, 5.2 ounces as against a minimum of 6 ounces, but this is not a very great difference if it be remembered that the races of India as a rule consume less albuminous food than Europeans, and it is more than compensated for by the much larger amount of carbohydrates in the native diet.

The amount of fat is a good deal less, but is still considerable, 2.6 ounces as against a minimum of 3.5 ounces.

The amount of salts in the native diet is larger than in this standard calculated diet if the chloride of sodium supplied as salt be included, less if it be excluded. But I shall treat of the salts separately.

The following diets taken from Parker's Work on Hygiene are "The average daily diet of men in quietude and—"
Subsistence Diet (Playfair) i.e. sufficient for the Internal Mechanical Work of the Body:

<table>
<thead>
<tr>
<th></th>
<th>Rest</th>
<th>Substance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Albuminates</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Fats</td>
<td>1.0</td>
<td>0.5</td>
</tr>
<tr>
<td>Carbohydrates</td>
<td>12.0</td>
<td>12.0</td>
</tr>
<tr>
<td>Salts</td>
<td>0.5</td>
<td>0.5</td>
</tr>
<tr>
<td>Total</td>
<td>16.0</td>
<td>14.0</td>
</tr>
</tbody>
</table>

The diet of the Native Soldier contains more than twice as much water-free food as either of these diets. Regarding the Subsistence Diet however Dr. Parke says that though it will keep a man alive it will probably not keep him from losing weight, and is therefore not really sufficient. It may be doubted if the other is so either.

Calculated in grains of Carbon and Nitrogen Dr. Parke gives the "Standard Daily Diet for an adult man" as:

- Nitrogen = 316.5 grains.
- Carbon = 4862.0 grains.
- Salts = 461.0 grains.

The Native Soldier's ration exceeds this considerably in Nitrogen and Carbon, and also in salts if the Chloride of Sodium be included, but is considerably below it in salts if this be excluded.

I will now give the Ration of the European Troops on Service, which was also constant, so far as I know, except
that potatoes often ran short and shall was given instead, a very bad substitution, but not occurring sufficiently often or for a long enough time to seriously affect their health.

Daily Rations of British Troops on Service in Afghanistan.

<table>
<thead>
<tr>
<th>Item</th>
<th>Amount</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>20 oz</td>
</tr>
<tr>
<td>Bread</td>
<td>20 &quot;</td>
</tr>
<tr>
<td>Potatoes</td>
<td>16 &quot;</td>
</tr>
<tr>
<td>Rice</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>Sugar</td>
<td>2½ &quot;</td>
</tr>
<tr>
<td>Tea</td>
<td>3¼ ounce</td>
</tr>
<tr>
<td>Salt</td>
<td>2½ &quot;</td>
</tr>
</tbody>
</table>

The composition of this Ration I find on calculation to be as follows:

<table>
<thead>
<tr>
<th>Composition of Diet of British Troops on Service.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
</tr>
<tr>
<td>-------</td>
</tr>
<tr>
<td>Meat</td>
</tr>
<tr>
<td>Bread</td>
</tr>
<tr>
<td>Potatoes</td>
</tr>
<tr>
<td>Rice</td>
</tr>
<tr>
<td>Sugar</td>
</tr>
<tr>
<td>Total</td>
</tr>
</tbody>
</table>

The total water-free food in this diet amounts to 26.338 ounces, with 372.21 grains of salts supplied in the food and exclusive of the Chloride of Sodium supplied as salt. Calculating the Nitrogen and Carbon on the same scale as for the Native Diet I get the following:
Diet of the Troops

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>Carbon</th>
<th>Sols</th>
</tr>
</thead>
<tbody>
<tr>
<td>346.38 grains</td>
<td>5616 grains</td>
<td>372.21 grains</td>
</tr>
</tbody>
</table>

It may be useful to compare this with the Home Diet of the British Soldier. This, as taken from Parker's Hygiene, 2nd Edition, is as follows:

**Daily Rations of Soldiers at Home.**

<table>
<thead>
<tr>
<th>Item</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>12 ounces</td>
</tr>
<tr>
<td>Bread</td>
<td>24 &quot;</td>
</tr>
<tr>
<td>Potatoes</td>
<td>16 &quot;</td>
</tr>
<tr>
<td>Other vegetables</td>
<td>8 &quot;</td>
</tr>
<tr>
<td>Milk</td>
<td>3/5 &quot;</td>
</tr>
<tr>
<td>Sugar</td>
<td>1 1/3 ounce</td>
</tr>
<tr>
<td>Coffee</td>
<td>1/3 &quot;</td>
</tr>
<tr>
<td>Tea</td>
<td>1/8 &quot;</td>
</tr>
<tr>
<td>Salt</td>
<td>1/5 &quot;</td>
</tr>
</tbody>
</table>

**Composition of Diet of British Troops at Home.**

<table>
<thead>
<tr>
<th></th>
<th>Water</th>
<th>Waterfree Albuminates</th>
<th>Waterfree Fat</th>
<th>Waterfree Carbohydrates</th>
<th>Sols</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>9.0</td>
<td>1.8</td>
<td>0.96</td>
<td>-</td>
<td>84.0</td>
</tr>
<tr>
<td>Bread</td>
<td>9.9</td>
<td>1.84</td>
<td>0.35</td>
<td>11.48</td>
<td>172.66</td>
</tr>
<tr>
<td>Potatoes</td>
<td>11.84</td>
<td>0.24</td>
<td>0.016</td>
<td>3.74</td>
<td>70.0</td>
</tr>
<tr>
<td>Vegetables</td>
<td>7.3</td>
<td>0.016</td>
<td>0.04</td>
<td>0.046</td>
<td>24.5</td>
</tr>
<tr>
<td>Sugar</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.28</td>
<td>2.915</td>
</tr>
<tr>
<td>Milk</td>
<td>2.8</td>
<td>0.13</td>
<td>0.012</td>
<td>0.144</td>
<td>9.8</td>
</tr>
<tr>
<td>Total</td>
<td>4.026</td>
<td>1.378</td>
<td>17.69</td>
<td>353.875</td>
<td></td>
</tr>
</tbody>
</table>

In calculating this diet I have calculated "other vegetables" as cabbage, this being from its abundance and cheapness.
the one most likely to be generally supplied.

We have here a total of 23.094 ounces of waterfree food, with 353.975 grains of salt contained in the food, and exclusive of Chloride of Sodium supplied as salt.

Calculating the Nitrogen and Carbon I got:

<table>
<thead>
<tr>
<th>Nitrogen</th>
<th>Carbon</th>
<th>Salt</th>
</tr>
</thead>
<tbody>
<tr>
<td>277.89 grains</td>
<td>4637.58 grains</td>
<td>353.87 grains</td>
</tr>
</tbody>
</table>

I shall now bring all these results together for the purpose of comparison.

1. Diet of Native Troops

   Albuminates ———— 5.256 ounces
   Fat ———— 2.6 "
   Carbohydrates ———— 26.52 "
   Total waterfree food ———— 34.376 " with
   344. grains of salts contained in the food, and 291.6 grains of Chloride of Sodium supplied as salt.

2. British Troops War Diet

   Albuminates ———— 5.02 ounces
   Fat ———— 2.028 "
   Carbohydrates ———— 19.29 "
   Total waterfree food ———— 26.338 " with
   372.21 grains of salt contained in the food, and 291.6 grains of Chloride of Sodium supplied as salt.

<table>
<thead>
<tr>
<th></th>
<th>Nitrogen</th>
<th>Carbon</th>
<th>Salt(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Native Troops</td>
<td>361.8</td>
<td>7224</td>
<td>344</td>
</tr>
<tr>
<td>British War Diet</td>
<td>346.38</td>
<td>5616</td>
<td>372.21</td>
</tr>
<tr>
<td>British Home Diet</td>
<td>277.894</td>
<td>~4637</td>
<td>353.975</td>
</tr>
</tbody>
</table>

When thus contrasted it will be seen that the Native Diet contains slightly more Nitrogen than the British War Diet, a good deal more than the British Home Diet, and much more Carbon than either of the British diets, but contains less Salts than either of these.

The Salts.

To make the comparison complete it is necessary to make an estimate of the different amount of various salts contained in the diets. I have done this according to the following table which is a mean of various analyses:
<table>
<thead>
<tr>
<th></th>
<th>Meat</th>
<th>Potatoes</th>
<th>Flour</th>
<th>Peas</th>
<th>Rice</th>
</tr>
</thead>
<tbody>
<tr>
<td>Potash</td>
<td>.56</td>
<td>.54</td>
<td>.44</td>
<td>.86</td>
<td>.18</td>
</tr>
<tr>
<td>Soda</td>
<td>.13</td>
<td>.04</td>
<td>.08</td>
<td>.16</td>
<td>.05</td>
</tr>
<tr>
<td>Lime</td>
<td>.06</td>
<td>.02</td>
<td>.06</td>
<td>.1</td>
<td>.02</td>
</tr>
<tr>
<td>Magnesia</td>
<td>.04</td>
<td>.03</td>
<td>.18</td>
<td>.18</td>
<td>.02</td>
</tr>
<tr>
<td>Phosphoric Acid</td>
<td>.63</td>
<td>.19</td>
<td>.9</td>
<td>.85</td>
<td>.16</td>
</tr>
<tr>
<td>Sulphuric Acid</td>
<td>.07</td>
<td>.14</td>
<td>.02</td>
<td>.12</td>
<td>.03</td>
</tr>
<tr>
<td>Chlorine</td>
<td>.11</td>
<td>.04</td>
<td>.02</td>
<td>.1</td>
<td>.03</td>
</tr>
</tbody>
</table>

It may be thought that I have given too high an estimate of the salts in flour, but I believe that on the contrary I am not too low. Wanklyn gives .7 as the percentage of ash in flour, but this is the analysis of the very finest wheat flour containing no bran. Bran contains from 5 to 7 per cent of ash or possibly more occasionally, and as the atta used in the campaign had all or nearly all the bran ground into it, the allowance of 1.7 per cent for the salts is low rather than high. It is lower than many analyses of flour in this country.

I should have produced a much more striking result had I adopted the lower scale, but I believe the one I have adopted is more nearly correct.

Calculated according to the above table the native diet scale contains salts as follows:
Composition of Salts in Native Diet

<table>
<thead>
<tr>
<th>Salt Type</th>
<th>Potash</th>
<th>Soda</th>
<th>Lime</th>
<th>Magnesia</th>
<th>Phosphoric Acid</th>
<th>Sulphuric Acid</th>
<th>Chlorine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alfa</td>
<td>61.6</td>
<td>11.2</td>
<td>8.4</td>
<td>25.2</td>
<td>126</td>
<td>2.8</td>
<td>2.8</td>
</tr>
<tr>
<td>Beta</td>
<td>20.06</td>
<td>5.6</td>
<td>3.8</td>
<td>6.3</td>
<td>29.75</td>
<td>4.2</td>
<td>3.5</td>
</tr>
<tr>
<td>Total</td>
<td>81.66</td>
<td>16.8</td>
<td>11.9</td>
<td>31.5</td>
<td>155.75</td>
<td>7.0</td>
<td>6.3</td>
</tr>
</tbody>
</table>

This gives a total of 310.85 grains and requires to have 23.2 grains added to it for the amount of salts in ghee calculated as butter. It is doubtful if this amount of salts should be added or not, as ghee if really clarified butter should contain no salts to speak of. It probably does however, but I have made no attempt at estimating each separately. This amount of 23.2 grains added to the total of 310.85 grains got by summing up the totals in the above Table gives 334.05 grains, which is somewhat less than the amount of salts calculated before, but sufficiently near to show that it is substantially correct. The two calculations are made by different methods, and are sufficiently accurate for the purposes of this investigation.

Composition of Salts in British Soldier’s War Diet are as follows:

<table>
<thead>
<tr>
<th>Salt Type</th>
<th>Potash</th>
<th>Soda</th>
<th>Lime</th>
<th>Magnesia</th>
<th>Phosphoric Acid</th>
<th>Sulphuric Acid</th>
<th>Chlorine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>49.0</td>
<td>11.37</td>
<td>5.25</td>
<td>3.5</td>
<td>55.125</td>
<td>6.125</td>
<td>9.625</td>
</tr>
<tr>
<td>Bread</td>
<td>35.5</td>
<td>7.0</td>
<td>5.25</td>
<td>15.75</td>
<td>78.75</td>
<td>1.75</td>
<td>1.75</td>
</tr>
<tr>
<td>Potatoes</td>
<td>37.8</td>
<td>2.64</td>
<td>1.4</td>
<td>2.1</td>
<td>12.7</td>
<td>9.64</td>
<td>2.64</td>
</tr>
<tr>
<td>Rice</td>
<td>3.13</td>
<td>0.575</td>
<td>0.35</td>
<td>0.35</td>
<td>2.5</td>
<td>0.575</td>
<td>0.515</td>
</tr>
<tr>
<td>Total</td>
<td>128.43</td>
<td>21.885</td>
<td>12.25</td>
<td>21.7</td>
<td>149.375</td>
<td>18.03</td>
<td>17.3</td>
</tr>
</tbody>
</table>
This gives a total of 368.97 grains, or adding the salts in the sugar (Coarse brown sugar) which I have not calculated in detail, a total of 374.4 grains, which is very near what was given by the other method of calculation.

Let us now look at the analysis of the salts in the Home Diet of the British Soldier.

<table>
<thead>
<tr>
<th></th>
<th>Potash</th>
<th>Soda</th>
<th>Lime</th>
<th>Magnesia</th>
<th>Phosphoric Acid</th>
<th>Sulphuric Acid</th>
<th>Chlorine</th>
</tr>
</thead>
<tbody>
<tr>
<td>Meat</td>
<td>29.4</td>
<td>6.72</td>
<td>3.15</td>
<td>2.1</td>
<td>33.75</td>
<td>3.675</td>
<td>5.775</td>
</tr>
<tr>
<td>Bread</td>
<td>44.916</td>
<td>8.16</td>
<td>0.858</td>
<td>18.375</td>
<td>91.875</td>
<td>0.29</td>
<td>0.29</td>
</tr>
<tr>
<td>Potatoes</td>
<td>37.8</td>
<td>2.64</td>
<td>1.4</td>
<td>2.1</td>
<td>12.7</td>
<td>9.64</td>
<td>2.64</td>
</tr>
<tr>
<td>Total</td>
<td>112.116</td>
<td>17.52</td>
<td>5.408</td>
<td>22.575</td>
<td>128.325</td>
<td>13.605</td>
<td>8.705</td>
</tr>
</tbody>
</table>

Here we have a total of 318.25 grains, to which, if we add the uncalculated salts of Cabbage (24.5 grains), Sugar (2.915 grains) and Milk (9.8 grains) we get 355.46 grains or very nearly the same amount as got by the other method.

The Native Diet deficient in Potash.

On comparing these diets with each other as regards the amount of different salts contained in them, one cannot help being struck with the deficiency of Potash in the Native Diet. Without adopting Dr. Gamobi's theory, it must be admitted that this might be brought forward as a case in support of it.

The Native Diet contains 81.66 grains of Potash, while the British War Diet contains 128.43 grains, being a difference of 46.77 grains or nearly a third. The British
Diet of the Troops

Home Diet contains 112.116 grains of Potash, or 25.45 grains more than the Native Diet, in addition to which there is to be taken into account the uncalculated Potash contained in the vegetables and milk.

And if it be considered, as it probably may be by some, that the scale I have adopted in calculating the amount of salts in atta and bread is too high, the adoption of a lower scale will make the discrepancy much greater, for taking Wanklyn's scale, or one half what I have allowed, this would make the Potash in the Native Diet very much less in proportion, the atta forming such a preponderant ingredient in this diet. There would in this case fail to be deducted from the Native Diet 35.8 grains, leaving only 55.86 grains of Potash, while from the British War and Home Diets only 19.26 grains and 22.45 grains respectively would have to be deducted, which would still leave the Potash as 169.18 grains and 89.66 grains, or very nearly double in the one case and upwards of a half more in the other.

In the Chapter on the General Pathology of Scroey I have endeavoured to show that there are facts which militate against Dr. Parrot's theory being regarded as a sufficient explanation of all the pathological phenomena of Scroey, but there is probably a certain amount of truth in it and in the other views which attribute these phenomena to diminished alkalinity of the blood, and the analysis of diets which I have given seems to be as far in their
There is nothing else very striking in the comparison of the salts, unless it be that the amount of Sulphoric Acid in the Native Diet is little more than one third of what it is in the British War Diet, and about half of what it is in the British Home Diet. As Sulphur is one of the elements to the absence of which L. Alcubridge attributes anxiety, this may be called attention to, but is probably of no great significance.

So sum up, the Diet of the Native Troops has been shown to be, having regard to the results of analysis only, and barring all questions as to suitability of food etc., inferior to both the British War Ration and the British Home Diet in the amount of Albuminates, Fats, and Carbohydrates, as well as in total Nitrogen and Carbon. It is inferior to these in the total amount of salts, excluding Chloride of Sodium supplied as salt, and much inferior in the amount of Potash. It is also inferior in Sulphur.

With regard to the question of whether these elements of diet were given in the most suitable form in the Native Diet, I think there can hardly be a difference of opinion. Both Native and European diëts are monotonous, but the monotony of that of the British Soldier was broken at least once a week, if not oftener, by the substitution of mutton for beef, and in addition he had his "coffee shop" almost always along with the Regiment, where his superior pay enabled him to buy many little...
additions to his rations.
The Native Soldiers' diet on the other hand was one of
unbroken monotony, and if it be argued that the diet
of the natives of India is as a rule monotonous, I should
answer that it is only so as to the main articles of food,
for in their own country they vary it by the addition of
large quantities of vegetables, fruits and spices, whenever
these are procurable, which they nearly always are.
I may say in addition that the Sepoys all along com-
plained of the quality of the alta supplied to them, and
on several occasions when I examined it it was cer-
tainly bad, having a sour musty smell, and being
evidently in process of decay. On one occasion I got a
Committee appointed to examine it, and it was condemned
as unfit for food. That particular batch of alta was
not again issued to the Sepoys, but to avoid waste the
Commissariat made it into bread for the Europeans at
the Station! This may appear surprising to those un-
acquainted with the ways of the Indian Commissariat
Department, but it is a simple fact. For weeks after-
wards we were unable to use the bread supplied by
the Commissariat, and were obliged to purchase flour
in the bazaar and get chapatties (unleavened cakes) made.
The Sepoys got rid of the bad alta on that occasion,
but the quality of what was supplied to them after-
wards did not improve much, and they never ceased
to complain.
Diet of the Camp followers.

I have little to say with regard to the diet of the Camp followers. It was the same as that of the Sepoys, except that they were only allowed three quarters of a less of atta (about 1½ lb). This would still bring it within the limits of a sufficiently nourishing diet as far as Nitrogen and Carbon are concerned, but of course the salts are less by one fourth in the atta, making the amount of Potash only 66.26 by the higher Scale of calculation, or 46.91 grains by the lower.

If it be considered that the salts, especially Potash, are too low in the Sepoys' diet, of course they are still more so in that of the Camp followers.

The monotony of the diet is the same, and as a rule the Camp follower was still less able than the Sepoy to afford to purchase additions to his diet when such were procurable.

Diet of the Europeans at Delhi.

The Europeans at Delhi consisted, as I have said, chiefly of Officers and non-commissioned officers, the former being both regimental and departmental, the latter departmental only, and connected with various branches such as the Commissariat, Transport, Ordnance, Signalling, Telegraphy.

British soldiers' rations were issued to all alike, but of course they had opportunities of supplementing their rations not enjoyed by common soldiers, whether European.
or native.
The officers had a well supplied Mess at Hull, except
that vegetables were very scarce. We had unlimited
limejuice (Commissariat), and a good stock of French
wines and latterly of Cider which was much drunk.
The Non Commissions officers were not so well off in
some respects, but a considerable number of them being
connected with the Commissariat, they had often, I believe,
better opportunities of getting vegetables both fresh and
preserved than even the officers.
Speaking generally, the Europeans at Hull were well off
as far as their diet went. It was always abundant as to
quantity, and, although occasionally when potatoes were
not issued for some length of time, it verged on being
a scorbutic diet, it never actually was so.
Chapter IV.

History of the Outbreak.

For about three years prior to the commencement of the Afghan campaign, the 29th Punjab Native Infantry had been stationed at Talagam, an out of the way Cantonment near the borders of the Salt Range, about sixty or seventy miles south west of Rawal Pindi. The regiment took part in the Jowaki campaign in the Winter 1877-8, but this campaign was a short one and no great hardships were suffered, so that the health of the men was not in any way injuriously affected.

At Talagam food was extremely cheap, a circumstance which has always great influence on the health of a Native regiment, as the men are not rationed in peace time, but buy their own food out of their pay. The pay is small, and most of the men have wives and families in their native place, to whom they remit a large portion of it in a most exemplary manner, so it follows as a natural consequence that when the price of provisions at a station is high, the men are insufficiently nourished. This was not the case at Talagam, and as vegetables here also abundant and cheap, the water good and the district non-malarious, the men were nearly all in a high state of health.

I took over medical charge of the regiment at Talagam from Dr. Aitchison, who was going on leave, on the 15th September 1878, and twelve days afterwards, orders
having been recalled to proceed to Kohat, the regiment marched for that station. The state of health of the regiment may be inferred from the fact that after a thorough inspection of the men, I found it necessary to leave only 6 men behind in hospital, or under 1 per cent of the

strength.

Arriving at Kohat on the 7th October, I handed over medical charge to Dr. Aitchison, who had thrown up his leave and rejoined. From that date I saw no more of the regiment officially until the 14th June of the succeeding year, but I will state in a few words its movements in the interval.

About 3 days after it arrived at Kohat it marched for Thull, where it lay until the commencement of hostilities on the 1st November. From the date of leaving Kohat it may be said, speaking generally, that the men were entirely without vegetables. Thull being at nearly all seasons of the year a malarious place, the regiment, although it was only a month there at that time, suffered a good deal from malarial fever, and when I took over charge of the Field Hospital at Thull on the 24th November I found 28 men of this regiment in it, nearly all suffering from fever.

From Thull the regiment advanced with General Roberts to the Peiwar Kohal, and took part in the storming of that pass on the 2nd December. Shortly after this the Right Wing was ordered back to garrison Thull. Having
there on the 31st December, and remained there from that time till the end of September of the following year. On the same day that I arrived at Hull, I left for the front, and did not see it again at all till the following June.

The left wing was sent to Nazar Poi Loran on the right bank of the Kura, about 25 miles north of Hull, and employed at roadmaking. It was chiefly employed at this kind of work till June of the next year when I joined it at Kura. This happened on June 14th and on the 20th of the same month we marched for Hull, arriving there on the 13th. I then handed over the medical charge of the left wing to Surgeon A. Barclay, who was in charge of the right wing, but on the 17th June Surgeon Barclay received orders to go down country, and I took over charge of the whole regiment.

When I received charge of the left wing at Kura there were 19 sick, and most of these showed scarbutic symptoms. Besides the sick in hospital a great many of the men in the ranks showed traces of scurvy. Dr. Crofts, who had charge of them before me, told me when making over the sick to me that he had called the attention of the Deputy Surgeon General, when in Kura a few days before, to the fact that the wing was becoming attacked by scurvy, and that the Deputy Surgeon General had held an inspection of the men and declared that
he did not see that there was much appearance of fever.

It will be noticed that the Deputy Surgeon General in a letter of his (Appendix A 3) refers to this examination and states that the proportion exhibiting signs of fever was comparatively small. From what I saw I felt strongly inclined to agree with Dr. Crofts, and it will be seen immediately that Dr. Barclay who examined the whole regiment after the bivouac had joined, also took the same view.

On the 16th June, after the whole regiment had been got together, Surgeon Barclay, at the request of Major Chalmers V.C. the officer temporarily in command, who was well acquainted with the importance of the subject of fever, made an examination of the men in the regiment not in hospital or on duty. He examined 388 men in all. The nominal strength of the regiment was over 700, but some were of course left on duty at the depot, and there were a large number of outposts round Hull and incessant convoy duty, so that the number left in the station was often comparatively small.

Of 388 men examined, Surgeon Barclay found that 218 or 56.3 per cent showed traces of fever. (Appendix A 3).

In his Report to the Commanding Officer (Appendix A 2) he mentions that the men have been entirely without food of an antiscorbutic character since taking the field,
and that every effort had been made to obtain vegetables, but without success.

He also mentions that a lime-juice ration had been early commenced, but without preventing the appearance of the scurvy. He does not state the time at which the lime-juice was commenced, but I believe it was in February or March. The amount was half an ounce per man three times a week, being all that the authorities sanctioned.

His Report of Surgeon Barclay refers only to the men of the regiment doing duty. There were, besides these, between 40 and 50 men in hospital, and the great majority of these had symptoms of scurvy.

Surgeon Barclay's Report was forwarded by his Commanding Officer to the Deputy Surgeon General, who sent it on to General Roberts accompanied by a letter (Appendix A 8) which conveys the impression that he thought Surgeon Barclay was somewhat exaggerating matters, but stating that he had called upon the Medical Officer to forward a 'Fortnightly Report on the health of the regiment.' The Assistant Quater Master General wrote back that the General did not propose to take any action on the Report at present, and as the matter stood in the meantime.

On the 17th June, having been already put in charge of the left wing of the 11th Bengal Native Infantry, I took over charge of the 29th P.N.I. from Surgeon-
Barclay. I found 45 cases in hospital, most of them having sickness more or less developed.
At this time there was great panic on account of cholera. About 1500 Coolie coolies had been employed in making roads in the neighbourhood of Hull. Cholera, which had been hanging about all along the road from the Punjab up to Karachi, fell heavily upon these men, and for many days they died in the Civil Cholna Hospital, of which I had charge, at the rate of 10 or 12 daily, and were even found dead along the side of the road. After a few days of this, and while a great amount of correspondence was going on among the authorities as to what was to be done with these unfortunate men, they took the thing into their own hands and disappeared entirely during the course of a single night, going off to their homes and no doubt carrying cholera to many a village among the hills.
From these men the disease spread to the town of Hull and to the Cantonments. When I took over charge of the 29th Regiment I found that one man had died and one or two more were down with cholera. I at once proposed to the Commanding Officer to move the men out to Cholna Camp. It was impossible to move them out to any distance on account of having to guard the Commissariat stores, but a move of about a mile to the south was made, and this proved sufficient to check the disease, as only one man depoy and one or two camp
followers died.
The 11th N.I. who had had one or two cholera cases, also moved their camp at my suggestion, and cholera never obtained a hold on any portion of the troops or camp followers, although a few isolated cases occurred, one fatal and deeply regretted case being that of W. Sinclair, the Assistant Commissioner, who had been indefatigable in his efforts to establish proper hospital accommodation for the civil population.

The 29th N.I. was moved back to the Cantonnement about the middle of July, the 11th N.I. remained out until it went up to Badish Kheyl about the end of that month. Out in camp of course every one was under canvas, and the men suffered extremely from the heat. A great many cases of malarial fever occurred both in the 29th and 11th Regiments, andremopy steadily increased. I made every effort to find some antiscorbutic in the neighbourhood, but nothing of the kind was to be found. Nothing green or acid could be bought in the town, not even vinegar being procurable.

Towards the end of June it was discovered that at a village a few miles off there was a quantity of melons, and these were at once bought up. I began to entertain great hopes of an improvement in the men's health, but unfortunately the supply obtainable from this village was only sufficient for two or three days, and no more could be heard of. I have no doubt that even this small
amount helped to retard the disease, but it was not sufficient to make any marked change for the better. At this time the men not in hospital were getting the amount of linseed sanctioned by the authorities, viz., half an ounce three times a week. Even this miserably insufficient quantity was not supplied as a ration, but was doled out as a special allowance on a special indent signed by the Commanding Officer. There happened however to be a very obliging officer at the head of the Commissariat Department at Hull at this period, and he supplied me with as much linseed for the use of my hospital as I chose to sign for, so that I was able to give each man in hospital an ounce of linseed daily. The Commissariat Officer referred to did not stay long at Hull at that time, and this mode of obtaining linseed was soon put a stop to, but as the Deputy Surgeon General was by that time convinced of the reality of the remedy, he countersigned my indents for linseed for the hospital and enabled me to obtain it. So that from the time of my assuming medical charge of the 29th Regiment to the end of its stay at Hull all my hospital patients had invariably an ounce of linseed daily.

Had the linseed been really linseed of good quality, this ought, one would think, to have produced a marked effect in a very short time, but until we
got vegetables I could not see that any improvement was effected in a single case. On the contrary, the patients got worse in spite of the ounce of lime-juice daily.

From this I am very strongly inclined to believe that the lime-juice was seldom, if ever, what it professed to be. There were no means of making any analysis, but it had seldom, either the appearance, smell or taste of real lime-juice, and not infrequently had that peculiar astringency which one never associates with anything else than alum. Being often, I believe, little else than a solution of alum in water, flavoured with a little essence of lemon. However that may be, it did not produce any visible beneficial effect. The 11th M.I., who were in camp near the 29th, suffered greatly from fever at this time, more than the 29th did from this cause. They ascribed it to the excessive heat, of which they complained greatly. I said to some of them jokingly one day: "Why, you have come from Oudh, which is said to be about the hottest part of India. What do you mean by complaining of heat?" "Sahib," they said solemnly, "it is hot in Oudh, but nothing compared to this." It is impossible to convey in writing any idea of the emphasis they put upon the "nothing." I mention this trifling conversation to show that the excessive heat was a fact, patent to all, native and European alike, in case I
might be thought to be merely recording my own sensations.

Scurvy was less prevalent among the men of the 11th, owing simply to the circumstance that they did not come up country till the Spring, so that the disease had not had such a long time to develop as it had in the 29th. The men of the 11th however began about this time to show traces of it, and latterly I found some pretty well marked cases among those admitted to hospital.

On the 30th of June I made an inspection of all the men of the 29th not in hospital who could be spared from duty to attend, 536 in all. It will be seen from the Report I sent in to the Deputy Surgeon General (Appendix B a) along with a Tabular Statement (Appendix B b) that of these 536 men doing duty 421 or 78.72 per cent. shewed signs of scurvy, and that while in 49.62 per cent. these amounted only to "traces", in 29.1 per cent. they amounted to well marked scurvy. In addition to these there were 91 men in hospital, nearly all of whom were more or less scurvy.

I remarked in this Report that the left wing which had come from Kuman, where it may be remembered I said a few wild antiscorbutics could be gathered if looked for, shewed decidedly less scurvy than the Right wing, which had been all the time at Hull.
This difference was more particularly noticeable in the percentage of "well marked" cases. Of these the Right Wing had 36.75 per cent., the left only 23.33 per cent., while of the 84 sick in hospital 52 belonged to the Right Wing and 29 to the left.

This report was forwarded by the Deputy Surgeon General to General Roberts along with a letter (Appendix B) recommending that nothing should be done in the way of moving the Regiment at present, but that in the meanwhile, however, measures should be taken to meet the prevalence of scurvy and the Commissariat directed to issue to the Regiment a daily ration of onions at the rate of 1 oz per man in addition to the ration of lime juice now allowed.

On my receiving a copy of this letter I thought I saw the end of our troubles, and of course lost no time in applying for the ration of onions. All that ever came of it was that after considerable delay I received a communication from the Commissariat Department to the effect that the allowance of onions in question had not been sanctioned, and consequently could not be supplied as a ration, but that as a great favour to meet the exigencies of the case they were willing to supply the men with onions on payment, mentioning a rate between two and three rupees a man and (about 80 lbs.) higher than onions were by this time selling for in the Khul-e bazaar. For early in July onions had begun
to make their appearance from down country, few and
dear at first, but plentiful and cheaper (although
still very dear) later on. At first they were too dear
for the men to buy unless in very small quantities, and
the hope of getting them as part of their ration naturally
made them both to buy them at first.
But by this time (the middle of July) the famine was
becoming a very serious matter, nearly the whole regi-
ment being affected, and it was becoming extremely
problematical whether it could long continue to be
able to call itself an effective regiment, unless some-
thing were done to check the progress of the disease.
I made another inspection of the regiment on the 14th
of July, with the result detailed in my Report to the
Deputy Surgeon General (Appendix C at p 39). I ex-
amined 434 men and found that 401 or 93.3 per-
cent showed signs of famine, as compared with
78.7 at the previous examination, and that the
percentage of men showing well marked famine was
46.3 as compared with 29.1 at the last examination.
In addition to these, who were all doing duty, there
were 98 men in hospital, and I had sent 22 of the
worst cases to their homes on sick leave. Had these
men remained in hospital they would have brought
up the list of sick to 120.
No notice was taken of this Report except in so far as
it is alluded to in a letter of the Deputy Surgeon General
dated 22nd July, asking about the supply of onions, (which letter with my reply will be found in Appendix D) and I took this silence as a hint that further reports of the kind were not wanted. A good deal of inconvenience and trouble to the men resulted from collecting them from different quarters for examination at one time, and the Commanding Officer and I agreed that unless reports were called for here should be sent, and, as I expected, none were called for.

From this time I gave up all hope of any assistance from the authorities, and saw that if the money was to be got under it must be done with the resources at our command in Hull.

I had discovered some time before that milk in abundance was to be had from neighbouring villages, at rather a high rate of payment however, and about the beginning of July I persuaded the Commanding Officer to give an order that every patient in hospital for whom I considered it advisable should have half a beer or 16 ounces of milk supplied him daily, and the price deducted from his pay. I put this order in force pretty early, and although it caused a great deal of grumbling, and the old soldiers in hospital one and all declared that they would not be much mind a stoppage of their pay for rum, but to be forced to buy milk was rather
too bad; I trust that some good resulted from the step. I say "trust," because I cannot honestly say that I observed any marked benefit result from the use of the milk. But I have really no doubt that the milk must have done some good, although this became merged in the greater benefit resulting from the use of onions.

For as soon as I found that it was hopeless to expect to get any of these from the Commissariat, I devoted all my energies to impressing on the men the necessity of buying them for themselves. I kept constantly haranguing them on this subject, both in the hospital and in the lines. I urged upon the Native Hospital Assistants the importance of using all their influence with the men to this end, and I had long talks with the most influential Native Officers, and convinced them of the importance of doing all they could to get the men under them to use onions freely.

In this I succeeded perfectly. Although the Sepoys are not fond of spending their money, and the onions were never anything but dear, yet they had got such a terror of this mysterious disease, which they had never seen or heard of before, and for which their language has no name, that as I said in my letter to the Deputy Surgeon General (Appendix D 3) "all are purchasing onions freely, most of them eating them twice a day - even the Dogras, to whom..."
in common with all high Caste Hindus onions are a
forbidden article of food; have become so impressed
with the necessity of checking the scurvy that they
are eating them as freely as the Sikhs and Mahom-
medans."

From the time that the onions began to be used freely
the scurvy was checked. From that time none of
the cases got worse as regards scrobutic symptoms,
and a great improvement was visible in health. But
the health of the Regiment had been too seriously sus-
dermined to permit of its being all at once restored to
a healthy condition. The ordinary diet of the sepoy
remained unchanged, and the onions with which
they supplemented it were too expensive to be used as
freely as could have been desired.

Towards the middle of August the supply of this vege-
table began to fall off, but in the beginning of Sep-
tember lines began to make their appearance from the
direction of Kohat, and although the price of these
was almost prohibitory, yet the men were induced by
representations to purchase as many as they could
afford, and everywhere might be seen Sepoys eating
sections of onions.

In this way the disease was kept in check, and as long
as I remained with the regiment the scrobutic symptoms
were receding, and only gave concern on account of
the infected health of the men laying there open to the
attacks of malaria, which in August and September assumed most formidable proportions.

In addition to measures for the mitigation of the Scourge in Hull, I resolved, as soon as I found there was no chance of the Regiment being moved, to send as many of the worst cases as I could away to their homes or to the Depot at Salford, and I sent in the course of July, August and September as many as 150 men on sick leave. Of these a few were utter wrecks and never lived to see their homes, but those whose constitutions were not so thoroughly broken up as to prevent their reaching their destination rapidly recovered under the effects of change of air and proper diet, and before I left I had the satisfaction of seeing a number of them rejoin in perfect health, and of receiving their thanks for sending them home and giving them the opportunity of recovery.

It will be remembered that on the 18th of July I stated the number of men in hospital to be 98. After this date, owing to the great increase in malarial fever, although the worst symptoms of the Scourge began to abate, I never found my hospital list below 100, except on the day after a batch of 20 or 30 had been sent on sick leave. A single day sufficed to bring the number over 100 again, and for the last month in Hull it averaged over 130.

It must be understood that these figures apply to
the 29th Regiment only. The total of the sick in all the different hospitals under my charge was often between 300 and 400.

The wing of the 11th L.I. left Hull in the end of July to join the Head Quarters of the Regiment at Badish Kheyl. It had suffered much from fever here in proportion than the 29th during June and July, but less from scurvy for the reason before mentioned. I do not know much of the medical history of the regiment after this, but I heard that both wings suffered terribly at Badish Kheyl from fever, and that scurvy increased greatly. When I passed through Kur气氛 in October I found that this regiment which had gone on to Ali Kheyl, had been obliged to leave over 300 men behind at Kur麻 as unfit to go on active service.

In July the 1st Bengal Cavalry came to Hull from Sialkote. At first this Regiment had a medical Officer of its own, but afterwards he was sent to the front and I had medical charge of it. I arrived in Hull in a fair state as regards health, except that it had lost a European Officer and some men on the road from Cholera. Having come straight up from a healthy district this Regiment showed no signs of scurvy on arriving, and was only beginning to show traces of it when I left it, but I have little doubt it would suffer seriously from this
disease later on. But the men as a rule were past the prime of life, a great many of them having served through the mutiny, and old age in their case seemed to have the same effect as hunger in the case of the 29th, in rendering them easy victims to the attacks of malarial fever. Hardly had the 1st B. C. settled down in Hull before it began to suffer heavily from fever, and it was not long before it had nearly half its strength on the sick list. When I took over charge of it in September I found over 120 men in hospital and had seldom much less than that number sick. This be it remembered was out of a total strength of 375 men. Even those who were nominally fit for duty were really little stronger than the patients in hospital.

Six years previously I had medical charge of this regiment at Camphire all through the hot season and the rains. At that time I had seldom over 6 men in hospital, and as far as I remember the largest number on any day was 15.

In the early part of September occurred the massacre at the Embassy at Cabul, and after that there was nothing talked of but movement to the front. In the latter end of September the 29th got orders to march to Ali Khel, and in a day or two afterwards marched.

I held a medical inspection of the men before marching.
to decide on who were fit to go. Everyone, whether in hospital or out of it, was anxious to go on, “anything to get out of this place” as one of my patients said to me. In selecting the men to go on I had special regard to the extent to which fever was developed in each. Looking to the probability of a hard winter’s campaign, without anything but their rations, being in store for those who went on, while those left behind had some chance of getting fruit now, as lines had appeared and the demand being known was likely to create a salary, I left behind all those who had had bad fever and were likely to relapse. On the other hand I had no hesitation in taking on those who suffered chiefly from malaria, as I thought they were likely to benefit by the change. Of course many febrile patients were too weak to march and had to be left.

In all I had to leave between 150 and 160 men in hospital at Khul, and this added to 150 men on sick leave, left little more than half the regiment fit for service. What with these deductions and the necessary guards &c. the regiment had to march out little over 350 strong.

Nor was this all, for so many, even of these picked men, broke down on the march to Khurun, a distance of less than 60 miles done by very easy stages, that when we went on to Ali Khel from Khurun I had to leave 41 sick behind there, and we arrived at
Ali Khoje but a little over too strong.
Almost the whole of this enormous amount of sick
ness and consequent loss of strength was due to two
causes only, viz. Dysentery and Malarial fever, and
although other regiments suffered from the latter cause
without having much Dysentery, yet the physique of
the men of the 29th was so immeasurably superior
to that of any of these others with which I came in
contact, and their state of health on commencing
the campaign was so perfect, that I believe I am
justified in saying that had the men not had their
constitutions undermined by Dysentery, the Malaria
would have been comparatively slightly felt.
In the month of December I left the 29th Regiment.
The health of the Regiment at least of those men
remaining with it was improving at that time,
and men were rejoicing from sick leave in good
health. Shortly after this however the health of the
men whom I had left behind at Thull were brought
up, and swelled the sickness of the Regiment.
The Medical Officers who had charge of it sub-
sequently have written to me giving me a short
account of the health of the men since my leaving.
Surgeon J. H. Corbett M.D., now with the 11th N.I. at
Lucknow, writes on the 29th December last:
"When I joined the 29th on the 8th of December
1879 I found about 40 p.c. had well marked
Symptoms of the disease and many more were more or less slightly affected. Independently of this the men with the exception of the Pathan companies were all more or less in an anemic and weakly condition, partly from the fever from which the majority of them suffered at Thull when under your care, and partly from the scenery. Diarrhoea and Dysentery were rife, scenery evidently being the predisposing cause, odd cases of pneumonia and pleurisy also occurred, and a lot of the men had coughs and colds.

Dr. Corbett then proceeds to describe the expedition against the Zainulbuts in the latter end of 1879 and beginning of 1880. With regard to the deaths (2) entered as laryngitis he writes: "These men died from a disease which I must certainly associate closely with the scenery. They got a sort of laryngo-pneumonia, the throat, which rapidly spread to the larynx and caused oedema, occlusion of glottis and death. Afterwards when at Shalzaza I had several cases of the same kind, but as they were more favourably placed as regards treatment they recovered. With the connection between scenery and dysentery before my mind I cannot help associating this rapidly spreading inflammation of the pharynx with the same disease."

Surgeon J. Crofts M.D., whom I mentioned before as handing over the left wing of the Regiment to me.
at Kuram, again took over charge on the 17th of June 1880 and is still with the Regiment at Agra. So here I am indebted for the details of the mortality in the Regiment to my leaving it. The rites are from field locker (on the march to Agra) as follows:

"When I joined the 29th at Kuram on June 17th 1880 a great many of the men were debilitated. I inspected the regiment and picked out 88 men that had reached symptoms of scurvy and had them followed every day with Dewai [meaning that he had them put under special treatment]. The Dogras and Pathans were most affected; the Sikhs suffered from anaemia but got nearly over the scurvy at that time (June). I enclose a list of the number of men that have died since you left the regiment, and I think I am safe in stating that the diseases from which they died were complicated more or less by scurvy."

He goes on to describe their march down country, and concludes: "I consider the men now in splendid health and they have lost all traces of scurvy."

**Mortality**

I come now to the mortality and must explain (1) that while nearly every case in hospital was complicated by scurvy, only cases that claimed admission originally for some septicemic symptom figure under the heading "Scurvy", and (2) that "Agra" must be read
as meaning malarial fever, whether intermittent or
recurrent, or as often as not of no distinct type.
It will be noticed that the mortality during the time
I was with the regiment was extremely small, the
more serious mortality coming as I feared would be
the case, when the broken down constitutions of the men
had to contend with cold and hardship.

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I have not got the particulars as to the months in which these deaths occurred, but I have no doubt that the enormous mortality from pneumonia occurred chiefly in January, and may be said to be owing in no small measure to the weakened state resulting from the Scoury.

The Camp Followers at Hull and everywhere else suffered much from Scoury, but the majority of them were so constantly on the move that it is impossible to give any detailed account of them. All Camp followers' hospital however, had always a large number of Scoury patients,
butie patients, the number varying in proportion to the number of camp followers in the station. At one time there would be 300 or 400 cabars in the station, at another time not over a dozen.

The ratios of all the camp followers, as I have before stated, were identical in composition with those of the deploys, but less in quantity, so that those most favourably situated, viz. camp followers connected with regiments, who at least got their pay regularly, were rather worse off than the Native Soldiers.

The cabars or dooly bearers were worse off still and there was undoubtedly a very great amount of sickness and mortality from dysentery and other causes among all classes of camp followers, but I am unable to say anything as to the amount.

Even Officers' servants, who had many advantages that the cabars and even the ordinary regimental camp followers could not have, suffered extremely. Of four servants who accompanied me from Kohat, two died across the Frontier. One of them died of scrobutic dysentery, the other of scrobutic diarrhoea and malarial fever. These men were at Thull along with me and suffered from scurvy there, although I gave them plenty of rice and victuals. They improved in health at the same time as the deploys did, on the introduction of onions and garlic, and seemed pretty well when we marched to the Front.
again. They broke down however under the sudden change to the cold, much about the same time as I finally broke down myself, and died before reaching the Frontier. They were both Mahomedans, and careless like most of their creed, so that I believe they paid little attention to my advice about themselves until it was too late. My two other servants were Hindus and paid strict attention to all that I told them as to prophylaxis. Neither of them ever had a trace of remy and they returned to India in perfect health.

Although there was this difference between Hindus and Mahomedans among my servants, it was probably merely accidental or owing to individual peculiarities, as I noticed no difference among the different classes of sepoyos. All classes suffered alike, Sikhos and Hindus as much as Mahomedans. So also among the camp followers I did not notice any difference due to nationality or caste. It will have been observed however that the medical officers who had charge of the Regiment after me noticed some difference in this respect.

The Europeans

No European at Pille had remy, so far as I saw or heard of, but all suffered much from malarial fevers. Some of the departments were at times almost paralyzed through all their officials being prostrated by this disease.
The native inhabitants of Hull and the neighbourhood seemed not to suffer at all from scurvy. I had a dispensary in the town of Hull, to which a large number of the native inhabitants applied for medical aid. In not a single case was any trace of scurvy apparent, but they suffered on the other hand extremely from malaria, apparently quite as much as the troops in the cantonment.

As they used neither vegetables nor fruit, as far as I could learn, I was, and still am, much puzzled to account for their immunity from scurvy, and the only explanation I can think of is that cuddled-tillle forms so large a portion of their diet as to exercise an antiscorbutic influence. If this explanation be the correct one, it will also account for the freedom from scurvy enjoyed by the various nomad races of Asia, who cultivate no vegetables or fruits, and do not seem to be affected by scurvy.
Chapter V.
Symptoms and Treatment.

The first change in typhus is said to be observable in the skin, more particularly in the countenance. Probably it was owing to the naturally dusky nature of the countenance, I had to deal with, that my experience does not coincide with this. I noticed a change in the countenance in a great many cases, but by no means in all, and the affection of the gums was most certainly the first symptom to make its appearance.

Further, in contradistinction to some observers who say this is by no means an invariable symptom, I never saw a single case in which a man who complained of any of the other symptoms failed to show acorbutic gums, while on the other hand I saw numbers of strong, fairly healthy men who complained of their gums and had well marked erubescenle gums, but showed no other symptoms of being affected beyond a little debility, and lassitude. In a good proportion of the cases the disease fortunately never went beyond this.

The depoys are much more particular about brushing their teeth than Europeans of the same race in life, and this never failed to call attention to the affection of the gums where it existed, as bleeding invariably ensued, however slight might be the affection.

The gums were sometimes much swollen, sometimes only slightly so, but they always had a bluish purple tint which
was very unmistakable, and which I soon came to regard as absolutely pathognomonic. It was particularly well marked at the junction of the gums and teeth where the blue hue of lead poisoning occurs. It had no resemblance to this however, being always either purplish or bluish, the blue tint when present being always subordinated to the red. The teeth were always more or less loose if the gums were much affected, often so much so as to come out very easily. More than once a patient whose I was examining, after telling me that his teeth were all loose and shaky, would pull one out between his fingers and thumb by way of clinching his statement and disarming scepticism.

Those whose gums were much affected complained of being of much difficulty and pain in chewing, accompanied by bleeding.

Debility with loss of appetite was very marked in a large number of cases, but as the majority of the men suffered more or less from malarial fever as well as remy, it was impossible to say how much of the debility was due to each in particular. But that much of it was due to the remy I have no doubt. It was marked in many cases where there was comparatively little fever. I can only say "comparatively little", as I doubt if there was any person at Tulul who had no fever at all.

Scurf was of course common, but attracted little notice and were less observable than on a white skin.
Sore on the lower extremities were very frequent. Sometimes these apparently developed from perineum, at other times they were the result of some trifling abrasion. They were very difficult to heal, which was the more remarkable as being so different from the usual experience in native hospitals, where as a rule anything in the shape of a cut or abrasion heals very rapidly and kindly, much more so than among Europeans. The majority of cases of this kind however never came to hospital unless for some other complaint. The better kind of Sepoy, which term includes nearly all the Sikhs and Dogras, is too proud to go to hospital for a trifling complaint, and often carries this very proper feeling too far, attempting to do duty when hardly able to stand. So we used to estimate the number of men with septiculic sores by noticing how many men in the lines (where they go about in native Undress) wore rags round their legs or feet. This number was always large, though latterly it began to decrease.

These septiculic sores were often troublesome, but never went the length of fungoid ulcers. This however was probably merely a question of time, as until the appearance of the ominous most of the sores were gradually extending and getting worse.

"Phlegmatism" as the men called it, i.e., extravasation and infiltration in and around the muscular tissue, was very common and was an early symptom to appear.
in many cases. There were several such cases among the 
Ricke at Kemm when I took over charge of the Left 
Wing on the 6th of June, and there were several more 
among the Ricke of the Right Wing at Thule. I had 
always a number of men in hospital each with a leg 
lost at an angle from hard infiltration at the lower part 
of the bone. They generally complained of a good deal 
of pain, especially when they attempted to walk. Usually 
only one limb was affected. In only one or two cases 
were both legs affected and in these the amount of in 
filtration and lameness was comparatively trifling 
on one side.

A smaller number of cases had an affection of a similar 
nature but less severe at the bend of the elbows, and 
a few had infiltration about the ankles, but I had no 
case with the jaw affected, either in the 29th Regiment 
or elsewhere.

There was often oedema of the feet and ankles.

In no case that I saw with this infiltration and 
dwelling did the local affection improve while under 
your observation. The general health did so in several 
instances, but without any appearance of improvement 
locally. Latterly I sent all such cases to their homes 
on sick leave whenever I had an opportunity.

Diarrhoea and Dysentery were both pretty common 
but did not prevail to such an extent as might have 
been expected. These are rather cold weather than hot
Symptoms and Treatment

He bade complaints on the Frontier, and dysentery was just beginning to assume a serious aspect when I left the regiment in November.

Both however were always present, and were fatal in several cases. Indeed most of the cases that terminated fatally did so from diarrhoea, dysentery, or jaundice, although not entered under these headings in the table of mortality. As before mentioned, two of my own servants died during the winter of Scrofulous diarrhoea and dysentery respectively.

Gastric Disturbance with loss of appetite was common, but it was difficult here as in the case of debility to say how much was due to fevers and how much to fever itself hot. The intense heat too was of itself sufficient to produce symptoms of this kind.

 Cyclophoria (or Generalphoria) I observed in several cases. This is not an altogether unknown affection (or symptom) in peace time in India. There is an interesting passage in Bishop Heber’s Journal regarding it. He says: “I am now, Mr. Smith, among the lowest classes in India, and to some professions of men, such as soldiers, very inconvenient. The Beps are paid in all kinds of sufficient for, and it is said to be always most prevalent in a scarcity.” (Bishop Heber’s Narrative of a Journey through the Upper Provinces of India in 1821-22.)
I am not certain whether to regard this sight blindness as a scabrous symptom, or as due to simple defective nutrition. Not necessarily scabrous, but I am strongly inclined to think that it is scabrous. I saw two cases previous to my experience at Hull, but not having had at that time any attention directed toward scabby, I unfortunately neglected to examine their gums. They had no other scabrous symptoms. The appearance resembling violent ophthalmia with chemosis, but non-inflammantary and painless, as described by Dr. Buzzard in Reynolds's Medicine, did not occur in a single case, to however characteristic it may be when it does occur, it certainly cannot be said to be a very constant phenomenon. Indeed it was remarkable how little in the way of eye affection I was called upon to treat. Considering the fearful heat and glare, and the constant dust loaded with all sorts of impurities one might have expected conjunctivitis to be very common. On the contrary, I had very few cases and these only trifling ones. Nothing at all resembling the pseudo-ophthalmic condition referred to came before me, and I am certain that a marked case of the kind could not have escaped recognition, even if the man had not voluntarily come to hospital.

Puffiness about the orbits was on the other hand common...
enough, but was not so marked as it would be among Europeans.

Sudden anxiety was not complained of, but may have occurred frequently notwithstanding. There is always so much noise going on where many natives are brought together, that it might easily exist without attracting much notice on the part of the patient.

Nausea, vertigo, and partial deafness were all common. One of my servants, who afterwards died, was very deaf for a time, and I thought at first he was shamming, but I became convinced finally that the affection was real.

I had no cases of syncope, although there was great prostration in many instances. The nearest approach to it was in some cases of men struck by the sun on duty during the day, but here the state, although of a syncopeal nature, was not pure syncope, and was referable to the direct rays of the sun, although the asphyxiated state the men were in from sunstroke did not assisted.

Affectedness of the respiration system were not a feature of the outbreak. Shortness of breath was common, invariable I may say in every well marked case, and this occasionally amounted to breathlessness with an increase of respiratory movement, but I saw no cases in which there was suspicion of any extensive extravasation into the lungs or pleural cavity. A few
Cases of pneumonia occurred when the cold nights began to set in, but these were real cases of pneumonia and had nothing to do with fever except as a pre-disposing cause.

Indeed all kinds of visceral complications of a pericardic nature were absent or extremely rare, with the exception of those of the gastrointestinal tract. I saw no case in which the kidneys were affected, and although congestion of the liver was not uncommon and congestion of the spleen occurred very frequently, indeed, these were usually attributed, and probably correctly, to the malarial fever from which the men suffered.

Treatment

There is little to say under this head, the treatment having been circumscribed by the very limited means at command. It was chiefly dietetic, and I have already described what was done in the way of attempting to procure antiinflammatory articles of food, and the comparative success that attended my efforts. In case it may be asked why I did not try some of the medicinal remedies which have been suggested for the treatment of remittent, I have simply to state that I had not got anything of the sort to try. My stock of medicines was at all times very limited, and it was with difficulty that I succeeded in getting from time to time small quantities of even the commonest
and most urgently needed remedies.

The malarious fever which prevailed during the whole of our stay at Thull was treated with "Aichona Felipage", an extract of the alkaloids of Aichona bark, made by the Indian Government and issued to Native regiments in lieu of quinine. Quinine was not to be had except in very small quantities, not sufficient for the Europeans at Thull, who would not use the Aichona Felipage. Latterly there was no quinine at all, except a little that some officers got privately at their own expense. Even of the cheap substitute, the Aichona Felipage, it was very difficult to get enough for the demands of my different hospitals.

Dysentery was treated by Specie on in large doses, i.e. a croup or half a drachm of the powder twice a day, and this treatment usually proved successful, although not so invariably as in the case of Diaphoretic Dysentery. Even where successful, the affection was here obstinate and required a longer course of treatment. Diarrhoea was treated as usual by different astringent remedies, these chiefly employed being opium and its preparations. Here also the success was less than in uncomplicated diarrhoea.

Other symptoms were treated on general medical and surgical principles, so far as practicable, the medical treatment usually depending a good deal on what remedies were available at the time.
Concluding Remarks.

I have little to add in the way of conclusion. In the foregoing pages I have endeavoured to give as full and accurate an account as possible of my experience of Kenny, believing that the outbreak I witnessed had peculiar features which rendered it worth recording. I cannot claim to have cleared away the truth which still to a large extent hangs round this disease, but I trust that the narrative I have given, which I have striven to make as complete as possible in all details, may be found to throw a little additional light on some important points.

One word in explanation of what may possibly be considered a defect in my account of the outbreak, the absence of a detailed description of individual cases. It will be evident to any one who has read my narrative, that during the period to which it refers I had very hard work in mere attendance on my numerous patients. If it be considered that in addition to this I had a considerable official correspondence to conduct and had no assistant capable of writing English, so that I had to make even the copies of my letters and reports myself, it will be easily understood that to keep a Case-book in ordinary form was a simple impossibility. But I made notes from time to time of the more salient points, and I believe that the account which I
have given is in all respects faithful and accurate.
Appendix
Appendix A.

(a)

To The Officer Commanding 29th S. I. S.
Camp Hall
16th June 1879

Sir,

I have the honour to inform you that I medically inspected the 29th S. I. S. (including the left wing not previously examined) with reference to the prevalence of Remdy among them with the results shown in the attached table.

I am of opinion that the general health of the regiment is considerably undermined from long service in the field during which time food of an antiseptic character was not obtainable. Every effort was made to obtain vegetables but without success.

A lime juice issue was early commenced but has not prevented the appearance of the diarrhoeal condition.

I have to

(aged) A. Barclay
Surgeon 29th Regt. S. I. S.

I have further to bring to notice that the men are in such an unfeebled condition that they would with difficulty resist severe or epidemic disease.

(aged) A. Barclay Surgeon
29th Regt. S. I. S.
Tabular Statement of 29th P.T. I. referred to in foregoing letter -

<table>
<thead>
<tr>
<th>Company</th>
<th>No. Examined</th>
<th>Face of Duty</th>
<th>Per Cent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>21</td>
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<td>36</td>
<td>65.4</td>
</tr>
<tr>
<td>C</td>
<td>37</td>
<td>34</td>
<td>59.6</td>
</tr>
<tr>
<td>D</td>
<td>61</td>
<td>38</td>
<td>62.2</td>
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<tr>
<td>E</td>
<td>45</td>
<td>29</td>
<td>64.4</td>
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<tr>
<td>F</td>
<td>24</td>
<td>16</td>
<td>66.6</td>
</tr>
<tr>
<td>G</td>
<td>40</td>
<td>19</td>
<td>47.5</td>
</tr>
<tr>
<td>H</td>
<td>36</td>
<td>25</td>
<td>69.4</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>358</strong></td>
<td><strong>218</strong></td>
<td><strong>60.8</strong></td>
</tr>
</tbody>
</table>

(y)

Forwarded to Deputy Surgeon General, Kurama Field Force.

The undersigned in forwarding the enclosed report and tabular statement from Surgeon Barclay begs to bring to notice that the men of the 29th have been much exposed on working duty under a hot sun and trying circumstances, both as regards weather and food.

The men are at present as well battled as circumstances admit, but one wing having been detached, only accommodation for four companies was completed before the hot months set in.
Appendix A

I have the

(29th) G. V. Chamber, Major-

temporarily commanding-

June 17th, 1879-

(S)

In forwarding the above for the information of the Major General Commanding I have the honour to state that when at Kurane shortly before the left

wing of the 29th I. M. I. proceeded to Kurane I inspected the men with the medical officer in charge

and the proportion that then exhibited symptoms of

fever was comparatively small. An issue of linen,

since 3 times weekly to the regiment will be sufficient

on the Indent of the Officer Commanding and the

Medical Officer should report fortightly on the con-

dition of the men.

(29th) J. G. Townsend

S. Surgeon General

Peirce 21st June 1879

(S)

The Major General has read this report, he

does not propose to take any action on it at present.

He desires that the fortnightly reports which the

Deputy Surgeon General has called for may be sent

on for his perusal.
Appendix A

By Order

[Signature]

A. 2. M. G.

15

Returned to the officer commanding 29th N.I.

Note: The above notice should be at once indented for.

[Signature]

F. G. Townsend

Surgeon General

K. T. F.


Of Hull 1st July 1879.

To The Deputy Surgeon General

Kurram Field Force

Sir,

In accordance with instructions received, I have the honour to submit a Report on the state of health of the 29th Regiment P.W.I.

I regret to have to inform you that the health of the Regiment has not improved since the date of Surgeon Barclay's Report. The number of men in hospital has not diminished, although
A good many have been sent on sick leave. On the last day of June there were 81 men in hospital and 28 men employed as sick attendants on them.

The great majority of cases in hospital are of a scrobutic nature, although only a few have been entered in the Admission and Discharge Book as such. Where a patient has come into hospital with Siege or diarrhoea or a blistered foot, his case has been registered under the head of the disease for which he was admitted. But the scrobutic stain in the majority of the cases as evidenced by the state of the gums, this itself in the ordinary with which the most trifling complaint resists treatment. A small sore on the foot which under ordinary circumstances would be completely healed in 2 or 3 days, remains in the same state for weeks and all other complaints whether trifling or serious show an equal tendency to resist treatment.

During the month there have been 8 cases of cholera among the sepoyos, of which two have proved fatal. The Mess Khan samah, a bunniah and a langri belonging to the regiment were also attacked by it. The Khan samah and bunniah died of the disease.

Two cases of smallpox also occurred during the month. Both are doing well.

On the last day of June I made an inspection
of all the men not in hospital who could be spared from duty. There were 536 native officers, non-commissioned officers and rank and file examined, and as the Table appended shows, I arrived at the startling result that 78.72 per cent of the men showed traces of Remoy, while 29.1 per cent of these exhibited it in a well marked form.

It is to be remarked that the Right Wing which has been at or near Thull for a long time exhibits a greater proportion of cases than the Left Wing which has just returned from Kurane. Taking the cases in which Remoy has been returned as well marked, the Right Wing has 36.58 per cent of such cases, while the Left Wing has only 23.39 per cent. Again, taking the hospital entries for all diseases, out of 81 men sick in hospital on the 30th June, 32 belonged to the Right Wing and 29 to the Left.

The men in hospital are all getting an ounce of lime juice daily, and those not in hospital an ounce of half an ounce three times a week. I beg respectfully to submit that the latter allowance, although it is in all probability, provided the lime juice be of good quality, sufficient to prevent an outbreak of Remoy among healthy men, is not sufficient to exercise a curative effect when the Remoy is so far developed as it is in the 29th. And I cannot
help, in common with many others to whom I have spoken, entertaining some doubt as to the quality of the lime juice supplied. Whatever the cause may be it seems to produce very little effect.

I have the honour to observe in conclusion that I agree with Surgeon Barclay in considering the health of the Regiment to be so undermined from venereal and other causes that it would be nearly certain to suffer most severely if attacked by disease in an epidemic form.

I have the

[Signature]

Robert Waddicor M.B.
Surgeon 29th P.V. I.
Table showing number of men out of hospital affected by 200 or 300 in the 29th Regiment P. 8. I.

Of Miliw 30th June 1879

<table>
<thead>
<tr>
<th>Company</th>
<th>No. of men examined</th>
<th>Times showing well marked 200 or 300</th>
<th>Times showing a slight trace of 200 or 300</th>
<th>Total of men showing a marked 200 or 300</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>45</td>
<td>16</td>
<td>35.35</td>
<td>30</td>
</tr>
<tr>
<td>B</td>
<td>51</td>
<td>26</td>
<td>50.98</td>
<td>49</td>
</tr>
<tr>
<td>C</td>
<td>71</td>
<td>26</td>
<td>38.02</td>
<td>66</td>
</tr>
<tr>
<td>D</td>
<td>78</td>
<td>16</td>
<td>21.79</td>
<td>61</td>
</tr>
<tr>
<td>E</td>
<td>72</td>
<td>21</td>
<td>28.77</td>
<td>60</td>
</tr>
<tr>
<td>F</td>
<td>77</td>
<td>17</td>
<td>22.07</td>
<td>55</td>
</tr>
<tr>
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<td>12</td>
<td>21.81</td>
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</tr>
<tr>
<td>Band</td>
<td>28</td>
<td>9</td>
<td>32.13</td>
<td>18</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>536</strong></td>
<td><strong>155</strong></td>
<td><strong>29.1</strong></td>
<td><strong>421</strong></td>
</tr>
</tbody>
</table>

And 51 sick in hospital, nearly all exhibiting 200 or 300 with complications.

From the Deputy Surgeon General, K. F. I. to the Art. Adjutant General, K. F. I.

Of Plivat Hospital 4 July 1879

Sir,

With reference to the enclosed report on the
I have the honour to remark for the information of the Major General that although the report shows there is a considerable amount of sickness among the men due apparently in some measure to a dermopathic taint, the mortality during the month of June was by no means heavy. Three deaths occurred during the month, two of which were from cholera. The fact that although cholera was present in Hull and the neighbourhood throughout the month only 8 cases occurred in the regiment and only 2 or 25 per cent proved fatal appears to me to indicate that the conditions under which the regiment is placed at Hull are not favourable to the prevalence of cholera and that the men are not likely to suffer severely from the epidemic. If however the regiment should be permitted to march to Tallagong [Vallagaoe, the depot of the regiment, mentioned in Part II] through districts in which the epidemic is reported to be now very rife it would probably be subjected to more unfavourable conditions and suffer great mortality.

I am of opinion that the regiment would suffer more by marching to Tallagong at this season of the year than by remaining at Hull till the commencement of the colder weather.

In the meantime however measures should be taken to meet the prevalence of disease, and the Commissioner directed to issue to the regiment a daily ration of
Onions at the rate of 4 oz per man in addition to the
ration of limejuice now allowed.

I have to,

(29th) S. B. Townsend, Q. S. C.

C.

(a)

To The Deputy Surgeon General R. F. T.

Hull 13th July 1879-

Sir,

I have the honour to submit the Second
Fortnightly Report on the health of the 29th P.O. I.

I have much pleasure in stating that
Cholera has ceased for the present, there being only
2 convalescent cases in hospital.

There have been no more cases of small pox.
Every precaution was of course taken to prevent the spread
of infectious disease among the men.

I regret to say that the general health of
the Regiment is worse than at the date of last Report.
There are now 98 men in hospital as against 81 at the
date of last report, and this although no less than 22
men were sent on sick leave from hospital. Had these
been remained the hospital return would have showed
120 as against 81.

I yesterday examined all the men of the
Regiment not in hospital or on duty with reference to the prevalence of syphylis among them. Out of 434 men examined 403 or 93.3 per cent showed traces of syphylis as against 78.7 at last examination. The percentage of men showing well marked syphylis was 16.3. At the last examination it was 29.1.

I append a table showing in detail the number of men in each company affected, the cases being as before divided into well marked and slight. It will be seen from this table that the left wing is now as much affected as the right.

I have to.

[Signature]

Robert Elliottie M. B.
Surgeon 29th F. V. I.
Table showing number of men out of hospital affected by scarlet in the 29th Regiment S. I. M. 
By Drill 14th July 1879.

<table>
<thead>
<tr>
<th>Company</th>
<th>No. of men examined</th>
<th>Number showing well marked scarlet</th>
<th>Number</th>
<th>Percent</th>
<th>Number showing slight scarlet or a decided taint</th>
<th>Total of men having a scarlet taint</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
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<td>89.1</td>
<td>19.8</td>
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<td>19</td>
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<td>93.5</td>
<td>93.5</td>
</tr>
<tr>
<td>C</td>
<td>66</td>
<td>30</td>
<td>32</td>
<td>48.4</td>
<td>62</td>
<td>93.8</td>
<td>93.8</td>
</tr>
<tr>
<td>D</td>
<td>66</td>
<td>28</td>
<td>35</td>
<td>53</td>
<td>63</td>
<td>95.4</td>
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</tr>
<tr>
<td>E</td>
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<tr>
<td>G</td>
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<td>17</td>
<td>39</td>
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<td>87.5</td>
</tr>
<tr>
<td>H</td>
<td>48</td>
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<td>47.9</td>
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<td>97.9</td>
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<tr>
<td>Total</td>
<td>434</td>
<td>200</td>
<td>205</td>
<td>47</td>
<td>405</td>
<td>93.9</td>
<td>93.9</td>
</tr>
</tbody>
</table>

And 98 sick in hospital.
Appendix D

[2]

From the Principal Medical Officer
Kurna Field Force

To Surgeon P. Moodie
In Medical Charge 29th P. I.
Shull-

Of Pocina Hotal 22nd July 1879-

Sir,

With reference to the Fortnightly Report on the health of your Regiment dated the 15th Instant, I have the honour to request the favour of your Information whether any measures have been taken to supply the men with onions or other vegetables, and if so to the date on which they came into operation, and the quantities issued daily.

I have to

S. M. O., K. T. F.

In Medical Charge 29th P. I.

To The Principal Medical Officer K. T. F.

Of Shull 26th July 1879-

Sir,

In reply to your letter No. 2048 dated 22nd Instant, I have the honour to inform you that in consequence of a free ration of onions not having been sanctioned...
No official steps have been taken to supply the men with

The Officer Commanding has no power to force the

Thus, the officers have been asked to use the article of diet of that nature

and in addition the rate at which the Commissariat

offered to supply them was higher by two or three

rupees per mouth than the price at which the men

could purchase them in the Bazar.

The men however have had impressed upon them

the necessity of making this addition to their diet, and

all are purchasing onions freely, most of them eating

them twice a day—Even the Dogras to whom in common

with all high caste Hindus onions are a forbidden article

of food, have become so impressed with the necessity

of checking the enemy that they are eating them as

freely as the Sikhs or Mohammedans.

I have to

(1907) Robert Moodie M.S.

Simpson 29th. N. I.

E

(a)

Memo 1248. 7th August 1878.

The Medical Officer 29th. N. I. is requested to state

when submitting his next indent for onion juice how far

the free use of it now sanctioned, has been successful
in improving the condition of the men, also whether it
has apparently had any effect in inducing diarrhoea.

Lt. C. Townsend
Surgeon General
P.W.S., K.F.I.

(3)

Letters from the Officers in Medical Charge
29th P.W.S.
To The Deputy Surgeon General K.F.I.
Hull 13th August 1879.

The undersigned has the honour to acknowledge receipt
of letters 127/8 requesting information as to how far
the use of lime juice has been successful in improving
the condition of the men, and whether it has apparently
had any effect in inducing diarrhoea.

With regard to the first inquiry, the undersigned has much
pleasure in reporting that the health of the men as far
as scurvy is concerned is slowly improving, but at the
same time the undersigned is extremely doubtful as to
whether the improvement is due to the lime juice. Until
onions made their appearance in the market, the health
of the men was steadily deteriorating, although they were
getting lime juice regularly. Since onions became pro-
cusable on a large scale, the health of the men has shown
a decided tendency towards improvement. The undersi-
gned has already expressed his opinion as to the quality.
of the limejuice issued.

With regard to the second enquiry, the undersigned has not had any reason to suspect the limejuice of causing diarrhoea. It certainly has not done so to any great extent, although it may have had such an effect in a few instances.

(290) Robert Moodie M.B.
Surgeon 29th P.V.I.

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Extract from Memo from Officer in Medical Charge 29th P.V.I. to Deputy Surgeon General, K.T.I.T.

By Hull 21st August 1879.

The undersigned has much pleasure in reporting that the return in the Regiment is not increasing, whilst some of the bad cases show considerable improvement. But the general health of the Regiment is too much undermined to hope for any marked improvement so long as it remains at Hull.

(290) Robert Moodie M.B.
Surgeon 29th P.V.I.

Finis.