The Etiology of Endemic Goitre.

The Etiology of Endemic Goitre is a subject which has occupied the attention of medical men and scientists generally from a very remote period, even yet it can hardly be said that any definite conclusion has been arrived at. This district of Cumberland, westmoreland is one where goitre in the endemic form is frequently seen, hence the choice of a subject for this essay. I may say at the outset that I do not pretend to have been able to elucidate the problem in any degree, but I think that any addition to the already large store of facts accumulated may help some observer with a keener insight or a more fortunate series of cases to fathom the causes of this very common disease.

It is hardly necessary to consider many of the numerous causes, which have been assigned to the malady, such as tight collars, sudden variations of temperature,
the practice of carrying loads on the head, alcoholtic or sexual excess, articles of diet as oat-meal, beans, pork and fat meat + the hundred other things which have been held accountable by various authors since these have been sufficiently disproved + many carry their disproof on the surface.

I think it is well to consider first the influence of sex, age, heredity + pregnancy + environment before discussing the essential cause of the disease.

Sex. In this country at least by far the greater number of cases occur in females. Dr. Ingles (English Broncho-pleur p. 36-42) gives an analysis of 190 cases of which only 10 are males. Sir Thomas Watson (Principles + Practice of Physic p. 798) has their lists comprising 235 cases of which 18 are males. Dr. Bruce-Lox (Sanitary + Other Papers p. 58) has collected 260 cases, the males affected with the disease being 16 in number. Dr. Sloan (Thesis Edin. Univ. 1885) gives 26 cases, with the large proportion
proportion of 4 males. Of 74 cases which I have been able to collect in this district, 7 occur in males.

The fact, illustrated by 779 cases, with a total of 57 males, giving an average of about 13½ to 1, shows conclusively that in this country females suffer to a far greater degree than the opposite sex.

In France and Switzerland the proportion is much less being 2 to 1, or even 5 to 4 (Rotini, Gout p. 244). In India the disease affects the two sexes almost equally (McCland, Medical Topography of Bengal). This peculiarity is said to be due to the fact that women are greater water-drinkers than men, a statement thought to be supported by the case of India, where the men drink as much water as the women.

I put forward the hypothesis that the tendency is hereditary in all the cases occurring in males, as will be stated in further detail later on. In 5 of my own cases the mother was gouty, and in the remaining
four no history could be obtained about the parents.

A female, at the age when goitre usually develops is in a stage of transition of a much more marked energetic character than a male; her blood is of a lower specific gravity, contains a smaller proportion of red corpuscles (Tosti; Physiology, p. 689). This watery condition of the blood, combined with the debility frequently occurring at this age, would seem to me to favour the deposited of white corpuscles especially in such a vascular organ as the thyroid gland, finally result in that formation of fibrous tissue which is the ultimate cause of the retention of the colloid matter in the acini of the gland the formation of the tumours. This condition combined with the essential cause of the disease, appears to me to account in part of the great prevalence of the affection in women as compared with men.

Age. It may be stated as a general rule that puberty is the age when goitre commences; there are many exceptions
to this statement, but as a general rule I think it holds good; indeed Sir Thomas Watson (Principles and Practice of Physic p. 798) says that Copland states he never saw a case before commencing puberty. Dr. Ingles (Principles of Scottish Bronchology p. 36) tabulates 130 cases, giving the result as 14 cases under 11 years of age & 64 under 19 years of age & he states in general terms that the goitre usually appeared when the Catamenia should have come. Dr. Sloan (Ibid. p. 81) agrees with this view but gives the age of commencement as usually between 17 + 24 years.

Among my own cases, certainly the usual period is between 14 + 20 years & the later menstruation appears the later goitre shows itself. The disease however does begin at much earlier periods. Robinson (p. 29) saw in Weardale three children born with it. Beaz (London Journal of Medicine 1850), Shrew (p. 79) & others also note this fact—

for myself, the earliest age at which I have seen a goitre is two years. So I cannot
Say how long it had existed, the mother, herself goitreous, not having previously noticed it; in this case the mother of four children have goitre, the father one child have not. Dr. Bruce Law (Santory Paper, p. 58) found it in 10 children under 5 years of age out of 260 cases. In some of these early cases it is noted that one or other parent is goitreous, but in others it is stated (Robinson, p. 29) that neither father nor mother suffered from the disease. On the other hand it may come on late in life; one patient, aged 79 years, seen by me at Clifton has a large soft goitre, which began when she was 64 years of age, whilst living at Stenton, a notoriously goitreous locality.

Hereditary.

This appears to be a much debated question, many authors stating opinions to the direct contrary to others. As far as the weight of opinion is concerned, it is, I think, in favour of the disease not being hereditary in the absence of the essential cause; at the same time, it seems to me that, given...
endemic influence, persons with goitreous parents are more liable to be affected than those without.

St. Leger (Les Causes du Crotinisme et du goût endemic p. 108) states definitely that it is not hereditary. McClelland is evidently of the same opinion. E. Robinson (Goitre ÿ Thyrocoele p. 30) agrees with the above named authorities and says that "children who are born of goitreous parents in a non-goitreous locality are not goitreous." That many cases arise in the offspring of non-goitreous parents in a goitreous locality on the other hand Sir Thomas Lewis gives as his opinion that there is much probability in favour of heredity.

Copeland (mentioned by Robinson) states emphatically that "authors have adduced conclusive proofs of its occurrence hereditarily, independently of endemic influence." What these proofs are I cannot say; for I have not been able to come across them. One example only is given by Inglis (Diseases of English Branchoids) tends to favour this conclusion - it is...
the case of some French prisoners, possibly from a goitrous district, who were brought
to a non-goitrous part of this country, here they contracted biliousness with the women
it is stated that the female offspring were goitrous. Inghirami clearly thinks the disease is hereditary (p. 24).
Sloan (thesis 1885) is of opinion that once established, it is often continued in
families by inheritance of 5 of 30 cases he thinks 13 show hereditary tendencies.
Dr. Bruce-Les (p. 68) states the simple
fact—142 cases out of 260 had
relatives with the same complaint, without
drawing any inference therefrom.
Between these two sets of diametrically
opposed opinions there are authors
such as McLeod (International Encyclo-
pedia of Surgery, p. 608) who holds the
opinion that the hereditary character
of the disease is not clearly established,
but that when both parents are affected
the children are usually similarly
affected and not unfrequently Cretins
or idiots: but he thinks this is not
probably
probably the result of similar causes acting on the children than heredity. The authors of Kent's "White's Surgery" (1875, p. 636) also state that heredity is not clearly established. Boonley, recorded in English practice (p. 88) is of the same opinion.

It is difficult, even impossible, to reconcile these opinions, but I think too little stress has been laid on the special circumstances of each case and the fact that most cases, which are supposed to show hereditary tendencies, are exposed to the same influences, which develop Phtice de novo, is evident. Dr. Sloan's cases occurred at Perris and Chesham, two districts which he himself proves to be gothic in character. Dr. How's cases come under the same category. I admit it is impossible to find an explanation for English cases of the French prisoners on any other theory than heredity. Among my own cases, there are many occurrences of the disease in the same family, but in none can
Satisfy myself that the affection is hereditary, and the patients were all living at the time of its onset in a goitrous district.

Were the disease hereditary, I think we should find it a good deal more generalized than at present; nor so much limited to localities. The fact stated by Sloan, that goitrous parents cease to have goitrous children, when residing in a non-goitrous locality, is very strong. At the same time, there appears to be a condition of body, which renders persons who have goitrous parents more liable to the disease than ordinary individuals. These cases do not develop goitre, unless they are in a locality where the disease occurs. In the five male cases of which I can obtain the history of the parents, the mother had goitre in each case, or the patient lived in a goitrous locality. One case of course give many cases, where women with goitre removing into a non-goitrous locality have healthy children as stated.
by Sloan, but such cases only show the non-hereditary character of the disease and nothing more to leave the question open whether these children would be affected by the disease more readily than the settled residents without the hereditary taint, if they again went to a goitrous locality. I think they would, but most of the cases of goitre which I can quote are those of settled residents in the district and the case does not apply to those who are new-comers and have developed goitre since their arrival have no goitrous relatives.

In the whole the safest opinion to give is that the hereditary character of goitre is not established.

Pregnancy and Disordered Menstrual Function as goitre often commences at the period of commencing activity of the sexual organs so it often takes on a further rapid growth at that greater distance of the sexual organs occurring in pregnancy: nearly all my married patients who have gone think that it has enlarged during gestation.
gestation of two cases at Acklam date
the commencement of the disease from their
first-pregnancy, although both had lived
in the same district formerly. St. Symon
expressed this view in his statement—
"in those cases where goitre does not
develop at puberty it nor uncommonly
appears during pregnancy; all my
married patients observed considerable
increase in it at that time."

Arnott (p. 29) states that many cases
begin with the first menstruation or the
first pregnancy. Sir T. Ho. Watson
notes the same fact.

Whatever the true reason for this may be,
it seems probable that there is a definite
connection between the Thyroid gland the
ovarian organs that disturbances of
the one may lead in special circumstances
to enlargement of the other. I find it
difficult to agree with the theory of M.
Guizot—mentioned by Sloan—that goitre in
these cases is only one of the manifestations
of the excessive production of fribone
"during pregnancy." The deposition of
fibrous.
Also one would expect it to occur in cases of pneumonia, where the fibrin in the blood is greatly in excess of normal.
fibrous would be quite as likely to occur
in other termini of the circulation & lead
to thickening round the vessels or in the case
of glands to consequent impairment of
function; but there is no evidence that
the fibrin of the blood, although excessive,
is deposited in pregnancy in this manner
when it is, it leads to thrombosis & not
to enlargement of glands. It seems to
me more likely that the enlargement is due
to the altered condition of the blood
allowing the specific cause of the disease,
whatever that may be, to more readily affect
the gland & cause the unusual hypertrophy
of its substance.

There is frequently disordered menstrual
function in women suffering from
Goitre - this has been noted by Ingles (p.29)
Copland (wettn. p.798). Sloan (p.83) - it
usually takes the form of menstruation in
adult women or in girls more often than in
a premenarcheal, although this is probably
due, not to goitre, but to accompanying
chlorosis.

Bruce (loc. cit. p.64) states that in the
Hemlocks
Helmley district there was a marked tendency to Post-Partum Haemorrhage among goitrous women. Lawson-Dait (Scri. Med. Journ. May 75) notes the same fact. Looking over the records of 300 cases of midwifery in the goitrous districts of my own practice I can only find four cases of Post-Partum Haemorrhage and none of these occurred in goitrous persons. Robinson (p.30) also states that "Fifteen" is not common in Levensdale, where goitre is endemic. The number of cases which I can find are too few to generalize upon. The only definite statement I can make is that this condition cannot be nearly so common in this district or in Levensdale as around Helmley, where 1/3 of the goitrous women who had born children were "habitual bleeders." I have a record of 16 goitrous women who have had children, only one of whom had a considerable amount of bleeding other than this amount as to be called Post-Partum Haemorrhage.

Environment.
Environment. The Sardinian Commission, who were appointed in 1850 by the French government to investigate the whole question of health, came to the conclusion that the causes were multiple and assigned as chief causes—insufficient nourishment, or of bad quality, insanitary houses, want of sunlight and stagnation of the atmosphere such as is supposed to occur in narrow valleys. They appear to have arrived at these conclusions on unsufficient grounds. St. Hager in the whole of his writings takes them overtly to task and shows the ground covered by him is the same as that gone over by the Commission, I think he has completely demolished their argument; one paragraph only gives a sufficient illustration (page 9) "Saint-Étienne est situé en face de Ribierso dont il n’est séparé que par le lit du corseil et quelques talus surmontés. Je doute qu’on puisse trouver entre les divers hameaux de cette petite commune une différence dans l’air qu’on respire, les aliments dont on se nourrit; les logements, les mœurs et—"
"Contreveno, tout est semblable de part et
d'autre, tout excepté l'eau potable," and
yet at Ribiero there are 15 goîtreous persons
and at Saint Étienne there is this small commune of only 216 persons.
In this district of the North of England the
cases assigned by the Sardinian
Commission are certainly not operative —
the inhabitants are well-fed and well-housed.
Goître does not occur in the narrow
valleys any more than in the open plateau.
It affects both rich and poor. The more
humid parts are less affected than others
with a less rainfall and a subsoil less
retentive of moisture — for other parts of
England the same statement may be made.
Sir Bruce-Laird's cases are taken chiefly
from "a breezy expanse of moor or mountain."
I think these facts should be sufficient to
show that the causes given by the Commission
are not the essential causes, although
they may have some effect in lowering
the power of resistance of the body to such
an extent as to make it more liable to
any disease to which it is exposed.
For example the valleys of Martindale or Martindale are both narrow, surrounded by high hills, which shut out a considerable amount of sunlight; have a large annual rain fall; yet there is to my knowledge no goitre in these valleys—Coming farther East, on the ridge separating the Howler Valley from the River Keith is the village of Howler; in this place, it has every advantage in the way of healthy situation, plenty of sunlight and average rainfall (42 ins.), yet here out of 120 persons, there are 5 who are goitrous. In condition of the people, their food, their homes, clothing & general surroundings are all much the same in each case, only varying with their social state, yet the difference in regards to goitre is remarkable. I am bound to mention as an exception the Valley of Pattardale, where the conditions, in part, are as mentioned by the Sardinian Commission with the exception that the inhabitants are well fed & well clothed, here goitre is very common, although it is on the clay state.
Causes of Paroxysmal Melancholic Gout

St. Leger devotes about four pages of his work to a succinct enumeration of the causes which have been at one time or another assigned to this disease, but as many of them are fanciful and of the post hoc, propter hoc order, I think it is not necessary even to recount them.

It will be sufficient to consider some of the principal assigned causes first of all I will take

St. Leger's theory of vasomotor paroxysms (Charcot. Medit. 1881)

he considers that the condition is caused by a paroxysm of the vasomotor nerves, which mediate the vessel area contracted by the

thyroid gland and states it to be the result of weakened function of the inferior cervical gland. To support this theory he accepts the view that the thyroid gland acts as a depository of the cerebral circulation to he distributed in the endemicity of the disease. In view of the recent advances made in the pathology of this gland, the fact is established that it has an intestinal secretion (System of Medicine).
Allbutt, p. 467-468. The want of which causes Myxoeidma, the excess of which causes Exophthalmic Goitre (ostensibly) — the actual mechanism appears to be a good deal more complicated than would appear from this bald statement, but for the present purpose it is sufficient. If there is some motor paralytic weakening of the tarso-constrictor function of the Sympathetic then should be dilatation of blood vessels, increased secretion and consequently Graves' Disease. This theory must apply to this one type of swelling of the gland, but cannot account for all cases of goitre, since in the usual form of parasymhalmic goitre, the blood supply is only increased pari passu with the bulk of the tumour or the amount of the secretion does not appear to be in any way increased. If the disease is not endemic, it should, on this theory, be as prevalent in one part of the world as another; yet in some places it is uncommon and in others very common. Even supposing this to be due to hereditary influences, in which Dr. Twort's belief
it cannot account for such a fact as that mentioned by Bellroth (Bruce-Low, p. 57) that on a fresh water supply being taken to Vienna from a goitreous district, a large increase took place in the number of goitreous persons in that city. The cause of the fact was not investigated by Dr. Bruce-Low.

**Malarial Theory**

Many observers have come to the conclusion that there is a definite connection between Goitre and Malaria.

Sir Joseph Lister (Lancet, 1874) says that he "has long been under the impression that "malaria......is also concerned in the production of this abnormal condition of the thyroid gland." Bellroth too believes that "Goitre is a chronic malarial affection endemic in certain places" (British Medical Journal, 1881). I think the malaria acts through drinking water. This statement, of course, may not mean very anything of a malarial nature, but I think it probably did at the time it was written since bacteriology was in its infancy.
But whether this be the actual cause or not, I think it is impossible either to affirm or deny, for as Forrest says, there is no evidence to show that a micro-organism is the cause of the disease. One fact against the idea that Falcí may be due to a micro-organism is that at Fulton John, a village in this district, the water is defiled by a modified Clark's Positive, this, as is well known, entangles the bacteria in the water in the precipitate, so that they are markedly reduced in number in the treated water (Thresh, water supply, p. 271). Yet Falcí occurs from the use of this water.

On general grounds also it would appear that the facts do not support the theory of malariaic causation. Falcí is prevalent in many places where malaria is now unknown. Even in India, a hot-bed of malaria, the two diseases do not appear to be confined to the same districts, since Falcí occurs in the Himalayas (water, p. 805) where malaria does not occur. And in Switzerland the greater number of ignorant persons criticize, live in valleys among the mountains, where malaria has
has never existed. The evidence of
this country also goes to prove that
malanà is not concerned in its production.
If Sir Joseph Fayrer's idea were correct we would
expect at times to see malarial symptoms
developing in a gôître person, without
subsequent exposure to malanà or gôître
commencing in a person who had had
malanà (with the same proviso), but I am not
aware that any account of such a circumstance
has ever been recorded.
I think all that one can state in this connection
is that gôître may possibly be due to a micro-
organism, carried by water, but that it is
impossible; that the evidence is against
its connection with malanà.

Nature of the Soil.
This has frequently been set down as the
cause of gôître, but as the water supply
of a place usually contains matter derived
from the soil or underlying strata, these
two factors may be taken as one and be
considered under the head of "potable water"
that the soil alone, without the water
derived from it is over the cause, is shown
by the fact formerly mentioned, that in
Thames, where water was brought from the
Syrnai Alps, Göitre increased from its use.
This town of Prunlith may be taken also as
an example: previous to 1850, the
inhabitants of Prunlith obtained all their
water from wells sunk in the Permian
Sandstone. The evidence of many persons
is that Göitre was more frequently Seen
there than now: since the date mentioned
water has been obtained from the River
Eamont, so no one would be inclined now
to say that Göitre was common, indeed the
contrast between Prunlith and some of the
surrounding villages is very great.
The village of Arkham, five miles from
Prunlith is another case in point; until
eight years ago, water was similarly
obtained from wells in the limestone, since
then from surface water from the moorland
above. I think I may say that Göitre occurs
much less frequently now than formerly, but
There are many persons whose thyroïd glands
are enlarged, almost all of whom date the
swelling
Swellings from a tube introduced to the
fresh water being introduced.

Drinking-water is the vehicle of the Cause.

I. From the very earliest times it has been
the custom to attribute the disease to
drinking-water. Hippocrates states that
snow-water was accredited as the cause,
chiefly blaming the coldness of the water:
Salt mineral constituents are held
accountable. This belief has again been
brought forward by St. Lages, Soucha and
many others.

II. In one of Capt. Cook's voyages (Dobson's voyage
round the world. p. 167) part of his crew
who drank water made of melted ice (melted
in the Copper) suffered from an epidemic
of scurvy, while those who used the original
supply were not affected.

III. St. Lages states that certain opinions are
well known in France as the cause of scurvy
that unwilling conscript to worst thieves as
a means of securing their rejection (les
Causins du Collinisme. p. 63.)

IV. Change of water has frequently been
known
Known to be followed by disappearance of the goitre—example is recorded by Johnston. (Paras. Hygiene, p. 64): he states that all the prisoners in Durham Gaol had swellings of the neck and that these disappeared when another & a poorer water supply was obtained.

I think these facts should be sufficient to show that the water of the various localities contains some substance which is the cause of goitre; but the actual ultimate cause is a much more difficult problem, and the presence or absence of many varied constituents have been held accountable. There may be taken creation:


This is the Classical cause: Hippocrates, Saint to his ancient writers, mentioned by Dr. Lages, being particularly precise on this point; but its occurrence in the Sahara, Heerst and Sumatra (Morsden's History of Sumatra) negative this idea. And also the fact that goitre is unknown in Greenland where all the water used is obtained from melted ice from snow. Again as S. Thomas
water, points out (Practie of Physic p. 801)
"the people in almost all the valleys in Switzerland
drink the waters which comes from the
"glaciers, while goitre is known in some of
"the valleys only". these facts are
sufficient to show that neither the coldness
of the water, nor even of water, is the cause of
the disease.

This is certainly not the cause. St. Leger
swears many witnesses (p. 248 et seq.) to show
that this theory is fallacious. Bruce and
swears (p. 37) the analysis of sea water from
the neighborhood of St. Helene, which have
nottoigious properties, as follows:

| Free Ammonia | 0.00 | 0.012 | 0.012 | 0.026 | 0.04 note
| Altunenoid Ammonia | 0.00 | 0.030 | 0.020 | 0.030 | 0.02 | 0.02.

I have made analyses of water from many
parts of this district, the amount of
organic matter contained therein appears
to have nothing to do with the prevalence
of the disease of goitre. The analyses are
subjected below, with the source of the water
and the fact of goitre being present or absent.

---

Lochlee
<table>
<thead>
<tr>
<th>Locality</th>
<th>Source/Method</th>
<th>Iodine</th>
<th>Chloride</th>
<th>Ammonia</th>
<th>Nitrites</th>
</tr>
</thead>
<tbody>
<tr>
<td>Culgaith</td>
<td>Public Well</td>
<td>0.096</td>
<td>0.094</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Watermilitary</td>
<td>Well</td>
<td>0.143</td>
<td>0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Armadale</td>
<td>Stream (surf. water)</td>
<td>0.00</td>
<td>0.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Melmerthy</td>
<td>Spring</td>
<td>0.002</td>
<td>0.004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maughaunty</td>
<td>Well</td>
<td>0.01</td>
<td>0.40</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Castlecomberly</td>
<td></td>
<td>0.00</td>
<td>0.29</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lampton</td>
<td></td>
<td>0.00</td>
<td>0.09</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rathes</td>
<td>Public Well</td>
<td>0.00</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Edenhall</td>
<td>Supply</td>
<td>0.02</td>
<td>0.06</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Newtysgyn</td>
<td>Well</td>
<td>0.034</td>
<td>0.124</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.014</td>
<td>0.123</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.116</td>
<td>0.174</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Britargins</td>
<td>Spring</td>
<td>0.002</td>
<td>0.02</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Southarms</td>
<td></td>
<td>0.008</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Mortland</td>
<td>Public Well</td>
<td>0.025</td>
<td>0.04</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Motherly</td>
<td></td>
<td>0.044</td>
<td>0.082</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Stellon</td>
<td></td>
<td>0.01</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

These analyses may be tabulated in another form, giving the maximum and minimum amounts of the Albuminoid Ammonia in the waters producing Goitre. Those which are innocuous in this respect.
<table>
<thead>
<tr>
<th></th>
<th>Maximum</th>
<th>Minimum</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ammonia</td>
<td>11.6</td>
<td>0.00</td>
</tr>
<tr>
<td>Allammonia-Ammonia</td>
<td>17.4</td>
<td>0.004</td>
</tr>
<tr>
<td>Non-Godinian</td>
<td>14.3</td>
<td>0.00</td>
</tr>
<tr>
<td>Non-Godinian</td>
<td>4.0</td>
<td>0.05</td>
</tr>
</tbody>
</table>

I think these varying results are sufficient to show that the presence or absence of organic matter has nothing to do with the production of goitre.

3. **Turbidity of the Water**

St. Lukas (p. 254 et seq.) quotes several authors, among whom may be mentioned Miller, Richardson, Grundin, Schlicht, who were of the opinion that substances held in suspension in water might be the cause of goitre. These may be divided into two classes: 1) - organic constituents such as are washed down a river in time of flood or mineral substances in suspension. That the former will not cause goitre has been discussed previously under the head of organic matter, 2) the fact may be taken into consideration that such are the waters that are usually used for drinking purposes, but rather avoided for the time being. Many
mineral substances occur in turbid water of a goitreous nature. St. Lago has found iron pyrites, sulphide of lead, sulphate of lime, arseniocalcium pyrites & silica; but the fact that these occur in suspension render them detrimental, since the majority of waters which are credited with causing goitre are of a perfectly clear character.

4. Silica occurs in all waters to a greater or lesser degree, but, as far as my observations show, not to a greater extent in goitreous waters than in others. Plants take up a certain quantity of silica, some to a large extent - one would imagine, if the presence of silica were the cause of goitre and considering the large amount of vegetables consumed by everyone, that the disease would be more common or more generalised than it is.

5. Absence of iodine.

This theory was put forward by Prévost chiefly on account of the improvement effected in dermohyaline goitre by the external application of iodine. It is supported by Ugle (English, Dorothy, vol. ii) who states that goitre does not occur in the town of Ruyse, while it
is endemic in the surrounding villages. This he attributes to the presence of Iodine in the town water. Also the absence of the disease near the sea is accounted for by him, by the presence of Iodine in sea-water or presumably in the sea-air. Numerous other writers have followed the same theory. But St. Leger (p. 240) brings forward many facts to disprove this idea of which the following will serve as an example:—

"Cantu avait trouvé de l'iode et du bromé dans plusieurs eaux qui servaient à soigner à des affections du Pédiment. Brunner avait trouvé ces mêmes substances dans les Sources à goître (Kopfbrunnen) du Canton de Berne." and he also states that Béjan and others have not found more iodine in the waters of the Jura, where there is no goître, than in those localities where goître is endemic. Also the Lombardy Commission did not find Iodine in the water supply of many places in Lombardy where goître was unknown. The evidence appears to be too to be against the theory of want of Iodine being the cause.

This is also mentioned by Shibazet (p. 247) as a theory brought forward by Achernar, chiefly in connection with Carlinism; but there appears to have been a considerable controversy between Ricketts and Calmin at that time, so great as to render any evidence in connection with the latter affecting worthless; indeed, the amount of phosphates ordinarily consumed in articles of diet, should be sufficient to supply the human frame, without the small addition which would occur in potable water. And Lockely states (Water Analysis, p. 115) that phosphates cannot exist along with carbonate of lime in a clear water, so that the amount ever present in any drinking water must be infinitesimal.

7. Want of Dissolved Oxygen or Carbonic Acid.

Since both these gases occur dissolved to a greater or less extent in all waters, the theory seemed only be used as one of degree, and I think it is sufficiently disproved by the fact that clothing, which absorbs the greater part of the dissolved gases, is believed (Sloan, p. 240) o-
I think rightly so, to render gottunyem
water innocuous. Also in most cases of

gottunyem there is no possibility when the water is
hard, due in part to Carbonate of Lime being in
solution by the large quantity of Carbonic Acid
Gas in the water.

The Etruscan theory that the disease is due to
excess of Carbonic Acid Gas has been
advanced by Chovos (St. Leger, p. 2), but in
this case gottunyem should be a disease that the
majority of mankind could hardly avoid
in these days of distilled water.

8. Fluorine. I have tried to obtain Maunier's

paper Experiments pour determiner l'action du

fluorine de calcium en l'eteen'e animale (1831)

but it is not to be seen. The theory is attractive,

but I suppose the arguments against the

idea are much the same as those brought

forward against iodine.


du 1838 Dr. Leder published his book "English

Porcelain" in which he states (p. 36) that

"Magnesium limestone districts produce por-

celain, the disease much more than those which

"pure water limestone exists" I think this

may.
may be due to the inferior solubility of the latter. Then in 1848-50, M. Pouget made some elaborate investigations (Annals de Chimie et de Physiologie, vol. xxiv. p. 364) in which he states from geological considerations that analyses of waters that Magnesium Salts are the cause of the formation of Goitre.

There is a remarkable case recorded in the Edinburgh Medical Journal (May 1883) of an outbreak of Goitre occurring in Dunblane; Dr. Johnston, who records the outbreak, attributes it to the water of a well at the prison. He gives an analysis:

- Sulphate of Lime: 31.38 g per gallon
- Carbonate of Lime: 15.35 g
- Sulphate of Magnesium: 4.49 g
- Carbonate of Magnesium: 1.48 g
- Chloride of Magnesium: 14.81 g
- Chloride of Sodium: 6.19 g

This analysis shows an enormous amount of Magnesium Salts—29.98 g per gallon.

Six months afterwards the water supply was changed, river water being used, the Goitre ceased. This is very strong evidence in favour of the theory we are discussing.

D. Roberts
Dr. Roberts in his work came to the conclusion that water uninformed with lime or magnesium is the cause of goitre. At the same time these facts are not conclusive since the cause may be something which exists along with the magnesium salts. On the other hand Dr. Hager gives numerous instances of magnesium being wanting in drinking water in goitreous places, the also states (p. 237) that M. Laque has given up his theory.

In some analyses which I have made the amount of magnesium salts vary from .2 to 4.88 to a gallon (expressed as Magnesia Oxophosphate). In six analyses of French soil (p. 57) the amount is always under a grain to the gallon.

The presence of magnesium in food and use in thera putes would also seem to show that magnesium salts alone are not the cause of goitre.

10. Linie.

It can hardly be said that lead alone is the cause of goitre, for many waters in goitreous places contain little or no lead.
One water which I have analyzed from stone quarries by the side of Lake Allswater contains only .987 per gallon of Sr. I have quoted (p. 232) many instances of water supplies, which contain a large amount of lime but do not cause goitre—on the other hand, the evidence that water derived from limestone & dolomite rocks contains some ingredient, which is the cause of goitre is very strong. The admirable manner in which Mr. Cleland in his paper brought out this fact—his remarkable cleanliness (in one of the Province of Khaman relative to Geology, including an inquiry into the Causes of Soibre 1833), he gives a table showing the occurrence of soibre in the district of Khaman.

<table>
<thead>
<tr>
<th>Population</th>
<th>Soibre</th>
<th>Criticism</th>
<th>Water Source</th>
<th>Per cent prep. affected with Soibre</th>
<th>Per cent prep. affected with Criticism</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>-</td>
<td>-</td>
<td>Stone &amp; gravel</td>
<td>0.2</td>
<td>0</td>
</tr>
<tr>
<td>500</td>
<td>-</td>
<td>-</td>
<td>Sand &amp; stone</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>3,957</td>
<td>29</td>
<td>-</td>
<td>Clay &amp; slate</td>
<td>0.54</td>
<td>0</td>
</tr>
<tr>
<td>200</td>
<td>-</td>
<td>-</td>
<td>Sand Sandstone</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>1160</td>
<td>390</td>
<td>384</td>
<td>Limestone Rock</td>
<td>32.00</td>
<td>3.1</td>
</tr>
</tbody>
</table>

---

Robinson.
Potter (Endemic Goitre p. 38) gives an account of the occurrence of the disease in Teesdale stating that "along the first thirteen miles of the Tees Valley, goitre is endemic, coinciding with the occurrence of limestone, further East (at Yarm which is situated on the gravel) little or no goitre occurs; and further East the millstone grit and true coal-measures appear, in which goitre is not endemic, just as in Northern England it does not occur as on the Chartist prophylaxis."

Hughes (English Broadsheet p. 7) quotes Franklin's narrative of "A journey to the Shores of the Polar Sea: containing the occurrence of goitre at Edmonton in Canada: shows how goitre affects three persons who drink river water, which comes from a layer of limestone - he also states that the natives who drink spring water at winter or water from small streams running into the river in summer are exempt from goitre."

That even the men, who develop goitre in winter whilst at home and drinking river water, become free again shortly after they leave home in the annual fishing expeditions. He also comes to the following conclusion:
"I cannot say that in all limestone districts grisea prevails, nevertheless I think that I am correct in supposing that the presence of magnesium limestone always predisposes the coexistence of the disease."

Pasteur ("Manual of Hygiene", p. 68) is evidently of opinion that water from limestone and dolomite regions, also from dolomitic in the granite or metamorphic rocks is the cause of grisea.

In this district by far the greater number of cases occur in the humble home of the inhabitants, drink the water derived from springs. The local incidence of the disease will be noted later on. Manson in England, Rally in Switzerland, Granello in India all support this statement, but on the other hand Dr. J. B. Todd from some investigations at Dhumsala, India, showed that although grisea prevailed exclusively there, the water, within a radius of ten miles contained only traces of lime and magnesia or iron (Medical Times, Oct 24, p. 693). Todd it will have nothing to do with "such an absurd opinion" that his ridicules the analysis of waters used in the houses.
part of the valley of the Mauresine; here almost all the inhabitants are subject to gout.
the soil that the water contains less gypsum +
Calcium than that used in the upper part of the valley where there is no
gråtre (gråtre du gråtre) .

St. Leger (p. 232 of 24) gives many cases to
show that gråtre does not occur in conjunction
with many waters from limestone rocks, which
me would expect it if this theory were true.
In fact, a per contra, many examples, where
it does occur in waters with little or no hardness.

Haeguer (Romani p. 37) has shown that in the
areas of the Depôt, Salzberg, Stajina + Crimea,
scarce, 0.2 per cent of the population, living
upon mountains composed of limestone,
are affected with gråtre, whilst in the older
behist of these countries the subjects of gråtre
constitute from a considerable proportion
of the population.

It is impossible to reconcile these conflicting
opinions but to my mind, the weight of
witness is in favour of the theory that some
constituent of the water derived from limestone
rocks is the cause of gråtre, not necessarily.
Sulphur is sometimes found in a combination with other substances, and in this case it is hardly possible that the combination should be a mere coincidence, more especially where they correspond with what is observed in different localities all over the world.


This is St. Hugues's theory, which had suggested that the whole subject was a large area of iron with great throwbones. He says (p. 2144) that the results of this inquiry are as follows that in red iron ore, the iron pyrites of these ores are always present. It is the element present in these ores, and is the most abundant and the most frequent. It is said that it is never absent. The presence is manifested by the existence of a great number of chalybeate veins, and the characteristic calcareous matter, and the compound of iron and magnesite, and the compound of iron and aluminum, are always present. In the other rocks, it is said that the pyrites of iron are found in the pyrites of iron, and that this pyrites is ferrous, and that this pyrites is ferrous.
Le décomposé au contact des calcaires et des dolomies et produit des sulfates des chaux et de magnésie qui ne préexistaient pas dans les roches. L'abondance de sulfure de fer est aussi en relation avec celles des sources ferriguières et sulfurées. Au second rang, dans l'ordre de fréquence, apparaît la pyrite de cuivre : sulfure double de cuivre et de fer.

…… j'avais observé que l'intensité de l'indemne géotherme est plus forte sur les terrains qui contiennent des pyrites certainement vitriolisables, telles que la pyrite magnétique, et comme dans les roches métamorphiques et les pyrites fœs magnétiques, présentes dans des terrains caugeux et les argiles latérites à lignites.

Il est aussi évident que l'abondance de minerai influence la diversité de la dréaude.

No doubt there being a very abundant mineral in present in a great number of rocks to a great extent in limestone but not in others, the presence in the locality of constituents derived from the limestone lomned.
formed complicated matters, but St. Ryer claims that large numbers of stones occur in the Lias Schists of the Iere (p. 286) where limestone would not affect the argument. He states that the Colours of the Schists is due to Iron. He also gives an account of the water supply of a village named Bellefontaine in the Department of the Doire (Boumeurseries Bel-Othrace du Doire, p. 21) where the supply is microscopic, while the wells are in the Sandstone (Mollasse), but where a layer of Clay with brown Coal is interposed. The water runs on this, the grise becomes common. The Clay contains Iron, thus the theory is developed. It’s statement of the action of Iron Salts is, of course, absolutely necessary for the theory, since Sulfide of Iron is insoluble in water. He made experiments on mice, thought he caused goitre in them by adding Sulfide of Iron to their food for several months, but experiments in dogs were unsatisfactory (p. 484). It would have been more satisfactory if he had included some analyses of the waters of goitreous districts—this indeed seems to be the weak
weak point of his work. He can hardly be said to have proved his theory, for his experiments on animals showed that much more conclusive than he himself makes out.

The water of Chalybeate springs are used by many persons in large quantities after considerable periods, yet, in my experience, these persons do not develop goitre if the amount of the iron salts affects the activity of the thyroid, they almost develop it in a short while.

D. S. B. I'leman's account previously mentioned (p. 237) states that there was no iron found in the majority of analyses of water at Thurnausa.

Also, the use of iron in therapeutics goes to contradict this theory, especially as a large quantity is converted into sulphide in the bowel. If so much would be in a nascent state able to affect the changes in the thyroid gland attributed to its use by Dr. Lager.

In this district, in the limestone, where goitre is most prevalent, iron occurs in
small quantities, varying in the analysis which I have made from 0.3 to 1.5 grams per gallon. In D. Bence-Lewis's paper (p. 57) the amount of "Oxide of Iron and Alumina" varies from 16 to 76 in the goitreous water of Helmsley. All these facts seem to contradict St. Leger's theory that Sulfide of Iron is a lesser degree Sulfide of Copper, is the cause of the disease. Incidence of Goitre in the Neighborhood of Plymouth

For the purpose of this paper I have taken a district included in about a seven mile radius from the town of Plymouth, the district contains all kinds of variations of natural features. In the west there is the Mountain of Bledington, reaching to a height of over 2500 feet, whose slopes drop rapidly into narrow valleys shut in by cliffs or "Scree" on each side as at nineteenth riverdale, yet in these places, where the inhabitants are chiefly small farmers, labours on the farms, Goitre may be said not to occur. The same remark will apply to Southward Head and Dockray in the S. W. Corners situated on the Sheep of Helmsley.
Around Greystoke Park the ground has an elevation of about 1000 feet, and is mostly open with gentle slopes and grass fields, but arable land and few trees—abundantly wooded. Clay and peat prevail, but nowhere to such an extent as elsewhere. Following the course of the River Petteril, there are a few farms at Skelton and at Muncaster, and at Laughton near Newton, nor do I know of any farm at Hutton-in-the-Forest or Texton. North of Petteril the Petteril valley opens out considerably, and the land becomes more arable, the lying valley to floods. There are here large plantations—all factors in making the climate damp; this is the characteristic of the country from South of Piel to Carlisle, and especially on the west; in this part there is little or no gîte.

On the east again this is the high ground of the Pennine range culminating in Cross Fell (3893 ft) falling rapidly to the Eden Valley on the west. The villages on the slopes of this range are usually in good situations, none of them in narrow valleys. "Sauvage and affranch"—several walled towns placed on what—
What might be called hill-tops stand up
them in open ground: they are well drained
and mostly exposed to the winds, both East
and West; the former blowing with great force
at certain seasons of the year. In some
of these villages, there occurs very
incomprehensibly a few cases of
Kirkoswald. I have come across
any cases of Goitre in the other villages on
the East side of the Eden. The two adjoining
villages of Kirkoswald and Aiksworth are alike in
almost every particular, except the important
one of their water supply: at Kirkoswald the
supply until lately, was derived from a
well, to which the inhabitants attribute
gobstercous properties. All the villages
named have in recent years had water
supplies installed by the Sanitary Authority
and it will be of interest to see if the prevalence
of Goitre is in any way affected - at the
current time it is too early to form any
opinion on this matter.

On the East side of the Eden Valley from
Edenhall to Longrigg, Goitre does not
occur; I have seen one case at Great

Saerle
Sackeld, but this had developed before the present advent to this district. T. Shore states that there were cases of gout at
Sackeld (a village of about 150 inhabitants) when his thesis was written in 1885, but they have all disappeared; the water supply
has been altered, but as it is only brought a short distance from a spring in the
same geological formation, it is not likely to have made much difference.
This leads to a question whether a water may not change its character from having at one time been able to produce gout, cease to do so. I can offer no evidence on this point, but it seems possible that if the
"fetidigenous principle" is a chemical one, it may be absent at times or altogether
lack to be present, depending of course on the strata traversed or dissolved by the water.
In the village on the banks of Lake Ulswater there is no gout, except at Watermillock;
here at least four families suffer from the disease. They do not drink the same
water, but it is from the same geological stratum (from closely adjoining) sources.
As Throsthwaite or Mardale end in the Mardale Valley there is no Goitre, but it lowers down where the stream joins the lower beck, there is a considerable amount of the disease in all the villages viz. Raecle, Shulton John, Pennedecor Motherley.

There are also one or two cases at Berrier. All these villages are well situated, with the exception of Shulton John, they have plenty of Sunlight; they are better supplied consequently they should be dry, there is usually little depth of earth, most of the house foundations being on the rock; the land around is drained there is little or no wood. Shulton John is the exception from its situation it more nearly approaches the conditions mentioned by the Sardinian Commission of a narrow valley, damp & that mix with those causing want of Sunlight. As the other three villages on the North side of the River Erme there is Goitre, but all the inhabitants whom I have questioned express that there is not so much now as formerly - this is especially the case at Shalmö, where...
Wells used to be drawn from wells & runs is chiefly obtained from a spring about 200 yards from the village, into which it is led in pipes. All these village are built in open healthy situations.

In the town of Barmouth itself, this is not much noted, a few occasional cases, some of which developed in the surrounding country the disease is not noticeable to the same extent as it is in the district round about. Cases do occur, which are extremely puzzling, as the case of a boy at Barmouth Workhouse, aged 13 years, who suddenly developed gout without any change in his surroundings, diet or health, it disappeared in about a month, whether from the application of iodine or not, is difficult to say - one of his aunts has a gout, but there were no other cases in the workhouse. The town has been supplied for the last 25 years with water from the River Emmett, proving that this water was not used, many of them considerably polluted with other detritus was more prevalent than ever since in the opinion of the older inhabitants. The town's health, the average death-rate for the last five years...
years from 1755: its characteristics need no detail as it is nor a place where gelse occurs in the same form.

Coming to the villages on the South of the Forest gelse is more marked than in any other part of the district. Taking Hinton as a centre, the twelve villages round all show cases of gelse with a greater or less degree of severity. As further villages, with a population of 129, here are 5 cases: at Axtham, population about 300, 8 cases; at Replin, population about 130, 12 cases; at Whelme and Norwich, but very small villages, of only 6 or 7 houses, there are also cases. At Ticknall and civil the farm-houses near, I know of 2 families persons affected with the disease. Further East—at Hackett, Great Northall and Melkinstoke, there is only one person in each village, who has the disease. At Otterton I have never seen a single case; but again at Morland there are 2 cases and two at Newby.

The characteristics of this part of the country differ in no respect from the whole surrounding district, with the
Exemption of the Geological formation or consequently the water supply. It is entirely an agricultural area; the inhabitants are well housed, well fed & clothed; poverty is conspicuous by its absence, most of the laborious classes being in regular employment under the Earl of Lonsdale. The area is composed of valleys, woods, or very streams, with high ground between; there is plenty of wood about, but the villages are open to obtain their share of sunlight, they are all well drained, have a dry outlook. In one respect do they suffer from "wretchedness, insufficient or bad quality of food, unhealthiness of houses, want of sunlight or stagnation of the air". Borthcam, one of the prettiest villages in England, is also one of the most healthy: the men are a sturdy race as the native Westmorlains usually are, the women are robust, of good-looking. They are not wanting in intelligence or can make a bargain as well as the average Scotsman. Is what then does the difference in the liability to virtue consist? Solely, in my opinion, in the difference.
difference of the geological strata on which their villages are placed—of which their drinking water is drawn.

Density of the Population of the District.
The population is a little scattered. With the exception of the town of这儿 which has about 9000 inhabitants, there are no places with more than three or four hundred persons. The majority of the villages do not number more than 150 to 200 individuals.

We may take the parish of这儿 as a fair example of the population of the district: here the average is 1147, the population 1742, giving only 8 persons to the acre. In many parishes where there is fell-land the density is much less.

Food.
The food used is, with differences according to the position in life, plain: of the majority of small farmers & labourers, who constitute the greater number of the population, eat bread, oatmeal, bacon, potatoes with meat at times. There is nothing in the diet of one part of the district which varies from that of another part, the food is the same.
ford of the labourers over the whole of the
North of agricultural England.
I cannot say that there is any habit or
custom peculiar to the district, which
might tend to produce goître. The amount
of intemperance is only small, and the
common "market day apace" of former years
is rapidly dying out.

Geology of the District.
The geology of the district is not complicated,
all the chief formations being absent.
In the west side the Silurian formation exists
as Skiddaw Slate, with patches of intrusive
rocks. This forms the mountainous part of
the Lake District and tends South to embrace
Ullswater — Goître is conspicuous by its
absence in this formation. There is however
one exception viz. Watermillock; here there
are six cases of goître in four families,
who drink water from different springs, but
all of similar character; it is of excellent
quality and not hard as well be seen from the
accompanying analyses.

water from Gosbarrows — Watermillock

Total Solids — 3.7 grams per gallon
Insoluble
Dissolved Solids: 2.23.80 per gallon

Silica: .1

Oxide of Iron: .07

Carbonate of Lime: .09

Magnesia (magnesite): .04

Chloride: 1.05

Nitrogenous Nitrate: .03

Sulfate: trace

Carbonic Acid + H2O: .66

Carbonate: .07

Ammonia: .008 per million

Albuminoid Ammonia:

Hardness: Total 1.2° CalCi Scale. Permanent: 2.8

The iron present was .035 for one gallon. The rock round the source of the spring, the banks of the channel show no signs of any deposit of iron such as St. Leger mentions, nor does there appear to be any metallic mottles in the immediate vicinity. The spring runs just at the junction of the Skiddaw Slate, with part of the Volcanic Series of Borrowdale in which mineral vein are frequently found. This latter is possible that there may be some deep minerals over which the water possesses  

St. Leger
St. Bayer states that gôître is endemic in the Schists of Silliman Formation, where they contain metalliferous veins. I am not satisfied with this explanation, but it is the only one I can offer.

The next geological formation further to the East is a small patch of Conglomerate (Basement rocks of Carboniferous series). In this there are no villages of any size in the tract of country which it underlies, is sparsely populated; I have not come across any cases of gôître in this region.

Extending from the North-East to the South-West is a broad band of Carboniferous Limestone; it is chiefly on this stratum that most of the Gôître occurs at such villages as Shetton, Graptop, Moreby, Penraddock and Stainton in Cumberland, at Stockbridge, Amham, Shetton, Frizlane, and Morland in Westmorland. The Limestone of this Series crops out in many places, and as it dips to the East, it forms frequent participated of "Seas" as they are locally called, giving the characteristic feature of the district. It alternates with thin beds of Sandstone, and the whole is in many places.
places covered with boulder clay.

This is the helvetic series, one of the deeper beds of the series, that gives seeds to reach its greatest intensity viz. at Helton, Arkham and Wholly. (This is colored darker in the plan). The analysis of water from this district is as follows:

<table>
<thead>
<tr>
<th>Solids</th>
<th>21.6 gr. per gallon</th>
<th>Silica</th>
<th>16</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fe (II)</td>
<td>1.05</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Carbonate</td>
<td>1.54</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Magnesia (Mg2O7)</td>
<td>39</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Chloride</td>
<td>1.01</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sulfate</td>
<td>3.5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Nitrate or Nitrate</td>
<td>0.7</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Free Ammonia</td>
<td>0.01 per million</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Total hardness</td>
<td>17°</td>
<td>Water hardness</td>
<td>40°</td>
</tr>
</tbody>
</table>

This water is taken from a spring, which is enclosed to form a shallow well and free from any source of pollution. The village consists of about 100 inhabitants, the majority of whom drink this particular water. There are 12 cases of disease here at all.
all persons who use this well.

Motherly,

<table>
<thead>
<tr>
<th>Total Solids</th>
<th>15.0 gals. per gallon</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silica</td>
<td>56</td>
</tr>
<tr>
<td>Oxide of Aluminum</td>
<td>Trace</td>
</tr>
<tr>
<td>Carbonate of Lime</td>
<td>11.50</td>
</tr>
<tr>
<td>Magnesia (MgPO4)</td>
<td>78</td>
</tr>
<tr>
<td>Sulfate</td>
<td>48</td>
</tr>
<tr>
<td>Nitrogen and Nitrites</td>
<td>164</td>
</tr>
<tr>
<td>Chlorates</td>
<td>1.1</td>
</tr>
<tr>
<td>Free Ammonia</td>
<td>0.44 per million</td>
</tr>
<tr>
<td>Alkali Ammonia</td>
<td>0.62</td>
</tr>
<tr>
<td>Total Hardness</td>
<td>12.0</td>
</tr>
<tr>
<td>Permanent Hardness</td>
<td>3.5</td>
</tr>
</tbody>
</table>

The water is from a spring at well, but I believe it contains some pollution from animal excreta, but only in small amount. All the inhabitants of the village use this water for drinking purposes, there will be about 80 persons in the village of whom four suffer from sítire.

The amount of iron in these waters is very small, even with the alumina it only amounts to a trace or the other only 0.2 gals. per gallon. The strata of limestone
also are now coloured with iron.

At Staninston a village on the same geological formation there are two cases of foétie, both in persons using the same well, but of different families - the older person, aged 60 years, states that there used to be many more cases in the village, but about 10 years ago a supply of water was brought, which although still hard, is less so than the majority of wells in the village; this may have something to do with the diminution of foétie as goes with what St. Leger states as happening in many instances in Dauphiné.

Newbiggen a village of about 150 inhabitants and on the same stratum, has only one case of foétie. The water, from springs, is fairly good ranging in hardness from 14° to 18°.

At Divile a small village of about 50 inhabitants, there are three cases of foétie. Astham with about 200 inhabitants, has nine cases of foétie. The same remark was made here as at Staninston, that in former years more cases existed; the water

Staphyly
Supply has been changed from wells to a surface supply from the fells: the potable water is not hard, that from the wells was excessively so.

In scanning over these notes, what strikes me chiefly is the fact that, although these villages are all on the same geological formation & derived in some cases their wells from a similar source, yet the amount of goitre varies considerably. Helms

Newbiggin both derive their water in great part from springs in the limestone, the villages are about equal in size & the occupations & characteristics of the people are of the same class, yet in one case there are 12 goitres & in the other only one. This seems to show that the goitreous element is not equally diffused through the same stratum, but is more powerful in some places than in others.

The hardness of the water is being practically the same, that it is not due to the combined salts which are indicated by the hardness.

The rest of the area composed of Carboniferous Rocks, goitre occurs, but not usually to the same degree.
The Chap limestone includes the village of
Broomlock opposite Motherby. I have only
seen one case of Goitre here -- part of the water supply
of the village is drawn from an abandoned
bore-hole, and for the purpose of prospecting
for iron, which was not found in sufficiently
large quantities to make the working profitable,
consequently there should be some iron balls in
the water.

At Fulton Thor, situated just on the junction
of the Bassenthwaite beds before mentioned with the
Shape Limestone, there is one family who
number four in the Goitre and one with two.
Both these families use water from the
same source, but with the difference, that
in the case it is softened with Artesian
water, a mixture of Lime and Soda which appears to act
by mixing with the Carbonic Acid in the
water before precipitating the Carbonate of Lime
held in solution by the excess of free Carbonic
Acid (as Lime alone does) by precipitating
some of the Calcium Sulphate. I found
the difference to be as follows:

<table>
<thead>
<tr>
<th></th>
<th>Unsoftened Water</th>
<th>Softened Water</th>
</tr>
</thead>
<tbody>
<tr>
<td>Manganese</td>
<td>21°</td>
<td>10°</td>
</tr>
<tr>
<td>Permanent</td>
<td>10°</td>
<td>6°</td>
</tr>
</tbody>
</table>

This
This case is interesting from the fact that...

Aluminium Ammonium 102 ppr.

Sulphate of Alumina 18 lb.

Carbonate of Lime 51 lb.

Sulphate of Magnesia (35") 11 lb.

Soda 2 lb.

Sulfate of Ammonia 1/2 lb.

The analysis of the water is

21.9 lb.

...and a further 3 lb. from a spring which

...the water is

...in the spring.

...which is probably

...the spring is

...the spring, and the village of...

...is about 2 miles...
Hardness: Total ... 16.8°

" Permanent ... 5.0°

The amount of iron as Ferro-Oxide is 8.

This farm-house is the only one supplied from the spring, and cannot bear from any other source of water in the neighborhood of Barton or Sirmil.

The Middle beds of the Carboniferous Series crop-out at Lowther Village, where there is a large quarry, in the stone of which considerable quantities of Iron Pyrites occur: a spring in this rock is used by some persons in the village, which contains 129 inhabitants, among whom are 5 gentlemen. This is another water supply from the higher ground, chiefly surface water; when this is low, the spring is wasted, with the result that the size of the gentlemen is said to increase.

Further South-east is the Village of Mortland in the Fost-Falten Union, there are perhaps 200 inhabitants, among whom 8 gentlemen. They all use the water of a particular well, known as "The Scholar's Well," the analysis of which is appended:

Total Solids ... 28.1 g per gallon.
Silica ...
Silica: 5 grains per gallon.
Oxyd of Iron & Alumina: 1.1 " " "
Carbonate of Lime: 12.2 " " "
Magnesia (MgO): 2 " " "
Asphah: 2.39 " " "
Sulphate: Trace
Nitrogen as Nitrate: 1.68 " " "
Chloride: 3.4 " " "
Carbonic Acid: 10.91 " " "
Free Ammonia: 0.25 ppm in million
Aluminate Ammonia: 0.4 " " "
Hardness: Total: 15.5°
Permangan: 6.8°

As Great Shrelicland & Neubury the Main Limestone is the chief bed, but there is little gneiss, one cove at Great Shrelicland & two at Newby. The water supply is from various wells. Melkshamrove & Clifton are situated on the edge of the limestone, where it touches the Permian Sandstone. The latter place obtains water from wells & there are four cases of stone in the former place, Melkshamrove used to obtain its water partly from the small stream, which runs past it; this was the supply in the case of one family, which has three generations passed;
The stream water is hard in summer, being chiefly derived from springs in the limestone over which it flows; but, however, some wells have been sunk through Bunter clay, into a bed of sand and sandstone overlying the limestone, and it will be interesting to watch the effect of the water on these persons.

As Goyt folk I do not know of any cases: at Berriew there are one or two, and I am told there are a few cases at Shelton, but it has not been my fortune to come across them.

Stretching from North to South last across the district is a belt of Permian sandstone on which the town of Penrith is situated. It forms the ridge of Hanging Fell or Penrith Beacon, also Whinfell and other places, as well as some localities on the East side of the Eden Valley, is only covered by earth in a scanty manner; over the rest of the Eden Valley it is covered by large layers of drift clay. Over the greater part of this area, water is scanty in amount and where derived from deep wells is "hard" in character. In general over this district goitre is conspicuous by its absence.
Some few cases do occur, which have
developed in this area. Of course, there are
persons living in it, who have got it, which
has commenced elsewhere.
In Pennine I have only come upon four cases:
one of these was an elderly person, who stated
that the disease used to be fairly common in
the town, but has decreased considerably of
late years. For about the last twenty years
the water supply has been obtained from the
River Conon, the hardness of which is only
from 15° to 5°, previous to that time the water
was obtained from wells & it was decidedly
hard.

The only other localities in this area, in which
Gritter has developed are Crumkill & Rushby,
in the former case the hardness of the particular
well credited with being the cause of Gritter
is 11°, whereas the hardness of the other wells
in the village is never above 5°.

At Rushby there are three cases only, in the case
of years of the particular spring.
I think the probable explanation of these cases is
that the water supplying the springs runs on the
Gritstone before it was through the Sandstone or
in
in. The ome of bushy the outcrop of limestone is only a few yards away as may be seen from the plan.

The remaining part of the country shown on the plan need not detain us - it is the high fell land of the Pennine Chain on the east side of the Great Fault - it is composed of Carboniferous Rocks. The commencement of the Coal measures is a smaller amount of the older Silurian Rocks; it is uninhabited only of interest in that it streams from it are in part the water supply of some of the villages.

Population

The population on the Silurian Rocks is the lowest, is approximately 1500, with only 6 cases of scrofula: that of the area covered by Carboniferous Rocks is 5000, with 55 cases of the district in which Permian Sandstone occurs has 12 cases of scrofula with a population of 13,000.

The number of cases per thousand and is represented by the following table:

<table>
<thead>
<tr>
<th>Group</th>
<th>Population</th>
<th>No. of Cases</th>
<th>No. per 1000 population</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silurian Rocks</td>
<td>1500</td>
<td>6</td>
<td>4</td>
</tr>
<tr>
<td>Carboniferous</td>
<td>5000</td>
<td>55</td>
<td>11</td>
</tr>
<tr>
<td>Permian Sandstone</td>
<td>13000</td>
<td>12</td>
<td>9</td>
</tr>
</tbody>
</table>

The statistics for the Silurian Rocks are altogether allied
attend by the Care of Watermill which Supplies
the whole number of goitres in this division.
Otherwise there is not a case in this part of
the district.


Professors Lebour of the University of Durham
(on the Geographical Distribution of Endemic
Goitre in England) gives a very complete
list of the places of geological characteristics
where Goitre occurs in this country. Stating
his opinion that "one point— and one alone"
"of any importance— seems to be established
as being common to those rocks in which
Goitre is found not to occur: the
absence of Limestone together with that of
Metallic impurities, and especially Sulphide
of Iron in both Countries (i.e. France and
England) the rocks which support most of
Goitre are such as are both Calcareous or
Metalliferous. But there are plenty of
facts to show that Metalliferous impurities
alone cannot be credited with the origin of
the disease, else the Devonian rocks from it
would not be free from it. Neither will
the absence of Limestone alone be sufficient—}

76
"To check the growth of bronchocele, the ligniferous beds of France and the ferruginous Sands of the Weald would not support it."
The following table is compiled from Professor Leconte's paper: but I would point out that Poitou is not entirely absent, even in what we would call the endemic form, from the red sandstone, which he puts in the Jurassic Period, whereas it is usually called Permian.
Geological Formation

Post-Pontian
- Deposit of Sand, Gravel, Clay
- Drift Debris

Sotrician
- Pliocene
  - Miocene
  - Eocene

Chalk with Flints
- Drift Chalk

Upper Greensand
- Gaault (Tertiary Marl, Land
  - Iron Greens)

Lower Greensand
- Whitby (Beck Clay, Hastings
  - Sand, Iron Greens)

Jurassic
- Oolite
- Keias

Triassic
- Slatey Shale
- New Red Sandstone

Permian
- Dolomite or Magnesian Limestone
- Red Sandstone

Geographical Distribution

Soil

- Absent

Including the London Basin and of Hampshire the Isle of Wight

- Absent

In Surrey, Sussex, (mainly at Newhaven), Hampshire, Dorset,金融 Bournemouth

- Present in Southdown Coasts

In the Nearest

- Endemic

Especially at Ampthill in Bedford, also in Surrey

- Absent

About Dunstable Wells at St Albans, Hertford at Herts

- Absent

Except at Holywell in Yorkshire

- Very rare

Which extends from Tavistock in Devonshire to Lyme Regis

- Absent

In Bovey-Cretonius near Framborch; except at Babbacombe

- Endemic

Near Holywell in Yorkshire

- Absent

In Cheam, or the West Side of the River Thames westward to

- Endemic

In Devon near Bideford, near Wolverhampton

- Absent

(pertactically)
Geological Formation

Carboniferous System

- True Coal-measures
  - Millstone Grit
  - 's. Pink, Slate, Sand, etc.
    - (often ferruginous)
- Carboniferous Limestone

Orizon or Old Red Sandstone

Silurian

Cambrian (Pre-Cambrian - Peneplite or even slate)

Superfice: Grumill, Porphyres, etc.

Geographical Distribution

as at certain localities in tweddale etc.

Present along each side of the Pennine range, i.e., in the West of Northern
England (South Uyerdale, Allendale, Ribbledale upper, Coquetdale); in the
Loch of Aberneth (upper Uyerdale, Cumbrae); in West Yorkish. (especially
at Skirrow); in North Yorksh. in Wiltshire (west of Long Willow);
in Cheshire; in Lancashire; in Westmorland (north coast side, especially)
in Cumberland (especially in the Allan mining district); in the
Malvern district; the Forest of Dean; in Flintshire and Bridle.

absent or nearly so.
Conclusions.

1. Poitrière in England is more common in women than men.
2. It usually commences about the age of puberty.
3. While not hereditary, a tendency to the disease exists in families exposed to the essential cause.
4. The evidence is against the disease being produced by a micro-organism.
5. Some constituent of potable water is the cause.
6. This substance has no relation to the colour, turbidity or organic impurity of the water.
7. The substance exercises most effect when water is derived from limestone or dolomite.
8. The disease is not due to the presence or absence of Silica, Soturie, Phosphates, Oxygen or Carbonic Acid Gas or Magnesium Salts.
9. The presence of lime alone is not the cause.
10. The presence of Metallic ferrous impurities alone is not the cause.
11. Poitrière occurs with greatest frequency in the limestone of Carboniferous Age.
12. It is not entirely absent from the Permian Sandstone.
Cases.

Aarkham.

Five cases occur in one family - the mother of four children, one of whom is a boy aged 12 years, the other children are 8, 6, 4, and 3 years of age respectively - until lately they obtained their drinking water from a well in the limestone. The mother's mother's sister was goitreous.

Female, 48 yrs., has a large goitre, which did not commence until she came to Aarkham 8 years ago. At that time obtained water from a well - no relatives are goitreous.

Female, aged 40 yrs. - goitre began when 36 yrs. old during pregnancy - she has always lived at Aarkham and formerly used well water - no history of goitre in the family.

Female, 30 yrs. - commenced at 15 yrs. when she began to menstruate - used well water has a sister with goitre also living here.

Clifton.

Male, aged 26 yrs. - has a small goitre, has lived here all his life - it began when 15 yrs. old.
old, but has never caused the least inconvenience.
none of his relatives have goitre - use water from a spring close by.

Female, 57 yrs. - goitre large hard, began when 40 yrs. ago - when living at Plumpton -
daughter has a goitre, which began when 10 yrs. old at Clifton - no other relatives goitrous.

Female 70 yrs. - has a large calcaneous goitre -
began climbing at Helton 15 years ago, when
using water from their brother's well, it has
become much larger since she came to
Clifton - she thinks it becomes larger
when she uses the water from the well
used by the first case mentioned at Clifton.

Female 28 yrs. began when 15 yrs. old at
Clifton, menstruated first at the same
time - no relatives goitrous - use the
water from a well in the Limestone.

Helton.

Female aged 70 yrs. has a small goitre which
began about puberty - father, mother &
two sisters had goitre & three daughters
one son developed the disease while
living here - they have always used the
water.
Female boys' unremarked, have a large goitre which began when 20 yrs. old, always took the same water.

Female age 60 yrs. has a large calcareous goitre, which began when 15 yrs. old; she drinks the same water. Her two daughters have smaller thyroid swellings, one of which began at puberty the other when she was 36 yrs. 9 mos. after marriage.

Two females aged 60 & 52 yrs., neither the same water having goitres, but none of their relatives have as suffered.

Female age 15 yrs. has a small goitre, which developed a year ago, when she came to live at Stettin & twice the water mentioned. She had not menstruated then, but now since.

Stettin John.

Female age 28 yrs., has a large goitre, which began when 16 yrs. old, when at Stettin John. When in London in frequent visits the swelling always decreased in size, his next entirely went away & always returned to
about the same size when she came back to Hutton John — the drinking water has
is softened by Anticalcium — when she went to Exmouth lately, the swelling again
became larger. Her mother, also, has
a small goitre which began 11 yrs ago at
Hutton John, on her return from India.
A sister has goitre, but it has ceased in
size since she married & left the district.
Female 41 yrs. has a goitre which began
when 38 yrs. old. She had been at Sparklet
(on Conglomerate formation) for a good many
years often returned to Hutton John —
ever had any menstrual troubles; use
the same spring as above but undrained.
Female 18 yrs. daughter of the last mentioned
began to have goitre at 15 yrs. No other
relatives goitrous.

Kirkoswald.
Female 52 yrs. has a large exophytic goitre, which
began at Lonstiel, but became larger when
she came to Kirkoswald. Her mother
suffered from the same complaint — she
had a son born with goitre — D. Macdonald
Tibb.
Tells me it was of considerable size, but disappeared before he was 7 years old.

Lazorky.
Male 50 yrs - goitre began at 7 years old, when he was 30 yrs old. Has a cousin who is goitre.

Southern Village.
Female 52 yrs has a large dog goitre began when 23 yrs old, during pregnancy. Never troublesome except when she has attacks of phlebitis, used to use the water of a spring from the limestone, not generally a supply chiefly surface water, but when this is deficient use the same spring as formerly relates that here the swelling increases in size.

Male 20 yrs of age - general goitre Swelling of the thyroid - began 2 years ago.
Female 46 yrs - Small goitre
Female 40 yrs - Small goitre. Large goitre, troublesome from increase of size at menarchal period - began at 16 yrs - as with relatives goitrous.
Female 18 yrs - Small, general swelling of thyroid began.
began at 15 years.
All three persons have lived all their lives at this village and all take the same water as the first case.

Nortland

Eight females have goitre here, two of whom are unmarried; they all use one well, the analysis of which is given on page 61.

Nortland

Female 81 yrs. Small goitre which began at puberty, whilst living at Nortland.
Female 62 yrs. began at 18 yrs. never caused any trouble.
Male 21, son of above. Goitre began at 16 yrs.
Female 50 yrs. large goitre at 19 yrs. goitre—unmarried. Iris grew menstruation when young.
All three persons drink the water from one spring: analysis on page 65.

Neubriesen

Female 72. Goitre began at 42 years, when she came to Neubriesen. It is unilateral, large cystic. No relatives had goitre.
Newby. Two females, one unmarried have goitre here.

Newby.

Female, age 40. Large goitre, began at 16 years, was cured from same spring as next two cases.

Female 32yo. Sister, above has goitre, began at 15yo. no other relative goitres.

Female 32yo. Small soft goitre - developed shortly before marriage, no relative goitres.

Melkinthorpe.

Mother & two daughters have goitre, all small & do not cause any inconvenience; used to drink the hard stream water, own a well, which contains softer water; case in each case the swelling began at Melkinthorpe the mother at the age of 64yo.

Purirk.

Female 72yo. goitre began when 30 years old, when living at Purirk using pump-water; it is large & partly calcified; she never had any menstrual troubles; has had children since, but never noticed any swelling during pregnancy.

Male 13yo. goitre began a few days before
Observation & now is a well-marked swelling: no change to account for it in any of his surroundings: no disturbance of general health or symptoms of Exophthalmos; one sister has goitre.

Dr. disappeared in the course of two months.

Male 35 yr. began when 16 yr. old, when living in Penrith among the general water supply; has not become any larger for 10 yrs. well marked tense swelling. gets larger when he drinks hard water but remains at original size - his mother has goitre.

Female 32 yr. married, one child, goitre for the last 3 months: menstruation irregular - no change of habits or locality.

Penruddock.

Female 30 yr. goitre began when 13 yr. old is always larger at menstrual periods which are regular: causes inconvenience only from its size; uses water from the few well - her mother & sister have goiters which began at Penruddock - no other cases in the village.

Sowerby
Soestbridge.
Female 45 yr. Had goitre as a child when living at Barton Hill-n-Disappered later—her three daughters aged 22. 18. 14 yr. have goitre—see spm. water (analysis p. 60) all began at 13 yrs. nearest.
the swelling began: have always lived in the same place; no menstrual troubles; no other relatives have goitre.

Male 42 yr. goitre began at 30 yr.: the cause assigned no cause: his daughter has goitre which began at 13 yr. when he began to menstruate shortly afterwards; it is always larger at menstruation periods or causes such discomfort.

Female 30 yr. 07r small goitre.

Female 42 yr. small hard goitre; began at 16 yr. when living in same locality: none of her relatives are goitrous.

Wickill:

Female 50 yr. goitre began at 21 yr.: was first swollen when away from Wickill; it is small & she has no symptoms relating to it.

Female 42 yr. Swelling began at 12 yr. of age. Her mother had goitre when they lived at Shrewsbury: a sister at thirty: had it, but this began at Shrewsbury: it is larger when she is pregnant - her daughter has goitre which began at 11 yr. of age, she did not menstruate until 15 yr. old.
Two other persons in the village have
suffered - they all used the same well
until recently.

Yanwath:

Three cases in females occur here - all
small, with no special characteristics.
They use water from separate wells.