PHLYCTENULAR KERATO-CONJUNCTIVITIS.

by

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INTRODUCTION.

Before setting out to consider seriously the subject of Phlyctenular, or as it is sometimes called, Strumous disease of the eye, it is perhaps well that there should be formed in one's mind some idea as to the plan of treatment to be adopted in dealing with the various aspects of the condition.

For this reason it has been thought advisable by means of these few introductory remarks, not merely to make some more or less general observations upon the subject with which we are concerned, but also to offer some explanation for the unavoidable subdivision into sections of the subject matter of this thesis. It is hoped that the reason for the order of their arrangement will be apparent to all.

Phlyctenular disease of the eye is one of very great importance if for no other reason than that it is of extraordinary prevalence amongst certain classes of the community.

Von Arlt¹ who calls the condition Conjunctivitis, Scrofulosa or Lymphatica, has stated that this is beyond doubt the most frequent of all inflammations of the eye. That the greatest number of cases occur in/

in children (not before the 9th month) then in youth; "and that cases which appear only at the time of puberty are rarer but more dangerous and more obstinate than the others."

Again quoting from the same authority by way of illustrating that serious inconvenience, and even blindness may result in later life amongst those in whom the condition has been neglected or inefficiently dealt with in their earlier years, we read that "cases sometimes occur in adults or aged persons who have previously suffered from scrofula, then appeared healthy for a time, and subsequently broken down in health on account of unfavorable influences, such as unwholesome food, imperfect ventilation, long-continued nursing etc."

The tissues involved in this disease process are the most superficial ones of the eye, and fortunate as this may appear to be, it is in reality far from being so, since the mere superficiality of the condition seems to fail to suggest to some the necessity for any other than the most superficial and consequently hopelessly inadequate treatment.

It is of course really deplorable that the apparent simplicity of any disease should be its misfortune, and yet that would appear to be so in this case. Another of the older authorities\(^1\) states:

\(^1\) Nettleship. "Dis. of Eye" (1890) p. 414.
states that "the strumous condition is a fruitful source of superficial eye diseases which are for the most part tedious and relapsing and are often accompanied by severe irritative symptoms."

Further evidence of the importance of this Phlyctenular eye disease is forthcoming in Parson's "Diseases of the Eye" where we find that "Phlyctenular Keratitis was found to be the cause of blindness in 3.58 per cent of 1855 blind children: (Harman)" and again, that "this disease and such conditions as blepharo-conjunctivitis" are largely due to insanitary conditions of life. They might probably be eliminated as causes of blindness by the adequate provision "for the education and treatment of the children in special residential schools." Swanzy too is alive not merely to the prevalent nature of the disease but also to the possibility of its causing trouble to sight in later life. He states that Phlyctenular Keratitis is important because it is excessively common, and because it is capable of causing considerable damage to sight."

Whilst of course blindness is probably the most serious end-result of the neglected or badly treated case, it is by no means the only one, as I hope may be/

1. Parsons "Diseases of Eye", p. 618.
2. Swanzy (Werner) 1925. p. 106.
be appreciated from a short study of certain amongst the list of cases given further on in this text. From this it will be seen that out of a comparatively small total number of patients, a very fair percentage has suffered from active outbursts of the disease requiring treatment, after having attained to the status of adult life. Not a few of those are to be attributed to factors which apply equally to the cases occurring in childhood; others however appear to be precipitated by such additional considerations as (1) unhygienic surroundings; (2) latent or obvious foci of sepsis; (3) uncongenial work; (4) uncorrected refractive errors; (5) a definite Tuberculous lesion; (6) faulty Dieting or some other accompaniment such as may have a lowering effect upon the resisting powers of the body as a whole towards any form of infection.

The name Strumous has long been applied to the condition because of its very frequent occurrence in children possessed of the Strumous Diathesis, or as is now more commonly said, in children of the Strumous Type. This leads one on to say a few words with regard to the relationship of Phlyctenular disease not only with the Strumous type of child, but also with the child who is definitely Tubercular.

It would be difficult to say whether or not any advance has been made during the past fifty years towards/
towards coming to any definite conclusions on this point. Much the same sort of view is to be found amongst the more modern text-books as was expressed by the writers of half a century ago. Nettleship\(^1\) says that "phlyctenules occur so often in strumous subjects, that we are justified in suspecting scrofulous tendencies in all who suffer much from them." Sir George Berry\(^2\) states—"Phlyctenular conjunctivitis is a distinct type of conjunctival inflammation which in its most characteristic forms is almost entirely confined to children, in whom it is altogether much more common than in adults. The affection is a constitutional one, and an evidence either of struma or some weakness following measles or other lowering illness of childhood." "This form of conjunctivitis"\(^3\) writes Von Arlt "occurs so frequently with distinct symptoms of scrofula in other organs, that the causal connexion with the general disease is manifest. Even when no manifest symptoms of scrofula are noticeable at the time of the conjunctivitis, the occurrences and relapses depend so little on external noxious influences, that as in the manifestations of syphilis, we are compelled to seek the cause within the organism. If we assume scrofula only when swelling/

swelling and infiltration of lymph glands or caries are found, probably only one half of the patients suffering from this disease would be considered scrofulous. But we must also take into consideration the condition of the general integument, mucous membranes (especially of the fauces and nose): state of development of the body at time of puberty and state of the nutrition."

From these extracts of the older writers it is evident that considerable stress is laid upon the general nature of the disease as opposed to its being one of a purely local ocular nature; and if we now examine for a moment the views held by one or two of the more recent writers on this subject they will be found to be on the whole not very dissimilar. Maitland Ramsay while appreciating that there is some connexion with Tuberculosis, goes on to state that "Phlyctenular Ophthalmia may be the earliest indication of a strumous condition and in cases where the conjunctival lesions are slight, severe subjective phenomena may arise from a source of irritation elsewhere than in the eye, e.g. Stomach or bowels. He holds that although some of the patients may present the outward appearance of good health, most of them are, owing to defective assimilation and excretion, either abnormally pale or unnaturally livid. They/  

They have but too obviously inherited the miserable legacy of constitutional weakness; and the inherent vulnerability of their tissues has been intensified by improper dieting and by overcrowding in insanitary houses." He goes on to say "They are called scrofulous, but as yet there are no symptoms to show that the tubercle bacillus has effected a lodgment: and careful examination fails as a rule to discover it in the conjunctival sac, although it is in children such as these that one would expect to find this microorganism developing and increasing most rapidly. The Germans speak of them as Candidates for Tuberculosis, but bacteriological examination of a pustule, excised with antiseptic precautions from the conjunctiva fails to find the tubercle bacillus or any other microorganism. Nevertheless those children present a general condition which if it be not actually tuberculous, is closely associated with a lowered resistance against the tubercle bacillus. The older clinicians always regarded intense photophobia in the absence of a lesion of the cornea as a sign of scrofula and superficial vascularity coming from the bulbar conjunctiva as the distinctive sign of a strumous affection of the cornea. Experiments with tuberculin corroborate those clinical observations because in patients suffering from phlyctenular conjunctivitis, the Von Pirquet cutaneous reaction is/
is always positive, and the Calmette ocular test is exceedingly dangerous."

Eyre in his Hunterian lecture, states that "until some responsible observer has demonstrated the presence of the tubercle bacillus in an extended series of Phlyctenules" he sees no valid reason for regarding phlyctenular conjunctivitis 'per se' as a form of tuberculosis of the conjunctiva. Again, it is the opinion of Parsons that whilst "the children often have enlarged lymphatic glands in the neck etc. or other signs of tubercle, yet on the other hand every sign of tubercle may be lacking. Sir Richard Cruise thinks that the phlyctenular ulcers or small discrete nodules occurring at the corneo-scleral margin in children suggest a toxi-tuberculous condition especially if of frequent recurrence and resistant to treatment." Although it may quite well be that the majority of the children who suffer from phlyctenular eye disease have a tuberculous lesion somewhere in their systems which it is not possible to demonstrate clinically, one cannot go so far as to say that this is absolutely so. Certainly in a proportion of cases there are definite tuberculous foci, whilst in yet others, where these are lacking, there is an undoubted/

1. Foster Moore "Medical Ophthalmology". 1925.
undoubted tuberculous family history. With regard, however, to the others they are, in the great majority of cases, simply children of the Strumous type, and one cannot say more. They belong to that class to which Higgins\(^1\) referred as coming from the slums of our large cities, poor and ill-nourished, having enlarged tonsils, adenoids, swollen glands of the neck, otorrhoea, rhinitis, thick lips, and displaying many of the characteristics formerly summed up by the word Strumous”.

As it is no part of my intention to take up the question of the etiology of Phlyctenular Keratitis fully here; and as this will be gone into at some length later on, I would now say a word or two with regard to the order in which the material contained in the following pages has been arranged.

In order that a fair measure of justice may be done to any subject, it seems only natural that a little time at the commencement should be allowed towards refreshing one's memory upon certain points concerning the derivation and nature of the structures involved in that study. The first part of this thesis has therefore been allotted to a somewhat cursory account of the mode of development, the anatomical structure, and the functions of the conjunctiva and its adjacent tissues. It is hoped that by this means one will be in a position the more

\(^1\) Higgins (Ormond) "Ophthalmic Practice" 1903.
more easily to appreciate the significance of what is
contained in the subsequent sections.

The second part contains what one might really
term the body of the thesis. In it, too, one has
thought it well to indulge in subdivisions in order
to simplify the reading, and to avoid as far as
possible repetition of statements.

The subsection here to which attention has been
chiefly focussed is that dealing with the etiology of
Phlyctenular disease. Indeed, taking the subject as
a whole, this has seemed to be the real centre of
attraction. With regard to the remaining subdivisions
of this part, dealing in turn with the Pathology,
Symptomatology, Course of the disease, Prognosis and
treatment, and finally Differential Diagnosis, the
last has probably received a more scanty consideration
than its predecessors. In the case of all of these
latter sub-sections, however, there has been no en-
deavour to do more than pay but a tolerable amount of
attention.

The views of others have been freely given,
throughout, in dealing with the various aspects of the
condition, and one only regrets that it has not been
possible for various reasons to have drawn upon a
larger field of ideas and experience, in this con-
nexion.

We next come to deal with the series of cases
which go to make up part three.

One/
One would have wished to have been able to review a much greater number of phlyctenular cases, and to have had at one's disposal considerably more full particulars of each individual case, especially with regard to those under treatment in the earlier years of the survey. The extent of the advantages which certain additional points of information upon the older cases, might have conferred, it would be unnecessary to detail. Suffice it to say that information of considerably greater value might have been gained on the questions of the time of onset of the initial attack of the disease; the eye first to become involved in the process; and the seat of election on the surface of the ocular globe.

The arrangement of the cases has occasioned some little amount of forethought as so many alternatives seemed to present themselves to one's mind. It has been thought best in the interests of simplicity if for no better reason, to divide the series into three age groups, irrespective of time of onset; sex; type of case; or fulness of description; and it is hoped that this method may not prove to be wholly without something to recommend it. Cases in which there is known to have been (a) some definite focus of sepsis; (b) or marked refractive error; (c) or obvious Tuberculous lesion have been marked with the large block capital letters S.; R.; and T.B., for purposes of easy reference.

In/
In the fifth section is contained a brief summary of such conclusions as one has been able to draw from a study of this most fascinating subject. The time at one’s disposal has been limited, and consequently the amount of clinical material handled has not been so large as might have been desired: nevertheless a very considerable number of cases has been seen in hospital, and a fair proportion of these has been followed up through one or more attacks of the disease.

A complete list of the various works consulted has been given at the end so as to facilitate the process of reference to the various sources from which the views of authorities on the subject have been derived.

In conclusion I must record the feeling of deep gratitude which I have towards my former chief in the Royal Infirmary for the generous way in which he has placed both clinical material and records of older cases at my disposal, and also towards those others, who have so kindly helped, either by affording me access to publications which otherwise must have been beyond my reach, or by furnishing special particulars of certain cases, e.g. those dealing with the dietary of a selected few, or by otherwise giving me the opportunity of seeing cases of particular interest, without all of which it would have been impossible for me to undertake this thesis.
13.

PART I.

DEVELOPMENT OF THE CONJUNCTIVA.

The whole of the conjunctival sac is derived from the ectoderm or epiblast. Somewhere about the 3rd month of foetal life two folds of epiblast begin to make their appearance on the anterior surface of the eyeball, the one above and the other below.

The upper eyelid is a development of the frontonasal process, and the lower eyelid of the maxillary process. That portion of the ectoderm which lines the inner surfaces of these folds, becomes modified eventually to form the conjunctival sac: the outer portion going to form the outer covering or skin of the lids.

The conjunctival membrane comes in contact with the anterior surface of the ball of the eye and so is continuous with the corneal ectoderm.

From the edges of the two epiblastic folds are formed the palpebral margins, and ingrowths from the epiblast along these margins into the substance of the lids, (which is of nasodermal origin) form the ciliary follicles, Tarsal glands, etc.

The ectoderm lining the inner aspect of the two primitive palpebral folds shows signs of differentiation into a mucous membrane soon after the eyelids have met and/
CONJUNCTIVAL SAC = BLUE.
CORNER = YELLOW.
LIDS = RED.
and fused in the 3rd month of foetal life. By a process of invagination of this ectodermal lining, the various accessory structures connected with the conjunctival sac, come into being. These include the lacrimal glands, the glands of Manz and the glands of Henle.

ANATOMY OF THE CONJUNCTIVA.

The conjunctiva is the mucous membrane lining the inner surfaces of the palpebrae or eyelids. It is reflected over the anterior portion of the sclera and over the cornea, thus forming a connection between the eyelids and the eye itself. This mucous membrane, taken as a whole, forms what is known as the Conjunctival sac, the mouth of which is bounded by the free margins of the lids.

There is really no actual space in this conjunctival sac which is merely a potential one, as its walls are in close contact all over. The conjunctiva lines the inner surfaces of the eyelids and is carried a little beyond into the supra and infra-tarsal regions. It is then reflected on to the surface of the bulb, the line of reflection round the eyeball being known as the Conjunctival fornix; that part of the conjunctival fornix which is reflected from the upper eyelid on to the surface of the eye being called the Superior/
Superior Fornix, and that from the lower eyelid the Inferior Fornix.

The connection between the conjunctiva and the outer or scleral coat of the ocular bulb is not by any means close, and here, in contra-distinction to the appearance of the palpebral portion it is thin, transparent, free from papillae, and almost completely avascular. The membrane becomes smoother in passing over the surface of the eye, and over the cornea it is continued as the corneal epithelium.

The ducts of the lacrimal gland open on to its free surface at the lateral angle of the upper lid, whilst at the medial angle the conjunctiva forms a semi-lunar fold called the "Plica Semilunaris". Medially too, are situated the Lacrimal Puncta which communicate with the mucous membrane of the nasal cavity through the Lacrimal passages.

The conjunctiva is firmly bound down to its adjacent structures in its palpebral and ocular portions, but is loose at the Plica Semilunaris, and at the fornices where it is also thicker. Here owing to the looseness of its arrangement, the membrane is thrown into folds when the eyelids are opened.

The membrane consists of an epithelial layer and a connective-tissue portion. The epithelium of several layers of cells which are columnar in the case of the palpebral conjunctiva, and stratified squamous/
Over the cornea there are about 5 layers of cells.

GLANDS.

In the region of the fornices and near them are a number of convoluted tubular glands – the glands of Krause. These open upon the surface of the conjunctiva, and are more numerous on the upper than on the lower eyelid. These glands are but few in number on the palpebral conjunctiva, and are not found at all near the margins of the eyelids.

Other glands, called by Henle, Trachoma glands, occur in the conjunctiva, and these according to Strohmeyer are found principally in the neighbourhood of the medial palpebral commissure.

The connective tissue basis or "Tunica Propria" is well developed in the region of the fornices, and to this is due the increased thickness of the conjunctiva there.

This "Tunica" is not so pronounced in the tarsal portions, and is entirely absent over the cornea. It is composed of a thin adenoid layer immediately adjacent to the epithelium, and a thicker deep fibrous layer containing a fair proportion of elastic tissue. The structure of the adenoid layer is somewhat loose, and it is permeated by white corpuscles, although less freely in the bulbar portion. This lymphatic permeation is especially abundant in the region between/
between the convex border of the tarsal plates and
the fornix, and principally towards the commissures
of the lids, where it is concentrated to form lymph
nodules, termed "Trachoma Glands" by Henle. Papillae
occur in a circumcorneal zone about 2 mm. broad, and
also near the margins of the lids.

The deep fibrous layer of the dermis is not a
ture constituent of the mucous membrane, being really
formed by subconjunctival connective tissue reinforced
in the palpebral region and fornix by fascial ex-
pansions of the sheaths of the levators and recti
muscles, and in the bulbar region by the anterior part
of the fascia bulbi. The fibrous layer is not
present in the tarsal region.

THE CARUNCULA LACRIMALIS.

This is a small red, cone-
shaped structure situated at the medial palpebral
commissure, and occupying the Lacus, Lacrimalis.
It consists of skin containing sebaceous and sudor-
iferous glands, and from it arises the whitish
secretion which is often found in this neighbourhood.
On its surface there are one or two small hairs.

The conjunctiva has an abundant nerve supply.
Many of the nerves end in terminal bulbs which were
first written of by Krause.

Blood/
BLOOD SUPPLY.

Arterial. The conjunctiva is for the most part supplied with arterial blood from 2 tarsal arcades formed by the palpebral branches of the nasal and lacrimal arteries in each eyelid. A plentiful supply of blood is supplied to the palpebral conjunctiva by the marginal arcade and the posterior tarsal plexus.

The peripheral arcade is the most important since it supplies both the fornix and the bulbar portion, its branches become finer and therefore the membrane becomes paler towards and over the globe, where they are usually only visible in hyperaemic conditions.

SCLERO-CORNEAL JUNCTION.

About 3 mm. from the edge of the cornea the posterior conjunctival branches anastomose with the anterior conjunctival branches which come from the anterior ciliary arteries (branches of the ophthalmic artery). The posterior conjunctival vessels are more superficial and more movable than the more deeply placed immovable anterior conjunctival ones. From the anterior conjunctival arteries a peri-corneal plexus, some 4 mm. broad, is formed. This is arranged in 2 planes; a superficial or conjunctival and a deep or episcleral, and from this loops of tiny vessels are sent into the edge of the cornea. The anterior ciliary/
ciliary arteries having given off their conjunctival branches, turn abruptly to pierce the sclera just in front of the insertions of the muscles, and enter the base of the iris.

In inflammation of the conjunctiva the posterior conjunctival vessels which are hardly seen normally, become visible as a close network over the bulb, fading away towards the corneal margin. These vessels move freely with the conjunctiva and do not disappear under pressure.

In superficial inflammation of the cornea the deeper plane of the peri-corneal plexus formed by the anterior conjunctival vessels is engorged and spreads in a freely branching manner into the corneal margin.

When deeper parts of the cornea and the iris are involved in an inflammatory process, the episcleral plane of the pericorneal plexus which is normally invisible, becomes apparent as a pink band of fine straight vessels round the cornea; these vessels do not move with the conjunctiva, and they disappear on pressure.

There are one or two veins to each artery, and their course is similar to that of the arteries which they accompany. Most of them drain into the palpebral vessels through the retro-tarsal venous plexus. Near the corneal margin an episcleral network is formed; the small veins here accompany the anterior /
anterior conjunctival arteries and drain backwards by the veins of the recti muscles into the ophthalmic vein and cavernous sinus.

There are 2 communicating networks of lymphatic vessels in the conjunctiva. The more superficial is the smaller of the two.

NERVES SUPPLYING THE CONJUNCTIVA.

The medial side of the conjunctiva is supplied by the infra-trochlear branch of the naso-ciliary nerve, and the lateral side by the lacrimal nerve. The corneal epithelium and a narrow band of the bulbar conjunctiva around it are supplied by the ciliary nerves. The nerves terminate in the conjunctiva either as free ends or in tactile corpuscles of Krause. In the former case after losing their sheaths they form a subepithelial plexus, especially marked at the free margins of the lids.

1

The cornea in the adult forms a little more than one-sixth of the circumference of the ocular globe in section. In thickness the cornea averages about 0.95 mm. for its central part whilst at its periphery the radial diameter is increased to 1.19 mm. It measures from 10.5 - 11 mm. from side to side and is/

is bedded within the foramen sclerae anterius in such a way that the bevelled edge of that aperture overlaps it slightly around its circumference where the tissues of the sclera and cornea blend. As a result of the differences in the lengths of the radii of the circles of which the cornea and sclera form arcs, the external corneal surface projects beyond a chord passing through its circumference where it unites with the sclera externally (Sulcus Sclerae Externus) to the extent on an average of 2.5 mm. Owing to the bevel of the sides of the foramen sclerae anterius, the area of the cornea when viewed from within is about 1 mm. wider in its diameter than that exposed externally. The inner surface of the cornea not only forms part of the arc of a smaller circle than that of the external surface, but the centres of the two circles do not coincide: that of the smaller circle lying anterior to the centre of the larger circle by a distance equal to that of the central thickness of the cornea. Measurements made yield an average radial length for the curve of the external surface of 8.4 mm.; whilst for the inner surface, the radius of the curve averages 6.8 mm. In this way the increased thickness of the cornea at its periphery is accounted for, but some arrangement is necessary whereby the thicker corneal margin may accommodate itself to the bevelled edge of the corneal aperture of/
of the sclera. This is provided for by the rounding off of the inner corneal margin where it becomes confluent with the inner surface of the scleral margin, so that in place of forming with the latter a uniform flowing curve, it makes by the abruptness of its overhang, a sulcus or groove at the point where it becomes blended with the scleral tissue. In the full time foetus the cornea amounts to about one-fifth of the circumference of the globe on section. Its transverse diameter is about 10.6 mm., so that comparatively little increase in its growth is required to reach the adult proportions. It follows then that the increase in size of the globe after birth is mainly due to the expansion of the scleral part of the eyeball and its contents.

At birth the thickness of the cornea is not only proportionately but also absolutely greater than the thickness of the cornea in the adult. In the full time foetus it measures 1.4 mm. at the centre and increases to 1.6 mm. at the periphery.
BACTERIOLOGY.

It has been thought by many observers in the past, that the small red conical elevations or phlyctenules occurring under the epithelium in Strumus, Scrofulous or Phlyctenular Kerato-conjunctivitis, must have been caused by some localised ectogenous infection. The fact that the epithelium, in the scrofulous individuals who suffered from this disease, was especially susceptible to injury, seemed to make it all the more probable that this should be so. Gifford in 1886 was probably the first to undertake bacteriological investigations of the eye in phlyctenular disease. Out of a total of twenty-eight cases studied in this way, he found staphylococcus albus and aureus in twenty-six. In 1887 Burchardt found micrococcus flavus desidens, and produced infiltrations not unlike phlyctenules in the cornea of rabbits with it. In 1888 Leber unsuccessfully attempted to produce phlyctenules in the human conjunctival sac by means of the Staphylococcus. Later on Harman studied a series of twenty-three cases and found no organisms in fifteen, and Staphylococcus albus in four of the cases. Weeks in his text-book on the Diseases of the Eye writes that "the researches of others as well as himself indicate that the affection/
It is not always easy to get a case in which there are not present in the conjunctival sac other organisms besides the staphylococcus, but according to Parsons, in the pure phlyctenular cases only staphylococci are found in abundance, and since staphylococci are not so common as might be expected in the normal conjunctival sac, it has been concluded that the disease is due to infection by this organism. Phlyctenules have never been produced by rubbing Staphylococci into even a damaged conjunctiva.

Igersheimer has expressed the view that in the normal conjunctiva the penetration of a pure culture of tubercle bacilli into the conjunctival sac produces no specific reaction: but that only when the material has been injected subconjunctivally or after injury to the mucosa do tuberculous lesions occur.

To quote Parsons again, we find "that the nearest approach to the artificial production of phlyctens has been by injecting cultures of tubercle bacilli, in which the organisms have been killed, into the veins of rabbits." "It is doubtful" he continues "if the infiltrates were real phlyctens in these experiments, but it is certain that the administration of tuberculin has not infrequently been followed by/

by an attack of phlyctenular conjunctivitis in the human subject. On the other hand, the superficial position of the lesions and the analogy to other ulcerative conditions of the cornea, favor the view that the disease is ectogenous in origin, the morbid agent being at present unknown. Von Herrenschwand\textsuperscript{1} discovered a Gram negative diplo-bacillus having morphological and cultural characters like the diplo-bacillus Liquefaciens of Petit, in two cases of severe phlyctenular conjunctivitis following coryza. Herzog\textsuperscript{2} regards the staphylococcus as the cause of many cases of eczema of the eyelids, such as occurs in many scrofulous children. In others, he thinks this organism plays only a secondary part. It has been already stated here that certain investigators have considered it to be without question that the epithelium in scrofulous children is particularly vulnerable. Over and above the names mentioned in this connexion are those of Duclos, Bucheron, Leber, Sattler, Straub, and Gallenga. These authors only attached a limited etiological significance to the bacteria found. Buchard, Bach and Smith have stated that the phlyctens are caused by a circumscribed inoculation with pyogenic cocci, especially the staphylococcus.\textsuperscript{3, 4}

\textsuperscript{2} Herzog. Leit. f. A. 1904. XI. S. 183.
\textsuperscript{3} Sattler. VII Internat. Ophth. Kongress zu Heidelberg 1898.
staphylococcus. The results of Axenfeld, Von Bach, Neumann and L. Müller have shown that it was not possible to find in the contents of very early phlyctenules a definite number of these known pus producing organisms. They found on the contrary that in these early cases, many gave negative results, whilst others produced in small numbers such a variety of bacteria that no definite conclusions could be come to.

Gifford and Straub attributed the occurrence of phlyctenules at the corneo-scleral limbus to the stagnation of tears laden with Staphylococci and their toxins, in the cleft between the cornea and the sclera.

Straub holds that phlyctens arise through toxic irritation to which bacterial invasion is added later.

Meyers and Van Haaften considered the Staphylococcus the predominant factor in the production of phlyctenules. These investigators however did not examine the phlyctenular contents, but only the secretions of the conjunctival sac.

Morax often found Staphylococcus in the conjunctival secretion in many cases, but in some the results were negative.

No phlyctenules resulted from the introduction into the conjunctival sac of large quantities of Staphylococci by Burchard and Bach, and even when Bach introduced virulent Staphylococcus Aureus beneath the surface of the bulbar conjunctiva still there:

there was no appearance of phlyctenules. Leber also failed to obtain phlyctenules in this way.

Axenfeld states that "with regard to cases of recurrent kerato conjunctivitis with characteristic appearance of vessels in the cornea, the view that their occurrence requires not only an external irritation but also some special state of the nidus, cannot be rejected". "I have" he continues "always obtained positive reactions with tuberculin in these cases".

He considers that it is hardly probable that kerato-conjunctivitis is a clinical etiological entity of specific nature, but that it is more probably an indication of the manner in which the conjunctiva of scrofulous persons especially, reacts to various forms of irritation.

Again, we find that Axenfeld is opposed to the view that the endogenous factor can be left aside and that the problem is solved by the finding of the Staphylococcus. Also however, he does not state absolutely that scrofula will produce a phlyctenular inflammation in a purely endogenous manner.

At the time of writing his book he maintained that there was no justification for excluding the possibility of the occurrence of phlyctenules in an endogenous manner. Hertel, Axenfeld, Wagenmann, Müller and Mayou failed to find organisms in the interior.

interior of fresh phlyctenules. The view that this form of Conjunctivitis is a true form of Tuberculosis does not receive the support of Azenfeld, who considers the condition an inflammatory one. He maintains however that there is an indirect connexion between this local scrofulous phenomenon and generalised tuberculosis.

Nais and Paton found that the opsonic index of the blood stream of patients with phlyctenules, was lowered for tubercle. The index rose as the lesion improved. They conclude that phlyctenules are caused by attenuated or dead tubercle bacilli.

It may be noted here that tubercle bacilli have at no time been recovered from actual phlyctenules. Inoculation experiments in animals with material from these lesions has failed to produce tuberculosis in the animals tested. Phlyctenular conjunctivitis is commonly met with in Eastern Practice. In a fair proportion of cases estimated at 33% by Herbert, the phlyctens occur in conjunctivae which are already the seat of chronic inflammation. It is suggested from this that they are developed secondarily through invasion of the inflamed tissue by other microorganisms. Phlyctenules have frequently been found by Herbert in association with conjunctivae, the seat of chronic Xerosis irritation.


2. Elliot, Robert H. "Tropical Ophthalmology" 1920, p. 293.
ETIOLOGY ETC. OF PHLYCTENULAR KERATO-CONJUNCTIVITIS.

The disease now commonly known as Phlyctenular or Strumous Kerato-conjunctivitis, has been and still is called by no small a variety of other designations. These further appellations may be regarded as synonymous with that which it has been decided here to adopt. They include the following:—Kerato-conjunctivitis or simply conjunctivitis (1) Lymphatica: because of the frequent association with a more or less generalised hyperplasia of the lymphoid tissue throughout the body or with Status Lymphaticus; (2) Scrofulosa, because of the supposed invariable association with Scrofula or Tubercle. (3) Eczematosa, on account of the very general co-existence of an Eczematous dermatitis of the skin. (4) Pustulosa, and so on.

On the Continent of Europe and in America there appears to be a tendency to favour the adoption of the designation Eczematosa, in the belief that there is a definite relationship between this ocular disease and the eczematous condition of the skin which is so frequently found in conjunction with it. In this country the older name Phlyctenular Conjunctivitis is more generally adhered to, although, as we shall see, this is strictly speaking quite an inaccurate way of/
of describing the condition. The word Phlyctenule is derived from the Greek word ολύκταίνα a hollow vesicle, bladder, or bleb. The so-called phlyctenules which occur on the conjunctiva are at no stage in their development hollow vesicles, but are on the contrary solid nodular elevations, (in their earlier stages sometimes called efflorescences), so that the use of this particular descriptive adjective is really anatomically quite wrong. To Stellwag we are indebted for yet another name for this disease - Herpes Conjunctivae. This too is not merely inaccurate but it is confusing, since a true herpes may occur in the eye concomitantly with a febrile attack, or with herpes zoster. As Fuchs\(^1\) has said however "The term Phlyctenular conjunctivitis though anatomically incorrect, is so firmly fixed by usage that it would seem desirable to retain it".

Now with regard to the alternative word used here, Strumous, the question of some generalised or constitutional state is at once brought to mind by its use. The words Strumous and Scrofulous are synonymous, and both are well known through the phrases "The Strumous or Scrofulous child" and the 'Strumous or Scrofulous diathesis". Each of these phrases implies the existence of some definite constitutional state; and so the words Strumous or Scrofulous used in/

in connexion with this disease of the eye seem to associate the latter with a generalised condition of the body: the nature of which it is not an easy matter to explain. McNeil in a most fascinating paper on "Scrofula and Tubercle" deals with this question at some length, and I feel that I cannot do better than quote here one or two of his passages. After dealing with the ancient origin of the word Scrofula, which in Greek and Latin medicine implies glandular swellings especially those in the neck, and certainly including tubercular glands of the neck, he goes on to describe how in the Middle Ages Scrofula stood definitely for a condition of neck glands, usually tuberculous, and associated with chronic inflammation of the eye. At this time too it became known as "The King's Evil" (Le Mal Royal), the cure of which by touch was practiced by the Kings of France and England for 900 years. Still later Scrofula came to be suspected of relationship to pulmonary phthisis; and then, after Koch's discovery of the tubercle bacillus, it fell into disuse. And now it is only met with in such phrases as Scrofulous or Strumous Conjunctivitis and Keratitis, Scrofuloderma, etc.: in which the word Scrofulous has no defined significance, but implies merely the survival of one of the oldest ideas in medicine,/

medicine, that of constitution as a cause or explanation of disease. Scrofula is a Latin word translating the Greek \( \chi \omicron \omicron \rho \alpha \delta \varepsilon \zeta \) meaning "Like a breeding sow" (e.g. chains of glands in the neck) and indicated glandular swellings in the neck, axillae and groins. It is curious to note how the development of these swellings of the neck were explained. The ancient theory was that they were due to an excess of cold and pituitous humour flowing from the brain into the throat and neck.

Struma is the translation of \( \chi \omicron \omicron \rho \alpha \delta \varepsilon \zeta \) used by Galen and Celsus. (30 B.C. - A.D. 200). It means a thickening or building up of the neck (Struere - to build).

In classical Latin treatises in the period of the Roman Empire, the words Scrofula and Struma were synonymous.

In the Middle Ages Scrofula became predominant, and later, especially in Germany, Struma came to be applied to thyroid rather than to lymphoid enlargement of the neck.

Still extracting from McNeil, we read that the words Strumous and Scrofulous have always been synonymous in English literature.

About 1,000 A.D. Scrofula became known as "the King's Evil". The custom began in France. It is of interest/
interest to learn that Dr Samuel Johnson the lexicographer, was "touched" by Queen Anne when he was a boy, and that Boswell in his life of Johnson says that his countenance was somewhat disfigured by the scars of that evil which it was formerly imagined the Royal touch would cure. William Cullen, in the latter part of the 18th Century, laid stress upon the hereditary character of scrofula, the frequency with which it occurred in early childhood, and to the regularity with which it was associated with involvement of the lymphatic glands throughout the body; inflammation of the eyes; chronic swellings of the joints; and in certain fatal cases enlargement of the mediastinal and mesenteric glands. He attributed the cause to a special constitution of the lymphatic system, associated with a peculiar acrimony of the fluids of the body, and maintained that an "acrimony" of the same kind was responsible for the formation of tubercles in cases of phthisis.

In making a plea for the continued use of the word Scrofula in medicine, McNeil goes on to say: "There are several reasons why the word scrofula might still be retained in its old and limited sense of glandular tuberculosis, and without the implication of constitution or diathesis." "Its ancient and etymological meaning" he writes "is accurately expressive of glandular swelling of the neck. Further,
Further, scrofula denotes the tuberculous gland which marks a definite stage in the morbid process of human tuberculosis, and one which is specially prominent and important in the period of childhood."

McNeil states that "the word Scrofula or Scrofulosis in the sense of an obscure constitutional change has persisted, and in the last fifteen years has gained ground. His capital description of the Scrofulous or Strumous child proceeds as follows. "This expression indicates a certain configuration of body which can be recognised by a group of stigmata or clinical features, and which when present are supposed to indicate tubercular disease, either latent or manifest. The older terms, Scrofulous habit or diathesis, have the same meaning; and in the older literature the scrofulous habit was divided into sub-types, - lymphatic (or phlegmatic), sanguine (or erethistic) and bilious. These clinical stigmata are large head, stunted body, which may or may not be wasted; face thickened and flabby, and especially a thickening and elongation of the upper lip, and a thickening of the nose and nostrils; the skin pale, generally a sallow dirty pallor, but sometimes clear and thin; the eyebrows and eyelashes long and dark, with overgrowth also of fine hair on the sides of the cheeks, behind the neck and shoulders and down the back and backs of the legs; and with this often unusual luxuriance of/
of hair of the scalp, this luxuriant growth of dark hair stands out in contrast with the pale skin and often wasted tissues.

Now to come to a consideration of the type of child which develops Phlyctenular or Strumous Kerato-conjunctivitis, it is found that a large proportion might without hesitation be classed as belonging to the strumous type or of being possessed of the strumous diathesis. There are however many of whom such may certainly not be said. Greeff¹ has said that almost invariably a general scrofulosis and tuberculosis is found, and that the individuals affected are, usually frail, poorly nourished children exhibiting all the signs of scrofula, (eczema, glandular swelling, a puffy, bloated appearance, thick lips etc.) He considers the basic factor in the disease is Scrofulosis. And he is by no means alone in maintaining this view.

Fuchs² holds that the disease has its origin in the scrofulous diathesis, and that like that condition it is a disease of childhood and youth. He formerly called the condition Conjunctivitis Lymphatica (Scrofulosa) on account, as he says, of its undeniable connexion with Scrofulosis. Later, he has replaced its/


its etiological term by that of Conjunctivitis Eczematosa, following the tendency of many recent authors. With this name for the disease he is not quite satisfied, however, since he goes on to say that "Whether the conjunctivitis of scrofulous children can properly be characterised as eczematous, we shall first be able to tell when the true cause of the conjunctivitis, on the one hand, and of the scrofulous eczema on the other, has been determined."

Amongst others who have adhered to the view that tuberculosis or scrofulosis plays a great part in the etiology of Phlyctenular Kerato-conjunctivitis, are, Tivnen, Stephenson, Verhoeff, Elliott, de Schweinitz, Walter, Derby, Davis & Vaughn, Wilder, Goldbach, and Lafon. Their evidence is based on a number of factors.

1. The Von Pirquet reaction.
2. Results of Tuberculin therapy.
3. Diagnostic injection of Tuberculin.
5. The incidence of Tubercle in children: and
6. The fact that it usually occurs in those who are poorly nourished and who live in unhygienic surroundings.

Derby, Stock, Weekers and Wilder have reported a series of cases in which the Von Pirquet reaction was positive in 80% - 90% of the cases. The figures of Bruns and of Tivnen in this connexion were 67.7% and 92% respectively.

R.J. Tivnen/
R.J. Tivnen has stated that some 12% of cases of phlyctenular eye disease show a personal history of tuberculosis. While Davis and Vaughn found a family history of tuberculosis in 17% of a series of cases.

Besso and Dazzi\(^1\) consider that the disease probably arises from some intestinal upset. They are against the tuberculous lesion because an examination showed only 59% of positive reactions to tuberculin. They hold that indican is a constant constituent of the urine in the active stages, and point out that those observers who have failed to find it, have probably not made repeated examinations or did not notice the ethereal sulphates. Engelking\(^2\) is of the opinion that phlyctenules are dependent upon the general condition of the skin and mucous membrane, and that in many of the cases the skin seems to show a definite toxic reaction to tuberculin in contrast to the non-specific tendency in the exudative diathesis. He thinks that there seems to be a special seborrhoeic diathesis shortly before or after puberty which aids in the development of the phlyctenules.

Piesbergen\(^3\) is another of those who favour the view that tuberculosis is responsible, or at least plays:

plays a part in the production of Phlyctenules. He states that an ordinary stimulus in a healthy eye will cause conjunctivitis, but that in the eye of tuberculous subjects it will produce phlyctenules.

A number of investigators are of the opinion that the conjunctival and corneal lesions in the disease which we have under consideration arise not directly through the action of Tubercle bacilli - these have never been discovered from phlyctenules at any stage of the disease - but from the action of tuberculous toxins.

Swanzy\(^1\) tells us that phlyctenular Keratitis\(^\) is now believed to be caused by the toxins of tubercle bacilli, and that irritants of different kinds, staphylococci for instance, acting in tuberculous patients may induce it.\(^\)

In the words of Parsons\(^2\) it is not improbable that the true cause of the outbreak is a toxaemia, the toxins, probably tuberculous, not being very potent, but sufficient if the patient is already in a weakened condition.\(^\)

Wolff-Eisner and Derby\(^3\) state that whether these lesions occur or not is purely one of dosage: if only a/

a small quantity of tuberculous material be present the pathological changes will not be characteristic, and typical tubercular formation will not take place. It has been demonstrated too, by certain authorities that tuberculins always produce essentially the same effects, and that they act as living tubercle bacilli do, except that they are devoid of growth and reproduction.

Weekers and Colmant\(^1\) had a series of 50 cases X-Rayed. All the cases had active phlyctenular lesions, or had already had an attack of Phlyctenular disease. Of the fifty cases, 34 were under the age of fifteen, 3 were adults with phlyctenules present in the eyes, and 11 adults who had had Keratitis. They found evidence of Tracheo-bronchial adenopathy of the 2nd and 3rd degree in all cases, although the older cases showed some calcification of the glands. In all the subjects during a phlyctenular attack the radiographic signs were those of active glandular disease. The X-Ray plates were interpreted by Mery, Détré and Desmoulins in their work "Le Diagnostic radiologique de la Tuberculose ganglio-pulmonaire chez L'enfant". 1921. Ten controls showed enlargement of the same glandular group, but to these they did/

did not attach any significance as the enlargement was only of the "first degree". From their observations they concluded that phlyctenules only developed in those who were tuberculous.

In his text-book of Ophthalmology Roemer¹ expresses his belief in the view that Kerato-conjunctivitis Eczematosa is related to the so-called scrofulous diathesis. "With many other clinicians" he proceeds, "I believe that scrofulosis is a disease sui generis, which is complicated secondarily in many cases by Tuberculosis, and agree with Grawitz that it is a disturbance of nutrition with a special tendency to inflammation of the lymphatic system." This writer gives an account of the two forms under which Scrofulosis occurs. (1) The torpid or sluggish type in which the children appear coarse and bloated, with pale skins, thick noses, puffy lips, short thick necks, and numerous enlarged lymphatic glands. Children of this class are slow mentally and physically. (2) The ereethistic or nervous type to which belong children who are of slight build, lacking in subcutaneous fat, of good mental capacity, have pale skins, and whose lymphatic glands are enlarged. In both these forms there is an increased functional activity of the sebaceous and sudoriparous glands which/

which explains the susceptibility of the skin to attacks of Eczema. After having explained that the efflorescences or phlyctenules are free from organisms, and are hence unlike other inflammations of the conjunctiva which are referable to ectogenous infection, Fuchs\textsuperscript{1} refuses to regard them in the light of true tuberculous nodules. "In the great majority of patients with conjunctiva Eczematosa" he writes "there are changes which are certainly tuberculous, most frequently in the form of Scrofulous lesions of the glands and bones, and not infrequently of pulmonary tuberculosis. But even in those patients who otherwise show no clinically demonstrable evidence of scrofula or tuberculosis, the examination with tuberculin (by subcutaneous or cutaneous injection) proves with rare exceptions the presence of latent tuberculosis". And again we find that if "the efflorescences are not actually Tuberculous nodules, and yet, on the other hand, they occur with such prepondering frequency in tuberculous men, we should not be far out in explaining them as being due to the action of toxic substances.

Duane here states that "it seems clear that the relationship of this disease to tuberculosis is at most an indirect one. The results of treatment point/

point to some other contributory or perhaps essential cause such as disturbance of metabolism, due to gastro-intestinal toxaemia, or pharyngeal or tonsillar affection. From another source we find the view expressed that the ubiquity of Tuberculosis in all children is very suggestive of the likelihood of this eye disease of childhood being due to the tubercle bacillus or its toxins. Hamburger (Vienna) has claimed that 71% of all children between the ages of 7 and 10 years give a positive Von Pirquet reaction, and 94% between the ages of 11 and 14 years. Also, Mueller (Munich) found tuberculosis in 40% of 500 autopsies on children of all ages. Again Albrect (Vienna) found Tuberculosis in 47.2% of autopsies on children from 1 to 12 years, and Comby of Paris, a percentage of 65 in the case of children over 2 years of age. The incidence of Tuberculosis, as indicated by the Von Pirquet reaction, increases from about 15% for 1 year to about 90% for the age of 14.

Swanzy thinks that phlyctenular disease is often a manifestation of Tuberculosis and in favor of this, states that the Opsonic Index for Tuberculosis has been found to be low in cases of this disease.

Finally:

Finally, it has been observed by McNeil in regard to this question of the place of Tuberculosis in the production of Phlyctenular Keratitis, that in many of the cases there is no obvious tuberculous disease, either in the neck, bones, joints or elsewhere. He regards 2 facts as important: (1) That the characteristic lesion - the phlycten - has the structure of a tubercle, and (2) That the cutaneous Tuberculin reaction is always positive and, as was first observed by Escherich of Vienna, is unusually severe and large. From this latter fact Escherich concluded that any clinical scrofulous manifestation was due to the existence of tuberculous infection and the abnormal general state known as Status Lymphaticus. McNeil and McGowan confirmed this association of scrofulous lesions and Status lymphaticus a year or two later. The conclusions drawn by McNeil from his study of this clinical type - Scrofulous conjunctivitis - are "that there is a tuberculous focus in the throat or nose; that owing to the morbid constitution Status Lymphaticus, there is an increased tuberculin reaction, clinically shown by the escape of small amounts of tuberculin into the conjunctiva, where "tubercles" (phlyctens) and excessive vascular reactions occur."

Another/


Another view which has received support from certain observers is, that Phlyctenular disease results chiefly from some Gastro Intestinal intoxication. Those who adhere to this theory do not necessarily imply that it is the only factor at work in the production of the condition. They maintain that it is the predominant one. Bruns, a strong advocate, has said: "It seems to be more logical in the present state of our knowledge to regard Phlyctenular Ophthalmia not as the effect of a specific toxin (e.g. Tuberculous) or as an ocular eczema, but rather as a neuropathic phenomenon brought about by an auto-intoxication originating in the great majority of cases in the derangement of the gastro-intestinal functions. Not all persons being equally liable to these morbid processes, but much more particularly those in whom we recognise clinically, the Scrofulous, Lymphatic, or Exudative diathesis, such persons being especially liable to tuberculous and other infectious diseases which in their turn further depress the metabolic and catabolic processes, the functions of digestion, assimilation, secretion and excretion and thus intensify and perpetuate the state of auto-intoxication."

2. Theobald too is convinced that phlyctenular/

Phlyctenular conjunctivitis is for the most part due to intestinal intoxication brought about, he thinks, in all probability by the entrance into the circulation of bacteria or their toxins from the alimentary canal. Indican has been found to be a constant constituent of the urine in these cases by a number of investigators, and Besso found it to be present to a marked extent in the daily urine of seventy patients of Eczematous Kerato-conjunctivitis. He (Besso) believes in, along with the two authorities already mentioned, the essential part played by intestinal toxaemia in the production of this form of conjunctivitis. He thinks that the positive skin reaction to tuberculin is only of value as to the existence of tuberculosis - but of 39 children with Kerato-conjunctivitis only 41% gave a positive reaction. The great majority of those who have studied the clinical aspect of this disease are prepared to admit the unfailing regularity with which disturbances of the digestive tract occur. As Ramsay puts it "Nutrition is seriously interfered with, and the coated tongue studded with large red papillae shows the irritable condition of the mucous membrane of the whole intestinal tract. It has been observed that gastro-intestinal disturbances are commonly recognised to/

to accompany Tubercular infection and that the two conditions, disturbed gastro-intestinal functions and phlyctenulosis might be concomitant manifestations of the activity of the Tubercle bacillus. The basis of the Intestinal intoxication theory rests on (a) frequency of gastro-intestinal derangements in phlyctenular patients. (b) Improvement of the eye disease when these derangements are treated. (c) Frequency with which Indican uria is present in Phlyctenular disease.

The view that phlyctenules are produced through the action of Bacteri ç has had and still does have a considerable number of supporters. This question has already been dealt with, and is only mentioned here along with other theories as to the causation of kerato-conjunctivitis. Workers in this field include, Axenfeld, Weeks, Gifford, Fox, Harman, Burchardt and others. The point which has to be settled before any importance can be attached to statements dealing with this aspect of the question, hinges upon the possibility or otherwise of producing in the conjunctival sac, ectogenously, lesions identical with those present in phlyctenular disease. Roemer, after expressing the opinion that some connection does exist, holds that Scrofulosis is not necessarily the only cause of Kerato-conjunctivitis Eczematosa. He goes on to say that/

that all scrofulous children do not suffer from this
disease, and on the other hand cases are met with in
which positive signs of scrofulosis cannot be demons-
trated. The scrofulous diathesis in the majority of
cases merely predisposes to the disease.

Continuing still further, Roemer, as a supporter
of the view that the disease originates from without,
proceeds: "I maintain that an ectogenous origin must
be granted before the disease can be understood.
The superficial situation of the nodules as well as
their discrete character certainly justifies the theory
that morbific agents gain an entrance through the
epithelium, and in scrofulous persons the epithelium
is known to be particularly vulnerable.

Many ophthalmologists like Axenfeld, Morax,
Casparini, and L. Muller, he observes, claim that the
picture of Conjunctivitis Eczematosa may be produced
in Scrofulous individuals by such known agents of
conjunctival inflammation as diplo-bacilli, pneumococci,
and Koch-Weeks bacillus.

The only conclusion that can be drawn from such
observations is that this disease can be produced by
an external infection." While Gifford and Weeks
considered that this form of ocular disease had its
origin in an ectogenous infection by the Staphylococcus.

Parsons and others think that these organisms are

3. Parsons.
are accessory and not causal. Pollock obtained negative bacteriological results in sixteen cases of Phlyctenular conjunctivitis.

Some people have thought that faulty dieting (chiefly excessive carbohydrate) may be the factor responsible for this form of conjunctivitis. Goldenberg from a study of five hundred cases came to the conclusion that (1) Ophthalmia Eczematosa is not a true pathological entity but a symptomatic manifestation of a systematic disturbance. (2) That tuberculosis, syphilis and sepsis can be excluded with certainty as causal factors. (3) That Phlyctenular conjunctivitis is in all probability one of the expressions of vagus system irritability produced by some toxic agent resulting from faulty carbohydrate chemism.

The constant association of Phlyctenular disease with diseases of the mucous membranes, lymphatic glands etc., has led some to treat this as the exciting factor. Bruns had a series of 172 cases examined by Lynch, who found Rhinitis, diseased tonsils, suppurative otitis etc., in 105 of the cases or 61%, nothing abnormal in 38%. Again, the fact that an eczematous condition of the skin is so frequently found to co-exist with Strumous conjunctivitis, has brought many to:

to the view that in this state of the skin lies the
principal causative factor. Indeed we need only take
heed of the name Conjunctivitis Eczematosa, by which
Phlyctenular disease is so often called, to appreciate
how prevalent the idea of this explanation of the
responsible factor really is.

Now, before discussing the question of etiology
let us look for a moment rather hastily at the points
of view adopted by yet a few more observers.

1. Funaishi concludes that the so-called phlyctenules
are only a local specific or non-specific protein
reaction to the general hypersensitivity of the body,
and that these may be non-tuberculous phlyctenules.
He found by injecting subcutaneously into rabbits,
Tuberculin, Staphylococcal emulsions and Tyram. solu-
tion composed partly of bacterial and partly non-
bacterial substances and afterwards introducing these
substances into the conjunctival sac, that a con-
junctivitis frequently developed, having peculiar
nodules similar to human phlyctenules.

2. Igersheimer and Prinz have observed that
phlyctenulosis shows no tendency to develop into real
tuberculosis of the conjunctiva. They have remarked
upon/

1. Funaishi, S. "Etiology of Phlyctenular Ocular
Inflammation" (1 ill.) Klin. M. f. Augenh.

2. Igersheimer, J. and Prinz, W. "Phlyctenular
inflammation of the eyes in Scrofula
(Tuberculosis)". Graefe's Arch. f. Ophth.
upon the great rarity of co-incident tuberculous processes in either the external or internal eye. Out of some fifty-eight cases of tuberculous disease of the eye (32 being from the Göttingen Clinic) they found a history of previous Scrofulous Kerato-conjunctivitis in only six of the cases. Again, out of 92 Scrofulous eye cases, 22 had lung changes, and in 12 or 13% there were symptoms of active tuberculosis - 15.5% of patients with previous scrofula and 17% with previous eye disease showed active pulmonary tuberculosis.

Trattner considered the tubercle bacillus as the most probable etiological factor in the production of eczematous conjunctivitis; whilst the experiments of Guillery seemed to show that phlyctenulae should be regarded as a manifestation of tuberculosis without bacilli. In connection with the production of this disease Wolff has propounded a theory that a previous tubercular infection, in cases of Scrofulous or Phlyctenular Keratitis, in the eye itself, which has been cured by natural processes, leaves the eye hypersensitive to the poisons of tubercle. He is of the opinion that the toxins are mobilised from the tubercular glands in the neck, which the patients almost always have.

Writing in 1904, Juler states in his text-book that Phlyctenular conjunctivitis is more liable to occur in children of tuberculous parents, especially children who present the appearance of the so-called Scrofulous diathesis. The frequency with which there is an associated pediculosis of the scalp and contagious impetigo is also noted by him.

As regards the type of child affected by this Scrofulous eye disease, there is ample evidence to show that it occurs, one might say almost exclusively, amongst children of the hospital class. Sometimes, however, an occasional case is found in which this is not so, but then some particular factor having a debilitating influence upon the child's general health can usually be discovered. Vide Case No. page .

In this case the home conditions were good, and every possible attention was paid to the dieting of the child. In fact too much care was taken, so that hardly such a thing as a vitamin could enter the system!

On the whole, those affected with the disease are poorly nourished, and of stunted growth: many show one or more of the stigmata of what has been referred to as the Strumous diathesis, the most constant indication of which is perhaps the hypertrophied upper lip. From the cases observed in hospital, one might say that there are in most of the children, apart from the/

the signs and symptoms produced by the ocular condition, certain characteristic features which hallmark them as sufferers from Phlyctenular disease, but that not all of these need be present in any given case. There is, as has already been said, an hypertrophy of the upper lip, giving rise to a thickening and lengthening which are very typical. Associated with this there is frequently profuse nasal discharge (Rhinitis) which is in all probability in many cases the cause of this over-development of the upper lip: the chronic discharge acting as an irritant upon the subcutaneous tissues. One French observer has seen a large number of soldiers with a form of Keratoconjunctivitis associated with and dependent upon nasal lesions; the eye condition being uni- or bi-lateral; and if unilateral it is on the same side as the nasal lesion. In some of the cases typical phlyctenules have been discovered and also small superficial corneal ulcers. The nasal lesions included Polypi; Acute Rhinitis following Coryza; Maxillary and frontal sinusitis; deviating septa, etc.; and on treatment of these the eye condition improved. Loss of the bridge of the nose is often present: the nose too, being broad, with thickening of the alae nasi. Failure of the nasal bones to develop properly has unquestionably some/ 

some connection with the defective state of nutrition so commonly found in those with Strumous Keratitis.

The Skin is quite characteristic; it is often pale and coarse, and is usually dry and scaly, having an appearance which it is somewhat difficult to describe. In a very large percentage of the children eczema is present in some degree and is found usually about the angles of the nostrils, the upper lip and lower portions of the ears. This condition of the skin is thought by some to be the primary factor in the disease, the ocular phlyctenules being merely the eczema modified by its situation within the tissues of the eye. There is very often a seborrhoeic dermatitis of the scalp, and the heads of many cases are infested with the pediculus capitis. Excoriation of the skin around and below the lobe of the ear, on the eyelids and malar regions of the cheeks, and on the upper lip and angles of the mouth is nearly always co-existent with otorrhoea, conjunctivitis and chronic rhinitis. The skin condition of the cheeks and eyelids is generally found to have commenced at the time of, or soon after the eye condition has first developed.

The patients are very often pale in colour, emaciated and obviously ill-nourished. In growth too they are stunted or at all events show some signs of under or mal-development. An interesting point is
the rarity with which one finds any history or evidence of rickets amongst these children, particularly as the home conditions as to general hygiene and dieting are in so many cases such as would make one think its occurrence most natural. Lack of decent ventilation in the home, of access to fresh air and sunlight, and of vitamins in the diet are almost invariable accom­paniments of the condition. That there is a re­lationship between corneal ulcerations and deficiency in the diet of the fat soluble vitamin has been mentioned by Goldschmidt.¹

Further characteristics of many of these children are to be found in the hair, which seems to have a tendency towards profusion and strength of growth, as seen by the heavy eyebrows, long lashes, and frequent excess of fine hair around the angle of the jaw. It has been suggested by some that the very long growth of the eyelashes may be directly con­nected with the constant irritation of the roots pro­duced by recurrent attacks of the conjunctivitis. The Teeth, too, are sometimes characteristic. The upper central incisors, being peculiarly well developed and large, and having somewhat excessive intervals between each other and the neighbouring dentures. In Edinburgh McKay and also Cameron have emphasised this/

this point. It has been thought that there may be some relationship between the hyperplastic condition of the upper lip so regularly found, and the excessive development of these upper incisors. A point that may be raised here relates to the time of onset of what is commonly called the strumous diathesis. Is it a state that may be recognised or defined prior to birth? If any stress is to be laid upon the condition of development of the upper central incisors, as peculiarities of this diathesis, then the fact that they are developed at an early stage is not without significance in this connection. May it not be that the health or state of nutrition of the mother during pregnancy, and at time of birth of the child, plays some part in determining this constitutional state known as strumous or scrofulous? It is certainly unusual for all the members of a family to present "strumous characteristics" and as a rule, only one or perhaps two develop the phlyctenular eye condition. The younger members of the family are most liable, apparently, to become victims to the ocular disease.

A very large percentage of children with phlyctenular disease show in addition, enlargement of the cervical glands. This is a very frequent accompaniment, and some have said that it is present in 90% of the cases. De Schweinitz gives it as his opinion.

opinion that in at least 50% of those with phlyctemular kerato-conjunctivitis there is tuberculous enlargement of the cervical glands. There is certainly no doubt but that enlargement does exist in a considerable proportion of cases, and that in some it is definitely tubercular, but as to the numbers so affected one is unable to make any definite statement. It has already been pointed out that there may be some relationship between this strumous manifestation and Status Lymphaticus, and with regard to this it might be pointed out that there is a very general co-existent hyperplasia of the tonsils and adenoids, and in a few cases also of the thyroid gland. McNeil lays considerable stress on this aspect of the disease and has found that the thymus is not uncommonly associated in this hyperplasia of the lymphoid tissue.

Chronic gastro-intestinal disturbances which are so often present, seem to indicate that some upset of metabolism is associated with the occurrence of the disease. The fact that probably 95% of the children have been fed at home on a diet consisting almost entirely of carbohydrates (a generous allowance of sweets, cakes etc. being given), and certainly practically devoid of vitamin content, no doubt explains in part the reason for this accompaniment.

There is a fairly constant history of the eye trouble coming on after an attack of one or other of the
the exanthemata. Measles is the chief offender in this respect, but scarlet fever, diphtheria, and whooping cough are also found to precede the onset of the conjunctivitis.

I am not disposed to think that any of these febrile illnesses plays any part in the etiology of phlyctenular disease beyond lowering the resisting powers of the body generally for a time afterwards, and in the case of measles producing in addition an increased susceptibility to infection in the conjunctival sac. If the interval between the occurrence of one of those infectious fevers and the commencement of phlyctenular trouble in the eye, is of reasonable shortness, then it is possible that certain children who might have otherwise escaped, have been rendered susceptible to become sufferers from this particular form of conjunctivitis.

After all, the percentage of children amongst the lower classes, who suffer from one or more of the infectious fevers is extraordinarily high, and one feels that great care must be exercised before any importance be attached to them as etiological factors in the production of Strumous Kerato-conjunctivitis.

With regard to Tuberculosis, definite tubercular lesions elsewhere in the body have been discovered in only some 7 or 8% of the cases reviewed here. In many others however, there may quite possibly be lesions of/
of this nature which it has not been possible to
demonstrate. On the other hand there is a fair pro-
portion of cases of whom it may be said without
hesitation that they are absolutely free from tuber-
culosis. Kleinschmidt has found in five children
a repeatedly negative reaction to tuberculin in spite
of the presence in each case of definite phlyctenular
conjunctivitis. He therefore suggests that Tubercul-
osis cannot be held responsible for the occurrence of
phlyctenules in all cases.

Now as to the site on the eye for which phlyctenules have a predelection, it may be said that there
is an apparent tendency for the lower half of the
ocular globe to be affected more often than the upper
half, but that it has not been found possible from
observations on these cases to localise the lesions to
the Temporal quadrant more often than to the nasal one.
Marx however, found that in a series of some 364 eyes
the greater number of phlyctenules were located to the
temporal side of the cornea, and that the inferior
portion was the site of phlyctenules more often than
the nasal quadrant. He puts down this distribution
to the effects of exposure, as the upper and nasal
quadrants/

1. Kleinschmidt, H. "Is there phlyctenulosis without
   Tuberculous Infection?" Beitr. Z. Klin. d.
2. Marx, E. Distribution of Corneal phlyctenules in
   Scrofulous Ophthalmia. (2 ill.) Ann. d'Ocul.
quadrants of the eye are more protected than the
temporal and lower portions.

In tracing the history of the onset of attacks of
the inflammation, one has found that in some 38% of
cases one eye has been definitely involved first,
and that in a fair proportion of those cases the other
eye has remained unaffected during the particular
attack considered. In 20% the left eye was first to
become involved, and in 18% the right eye.

That this disease is one of very great prevalence
has already been stated. Out of some eleven or twelve
thousand cases of all eye conditions (i.e. including
injuries) attending hospital during the years 1923,
1924, 1925 and part of 1926, one in every sixteen cases
has suffered from Phlyctemular disease of the eye in
some form or another. The disease is unquestionably
one affecting children, and principally those of more
tender years. It occurs more frequently in girls than
in boys, the ratio being 1 to 1.6.

From a total of 468 cases of the disease dealt
with in this thesis, 182 occurred in males and 286
in females. These figures refer to patients of all
ages, and are equivalent to 38.9% males and 61.2%
females. When we consider only cases occurring
after the age of 16 years, it is found that out of the
total of 468 unselected cases at all ages, one hundred
were/
were of 17 years or upwards, (i.e. a ratio of 1 - 4.7). This means that 21.4% of the cases of Strumous Conjunctivitis attending hospital were over the age of sixteen years. Again it is seen that the percentage of females suffering from the disease after the age of 16 is increased as compared with that for females at all ages, the figures being 72% and 61.2% respectively.

It has not been possible to obtain accurate information regarding the time of onset of the first attack of the inflammation in more than 150 cases. From these however, one finds that a hundred and three of the cases occurred in children of five years old or less, (i.e. a percentage of 69 at ages of 5 years and under) and 47 of the cases, or 31%, were over 5 years of age at the time of the first appearance of the disease.

The greatest incidence is between 3½ and 4 years. This is at an age somewhat lower than has been stated by certain authorities. Bishop Harman’s figures at the Belgrave Hospital in London showed the greatest incidence at the age of 5 years, and that no case occurred during the 1st year of life in a series of 400 cases. The Moorfields Hospital statistics showed the greatest incidence to be between the ages of four and fourteen years.

In the case of six children the onset occurred between 6 months and 1 year old: whilst in one case the/
the age at the time of onset was over 30 years.

Fuchs and Swanzy consider that Phlyctenular Kerato-conjunctivitis is rare under the age of 1 year. The former holds that the disease generally ceases at puberty, and that when it occurs in adults it is carried on from childhood. Swanzy too states that the disease is uncommon in adults, and that those of the Strumous constitution, (as indicated by the swollen nose, and upper lip, sometimes enlarged lymphatics of the neck, and by eczema) which is allied to if not indeed a form of Tuberculosis, are most liable to this affection.

The number of cases, out of our series of 150, in which the trouble began amongst children over 14 years of age was seven, or 4.7%. McNeil's opinion is that the condition almost never begins after puberty, but that it may continue with relapses throughout childhood, very seldom however going beyond puberty. Maitland Ramsay has found the disease most frequent in the first decade of life, and that its incidence is greater in girls than in boys. Herbert saw in India 100 cases of whom over one third were/
were over the age of 20 years. In a series of 107 cases, Stiell found that 90 were in children under 14 years, 16 in patients under 21 years, and one in a female of 45 years.

There seems to be something too in the question of racial incidence. The disease is said to be less prevalent amongst the Jews than might be expected.

Again Brun's statistics have shown that the black races are much more susceptible than white people, to this particular eye affection. In this connection, however, one is not able to offer any opinion.

Gutzeit states that since the World War the number and severity of cases of phlyctenular conjunctivitis (Kerato-conjunctivitis eczematosa) has markedly increased, and that whereas before the war it was confined almost exclusively to children and adolescents, he now finds it in increasing numbers in adults. He considers the chief reason for this to be the condition of malnutrition in all classes of the population.

It has not been possible to come to any conclusion regarding the time of year at which initial attacks or recurrent attacks most commonly take place, because/

because apparently there is so much variance in this respect amongst the cases which have been considered.

In the case of certain children, however, one has found quite a definite tendency for recrudescences to occur each year at about the same month. The times most frequently associated with these attacks are late summer or early autumn, and the first two months of the year.

Lastly, one would say here that there are certain definite factors concerned with the continuance of the disease into late adolescence and early adult life. These may be grouped under four heads: (1) Obvious or latent septic foci such as chronic rhinitis, ozoena, otorrhoea, septic teeth, etc. (2) Infected lymphatic glands, e.g. tonsils, adenoids, etc. (3) Tuberculous foci elsewhere in the body, and (4) Uncorrected refractive errors.

Other factors also playing a part in this respect in certain cases are unhygienic conditions of the home, faulty dieting, and debilitating occupations. The first two of these subsidiary accompaniments are more often found in connexion with the disease in children, than amongst those affected later in life. Statistics formed from the series of cases considered here, show that amongst the older patients (i.e. those of 17 years old and upwards) uncorrected refractive errors appeared to be the principal factor concerned in/
in the continuance of Phlyctenular disease in 15% of cases. In 27% of other cases the recurrences were apparently due to demonstrable septic or tuberculous foci, or lymphatic gland involvement. Amongst the younger children uncorrected refractive errors either due to hypermetropia or myopia seem to cause a certain amount of eye strain which is sufficient in many instances to act as a predisposing factor of attack of the disease. Great difficulty is met with in the treatment of such cases when a squint has developed, and the question is complicated by the presence of central corneal opacities which have resulted from previous attacks of strumous Keratitis."
CONJUNCTIVAL PHAEOCTENULAE
PATHOLOGY.

The so-called Phlyctenules commence as tiny, reddish circumscribed elevations and most usually they are found at the limbus of the cornea. In the earliest stages these little nodules are often called efflorescences. They are conical in shape and are covered by the conjunctival epithelium. Sooner or later separation takes place of the epithelium at the apex of the cone, and then the tissue immediately beneath breaks down, forming a small ulcer which lies above the level of the surface of the conjunctiva round about. The ulcerative process goes on until the whole of the little nodule has disappeared and then healing takes place, the site being covered over by the epithelium.

With the development of an efflorescence the vessels of that part of the conjunctiva immediately around become injected. The hyperaemic area of the conjunctiva is in the shape of a triangle of which the efflorescence or phlyctenule forms the apex, the vessels being directed towards it in all directions. This is the characteristic feature of Strumous conjunctivitis— that it involves in its inflammatory process not the whole of the conjunctiva, but merely that/
that portion of it having direct relationship to the minute cone-shaped eminence, the so-called phlyctenule.

It may here be noted that only one phlyctenule may be present in the conjunctival sac in which case it is generally of a pretty good size - 1 to 4 mm. in diameter. There may be, however, a good many very small phlyctenules all round the limbus (miliary phlyctenules). In the latter case the injection of the conjunctiva becomes generalised, a state of affairs which also occurs in cases where there is secondary infection by pyogenic organisms.

Phlyctenules may be situated on the corneal limbus, or on the cornea itself, (in which case the epithelium is involved,) or outside the limbus on the bulbar conjunctiva. Rarely, the palpebral conjunctiva may become involved with phlyctenules, although Elliot has found this of frequent occurrence in India and elsewhere, the lesions being very often found on that part of the membrane which lines the tarsal cartilages. In these cases where palpebral phlyctenules are found, the inflammation is diffuse. Elliot states that there are usually bulbar phlyctenules in conjunction with palpebral ones. On the palpebral portion of the conjunctiva they are more commonly multiple than single, and the favorite site is just within the lid border.

1. Elliot, R.H. Tropical Ophthalmology. 1920. P. 293 etc.
Elschnig\(^1\) also, has found phlyctenules affecting
the palpebral conjunctiva. His experience leads him
to state that they occur in 10% of cases of severe
phlyctenular involvement of the bulbar conjunctiva,
but not with miliary phlyctenules of the limbus.

Gutzeit\(^2\) reports a case in which there were
Phlyctenules of the tarsal conjunctiva, and none of
the limbus. He claims this to be the first reported
case of phlyctenules of the tarsal conjunctiva alone.
Further, with regard to the site of the phlyctenules,
it is his belief that their predilection for the
limbus is due to mechanical traction of the scleral
conjunctiva on the stationary conjunctival portion of
the cornea.

Phlyctenules occurring on the cornea begin as
an accumulation of leucocytes, immediately underneath
Bowman's membrane. This membrane is very closely
bound down and cannot be raised up as happens in the
case of the conjunctiva covering the sclera. Corneal
phlyctenules are therefore but slightly projecting,
or do not project at all. When the process has gone
on for some time, ulceration takes place through the
breaking down of the corneal epithelium and Bowman's
Membrane. No trace is left after the healing of

superficial phlyctenules, but in the case where the ulceration has penetrated into the parenchyma proper, permanent opacities are left.

Infiltration takes place along the nerve filaments. If the infiltration extends through Bowman's membrane into the corneal substance an ulcer is produced by its breaking down, which may penetrate the cornea.

Phlyctenular disease, when involving the epithelium of the cornea, may be said to occur in three forms:

1. Minute grey sub-epithelial infiltrations which may result in small ulcers and which when healed leave faint opacities or practically no trace whatever.

2. Larger and deeper infiltrations giving rise to ulceration and heal by vascularisation from the margin of the cornea. These larger ulcers leave pretty intense opacities which do not clear up readily, particularly if centrally situated.

3. Pustules which are both large and deep, and which have become secondarily infected. The ulcers resulting from these may go on to perforation of the cornea.

Strumous ulceration of the cornea may further develop into what is called Keratitis Fasciculus. (Fascicular Keratitis). In this case the little ulcer commences at the margin of the cornea and works its/
its way towards the centre, blood vessels being trailed out after it and enabling the process of healing to take place from the periphery. This has been called vascular fasciculus, and it is formed by a band of blood vessels stretching from the margin for some distance into the cornea. At its apex a small greyish crescent indicates the infiltrated advancing edge of the ulcer.

Another type of this form of conjunctival affection is the Strumous Pannus or Pannus Eczematosis. In this, instead of there being a number of separate foci of infiltration, the exudate occurs as a continuous new formation of tissue on the surface of the cornea. It may develop from any part of the corneal margin, and is usually thin and not very vascular.

It may thus be seen that Phlyctenular Keratoconjunctivitis may occur in the conjunctiva proper or in the conjunctival layer of the cornea; it may be represented merely by one efflorescence or these may be multiple; the ulcerative process may be superficial (and it usually is), or it may penetrate deeply; and it may take the form of Keratitis Fasciculus, or that of Strumous Pannus. In the case of both the Solitary or Simple Phlycten, and Multiple or Miliary Phlyctens, there is liability for the disease to extend to the Corneal epithelium. It is only then that the disease really becomes serious.

A/
A study of the composition of the phlycten is of interest. There is in the subepithelial adenoid layer an enormous number of mononuclear lymphocytes which are closely packed together. The epithelium covering this is quite whole, and according to Parsons it is doubtful if a vesicular stage has ever been observed.

In cases where there is a generalised infection of the conjunctiva accompanied by muco-purulent discharge, polymorphonuclear leucocytes are present as well as lymphocytes in the subepithelial tissues. Dealing with the question of this subepithelial collection of lymph cells, Wolff-Eisner and Derby advance the view that it may be the first change in the tissue produced by tuberculous material. They are of opinion that the characteristic formation of a tubercle only takes place with a certain degree of infection. Such a gathering of lymphocytes as occurs in a phlyctenule they consider may be brought about as the result of a less intense tuberculous infection or intoxication. In other words, it is tuberculosis without tubercle formation.

Iwanoff (1869) found nodules of cells upon Bowman's Membrane raising the epithelium. They also surrounded the nerve fibrils passing through this membrane which might be partially destroyed.

The infiltration around the nerves was held to account for the pain and photophobia, since the cells which go/

1. Iwanoff, B. d. o. bi. 1869. Path. of Eye, Parsons, 1904.
go to form the phlycten follow the course of the nerve filaments which they must irritate in their progress.

Leber and Wagenmann\(^1\) in 1897 confirmed the presence of subepithelial nodules. The epithelium was infiltrated and ultimately destroyed and superficial vascularisation occurred. Baas found nodules below Bowman's Membrane in a case of prolonged scrofulous keratitis with superficial opacities. The nodules consisted of newly formed fibrous tissue with flattened nuclei lying parallel to the surface. They involved either the whole or only the deeper part of Bowman's Membrane. With reference to these nodules found by Baas, Parsons\(^3\) states that they are "obviously late scars". "So far as they go" he continues "they tend to show that the phlyctenules are endogenous, the aggregation of leucocytes lying originally below Bowman's Membrane.

The presence of follicles in the conjunctiva in many if not all of these cases of Conjunctivitis Eczematosa has been pointed out by some observers, but that these do exist is not generally maintained. That there is sometimes a space beneath fresh phlyctenules/

phlyctenules and under Bowman's Membrane has been stated by Piesbergen. The space is filled with albuminous material containing small lymphocytes, connective tissue and epithelial cells. The disease may affect one or both eyes. From a study of cases seen in hospital one would say that in probably 35% of those in whom there is no actual ulceration of the cornea, only one eye is involved. There would seem to be a tendency to more frequent affection of the left eye in those monocular cases, but little importance is attached to this point. In some 65% of cases of Phlyctemular conjunctivitis purely and simply both eyes become involved, whilst in cases with corneal involvement the figure is somewhat higher. Hansell and Sweet in their text-book state on the contrary that the disease is usually monocular.

The blood picture in the few cases which it has been found possible to examine seems to show that there is a definite relative lymphocytosis. In no case did the total leucocyte count exceed 12,000 per cmm., whilst in one child (the baby whose photograph is shown at the beginning) the count was 5,600 per cmm.

SYMPTOMATOLOGY.

There are few symptoms associated with a simple attack of phlyctenular conjunctivitis. Probably discomfort and slight irritation giving rise to reflex lacrimation are all that one will discover. So long as the cornea is not involved and there is no muco-purulent element associated with the attack, photophobia is not likely to be present although it may be so in a slight degree. In all cases where the cornea is involved in the inflammatory process, photophobia or, as it should properly be called, blepharospasm is intense, and there is generally muco-purulent discharge and an increase in the lacrimation. The so-called photophobia is not due to dread of light, but is brought on as the result of irritation of nerve endings of the 5th nerve exposed by the process of ulceration of the corneal epithelium. Any attempt to move the lids over such an exposed surface will cause increase of pain and thereby reflex spasm through the 7th nerve of the orbicularis palpebrarium. Blepharospasm is not confined to occasions when the child is looking at the light. It is still present in the dark room. It is said that the site and number of phlyctens present has a modifying effect upon the degree/
degree of blepharospasm: that it is worse when they are numerous and when situated near the cornea. Blepharospasm can be got rid of by a good application of Cocain. When this symptom is severe, very great care must be observed in the examination of the eye, on account of the danger of increasing the damage already existing in the cornea.

If the blepharospasm has lasted for any length of time, it occasionally happens that a temporary amaurosis results. This is probably functional, and is said to have been brought about, in the first instance, by a desire not to see, and this is aided by the long continued pressure of the eyelids on the ball of the eye, affecting the nutrition of the retina. It is also held by some to be due to disturbance of the intra-ocular circulation.

In cases of fairly old standing, the eyelids, nose, and upper lip are markedly swollen and usually there is a pretty severe eczematous eruption about the face. The excoriation of the skin leads to the formation at the outer canthus of a fissure which is very liable to bleed and cause intense pain should any rough attempt be made to forcibly open the lids.

It is extraordinary to find that even in cases with intense photophobia and oedema of the lids, how there may be hardly any trace of infection of the scleral/
scleral conjunctiva. There is however in most cases evidence of localised areas of inflammation in association with one or more phlyctenules on the bulbar conjunctiva. When there is corneal involvement the pupil is markedly contracted as the result of irritation of the corneal nerves. It is only too, when active ulceration of the cornea sets in that there is any real suffering. In these cases the pain is very apt to come on suddenly in the night time.

The attitude of the child with an active strumous lesion is very characteristic: if left alone in a dark corner he is all right: if in bed in the ward or elsewhere, the face is buried in the pillow, and when made to sit up prior to examination the head is held down and the eyes covered with both hands, the child struggling violently and crying bitterly the while.

On admission to hospital the vast majority of these strumous children are in a state of more or less complete exhaustion. For the first few days they appear to sleep incessantly when in bed, as if utterly worn out. After that time, however, there is usually seen a change for the better. The child begins to fret less, and for the first time seems to be taking some interest in its surroundings if the local condition permits of this. Another point about those cases which are admitted to hospital, is that almost without exception/
exception the appetite is ravenous. These children have a constant craving for food, and if allowed to do so will eat far more than their digestive apparatus can possibly deal with satisfactorily. These points are indicative of some of the hopelessly unfortunate state of affairs in the homes from which the great majority of strumous children come. Mental and physical exhaustion have resulted from long continued existence in probably damp and ill-ventilated houses where there is little chance of obtaining anything like a sufficiency of sunlight or fresh air, from irregular, insufficient, and absolutely unsuitable dieting, and from deficiency in sleep, through the lateness of the hour at which retiral to bed is permitted. Many of the children with whom we have to deal are lethargic, and present an appearance at once suggestive of some upset in the metabolism of some or more of the ductless glands. They are called by some Leuco-Phlegmatic, and are not infrequently sufferers from that condition known as Status Lymphaticus.

Digestive troubles are very commonly met with, and these are certainly accentuated by, if not wholly the result of, the unsatisfactory methods of feeding indulged in at home. There is very often present a marked degree of secondary anaemia, and in some where there are obvious or latent foci of sepsis a leucocytosis is exhibited.

Other/
Other of the more commonly occurring general symptoms have been referred to elsewhere; they include Eczema, associated in many cases with pediculosis of the scalp; Enlargement of the cervical glands and those around the throat and mouth; Recurrent nasal discharge often due to swelling of the tonsils and other lymphatic glands in the nasopharynx, and otorrhoea.
Phlyctenular disease so long as it involves simply the Conjunctiva is not to be regarded as serious, either in the effects it produces or from the point of view of the time each individual attack takes to clear up. These simple cases recover remarkably quickly, especially if they are treated in hospital where the hours of feeding and sleeping are regulated and where everything else is conducive to the early attainment of good end-results. Anything from about a week to 10 or 14 days is a pretty safe time-limit to allow. When even a simple case is being treated at home, the results are generally very different; the same chance is not given to the process of healing, since many of the old (causal) factors still continue to exert an influence, in spite of the fact that most careful instructions may be given regarding the general hygiene and the feeding of the patient. In very many cases the homes are so poverty stricken that it is quite impossible for complete recovery to take place.

With regard to the more severe types of case, and particularly those in which there is involvement of the cornea, the course of any one attack may be considerably/
considerably prolonged. In such cases it is not always easy to hazard any conjecture as to the probable duration of the condition. It very frequently happens that cases which at the commencement involve only one eye extend to the other eye afterwards. It may be a day or two, or it may be several weeks later. Then again, there is a great tendency for the superficial layers of the cornea to become the seat of the disease in children whose conjunctiva only, has been primarily affected.

Two factors, apart from the question of efficient local treatment, may be generally held responsible for such extensions of the disease. A. The first of these is the presence of some other focus of infection in the body. This may take the form of (1) Enlargement and septic infection of lymphatic glands, especially those in the throat and naso-pharynx. (2) Some definite focus of tuberculosis such as Bone caries; abdominal tuberculosis; tuberculosis of the lymphatic glands at the roots of the lungs, or in the neck etc. (3) Derangement of the functions of the endocrine glands, giving rise to a perversion of the normal metabolism of the body and (4) Gastro-intestinal toxaemia, a very frequent accompaniment. B. The second factor which seems to play a part in evolving the more severe type of case out of an originally simple one/
one is the condition of the child's environment, its general hygiene, and the type of dietary to which it is ordinarily subjected at home. There is probably no disease in the whole of medicine of which it can be more truly said that these points are of paramount importance. It is impossible for cases to recover within any reasonably short period of time, and without producing quite unnecessarily severe effects upon the surface of the eye, so long as any one or more of these extraneous or perhaps one should say, essential elements continues to exist.

It is my considered opinion that at least portions of one or other - or it may be both - of the two groups of factors already referred to, may be found continuing to influence the course of every case of originally simple phlyctenular conjunctivitis which has later gone on to corneal ulceration. - Over and over again one has been impressed by this fact on meeting in the out-patient department some child but recently sent home from the Ward as cured. - Rapid improvement in hospital, leading to complete arrest of the disease process and apparent recovery, has resulted from the rest, appropriate dieting and the regularity of hospital régime; but no sooner has the child returned to the old wretched conditions of its home than the inflammation of the eyes has begun again.
again. Then too, it so often happens that cases which have been treated as out-patients from the beginning, fail to improve as one has been led to suppose they ought to do, even after weeks of treatment. With them there seems little doubt that what is keeping the bodily resisting powers at just too low a level is (1) the overgrowth of adenoid tissue in the pharynx; (2) the large and chronically inflamed tonsils; (3) the more or less generalised glandular enlargement; (4) some definite tuberculous focus; (5) the septic condition of the teeth; (6) the eczematous state of the skin; (7) or the very frequent derangement of the digestive and excretory functions of the body which, although unrecognised previously, have nevertheless been playing their part as debilitating factors all the time.

To give a definite prognosis in this disease is not an easy matter. One would say, however, that, as regards the case of simple conjunctivitis, where there is no question of corneal involvement, the outlook is good. This also may hold for those cases where there has been but slight infiltration of the cornea. Recovery from these mild attacks is usually complete in from about 10 days to 2 or 3 weeks. Should the home conditions be unsatisfactory, however, and they generally are - and should any of the other factors likely to produce a lowering influence upon the system be at work, then the prognosis must of necessity/
necessity be modified, a more generous time-limit being allowed.

The characteristic feature in the course of attacks of strumous disease is the great persistence with which recurrences take place. A fresh attack is liable to come on at almost any time, but more usually the time selected is one when the patient is run down in health, e.g. during recovery from influenza, etc. Very often only one or perhaps two outbreaks occur in the year, and not infrequently these take place at about the same season. It stands to reason that with each recrudescence the condition of the eye is likely to become worse, so that there is considerable danger of its losing the capability of acting as an efficient visual sense-organ. Repeated attacks of corneal ulceration lead eventually not only to impairment of vision through the resultant opacities in the cornea, but also to much irregularity of the corneal surface giving rise to an irregular astigmatism for the correction of which it is all too often impossible to order a lens. Recurrences after the period of late adolescence are most frequently found amongst females, and in them it is not unusual to discover that the time of onset coincides with the menstrual period. In both sexes where phlyctenular disease has been carried on from youth into adult life/
life there is almost without exception some demonstrable
shall we say precipitating factor in evidence, to which
it seems not improbable that the continuance is due.

Superficial corneal phlyctenules rarely leave any
permanent trace; but where penetration into the corneal
substance proper has taken place, opacities of varying
degrees of intensity are left. If the opacity is of
the nebulous variety, considerable improvement may
result from the prolonged use of Hydrarg. Oxii. Flav.
ointment alone. The effect which those opacities
will have upon the visual acuity of the eye depends
upon the extent to which the central or pupillary
area of the cornea has been involved.

In the most severe types case, where secondary
infection has followed, hypopion, iritis and even
perforation of the cornea may result.

More or less complete blindness may be a sequela
of the disease; fortunately however it is a rare one.
Differential Diagnosis.

Owing to the tendency towards discrete distribution of phlyctenular ophthalmia in its simpler forms, the question of differentiation from other varieties of congenital inflammation should not present much difficulty.

Practically all other types are accompanied by a generalised injection of the whole conjunctiva. Then again, this form of superficial eye disease is of such common occurrence amongst children, - it is so essentially a children's affair - that when one is confronted with young patients who as the result of the associated blepharospasm appear to experience difficulty and it may be pain also, in keeping the eyes properly open and who persist in shielding their eyes with the hands on any attempt at examination; little doubt as to the nature of the condition can be left in one's mind. In the case of infants who are in bed, the attitude is very characteristic; the head being buried in the pillow. (See photograph at beginning of thesis, and also that on opposite page, both of which demonstrate this point quite well.) From the attitude of the child, therefore, and from the general appearance presented by very many of the cases/
cases it is possible to spot the diagnosis so soon as the patient has entered the room. The stunted growth; characteristic facies with thickened upper lip and broad flat base of nose; strong growth of hair; curious dry scaly skin which is nearly always in an eczematous condition, particularly about the face, neck, ears and scalp; pallor of the skin, from an associated secondary anaemia chiefly found in the thin emaciated type of child; dull heavy look of the lymphatic or leuco-phlegmatic type which is not infrequently seen, all help one in this connexion.

Now as regards the examination of the eye itself. Where the case is not an advanced one with much corneal ulceration, and where there has been no generalisation of the inflammation from secondary organismal infection, the first thing to note is the localisation of the injected area. The condition is a focal one. A small patch of scleral involvement may somewhat simulate the phlyctenular condition, but in that case the injected vessels are more deeply situated and have a deeper colour, and there is no suggestion of the characteristic efflorescence. The Keratitis accompanying Acne Rosacea may give rise to trouble in diagnosis. Like phlyctenular keratitis, it is often a more or less focal inflammation and is associated with nodular elevation in the marginal region.

Relapses/
Relapses too are of frequent occurrence, whilst photophobia and lacrimation are prominent symptoms. Acne Rosacea Keratitis is found amongst adults, and only in those in whom the acniform eruption on the skin of the face is actually present. The eye condition will disappear with the successful treatment of the skin lesions.

In Spring Catarrh, ulceration does not take place such as occurs with the strumous ophthalmia. Trachomatous Pannus is differentiated from the pannus of strumous origin by the characteristic changes in the palpebral conjunctiva. At this point it may be mentioned that some observers have laid stress upon the frequent occurrence of small follicles in the conjunctivae of undoubtedly strumous cases. One must, however, state that these are not held to be present by many other authorities.

Where the inflammation has become generalised, and there is profuse discharge and even oedema of the lids, it may not be easy at first to distinguish a phlyctenular from an ordinary catarrhal inflammation of the conjunctiva.
The treatment of Phlyctenular Kerato-conjunctivitis must be both local and general. It is difficult to know which is the more important, but one can most certainly say that local treatment alone will rarely succeed in procuring recovery.

LOCAL TREATMENT.

This consists in the frequent use of some mild antiseptic lotion for bathing the eyes. The lotion should be tepid and should be used at frequent intervals, especially in those cases which are accompanied by ulceration of the cornea and in those where there is a muco-purulent or purulent discharge. In such cases it is of primary importance that all precautions should be taken to avoid unnecessary multiplication of pyogenic organisms, and contact of purulent material with the surface of the cornea. The antiseptic used in these irrigating lotions may be boric or sublimate.

Another very useful local application for use in these strumous eyes is yellow oxide of mercury ointment. (Hydrarg. Oxy. Flav. or H.O.F.) The strength of this may vary from 4 to 8 grains to the ounce, and it may be used 2 or 3 times a day, or only at night. A small piece being inserted with a glass rod, /
rod, on to the inner surface of the lower eyelid, the lids are closed upon the rod which is then gently withdrawn. The ointment may be disseminated throughout the conjunctival sac by means of a little careful massage.

Atropin Sulphate solution (1%) or about gr. 4 to 31 is to be recommended for universal use in cases of active corneal ulceration, or where this is likely to take place.

Quite frequently dionine, a morphine derivative, is incorporated with the Hydrarg. Oxy. Flav. ointment to the strength of 3 or 5%. It is an exodyne and is said to produce a lymphogogue action. At first the eye looks worse owing to an increased congestion brought about by the lymph stasis. The patient after 2 or 3 days develops a toleration for the drug and the congestion then passes off.

A point worthy of note in dealing with the local treatment is the necessity for continuance of the use of ointment after apparent complete subsidence of inflammation in the eye. It is a safe plan to fix the time of this extended treatment at 2 or 3 weeks; and in some cases even more, especially where there is corneal scarring, as the ointment is of use in bringing about scar absorption in certain cases.

Finely powdered calomel dusted into the eyes is sometimes/
sometimes used in place of the yellow oxide ointment, but it is not now in general use, although the results obtained through its use are very often excellent.

In those cases in which photophobia is very marked, smoked glasses or an eye shade may be ordered. Bandaging is to be avoided since it tends to harbour up the infective secretions within the eye and thus lead to a multiplication of organisms in the conjunctiva.

GENERAL TREATMENT.

This is absolutely essential in all cases. General treatment is almost more important than local measures in cases of Phlyctenular disease; certainly it is so in those uncomplicated by corneal trouble. In hospital many children recover completely from an attack without any local measures beyond perhaps irrigations, and this is obviously due to the much better conditions in which they find themselves in the Ward. The feeding is regular and of the right kind. The atmosphere is pure, abundance of sleep is obtainable, the bowels are properly regulated, and septic conditions such as of the skin, scalp, nose, ear etc. are as far as possible reduced to a minimum. Children who suffer from this disease almost invariably live under conditions at home where it is impossible to obtain a sufficiency of good air or/
or sunlight, and on this account, (in part, at any rate,) they are often pale and debilitated. Nothing is better than fresh air for those cases who are able to get out of door, whilst for those in acute attacks the well ventilated atmosphere of a hospital ward is a capital tonic. A good wholesome diet is perhaps the most essential thing in the general treatment of children of this type. At home, the usual feeding consists of bread and tea, together with a liberal supply of sweet things such as cakes, fancy biscuits, and buns. Nearly all the children are fond of sweetmeats and are allowed to have as many as they can afford to buy. It is really rare to find in the home dietary such things as porridge; good milk; butter, in any quantity; a sufficiency of green vegetables; vegetable soups; fruit; or anything like enough of fresh butcher meat. Goldschmidt is not alone when he points out that there is some connexion between corneal ulceration and deficiency in the fat soluble Vitamin. It seems strikingly evident that this is the case. In the vast majority of cases there is an almost complete absence of vitamins, whilst the protein and fat contents are reduced to an absurdity.

The necessity, therefore, for insisting upon a diet containing a fair proportion of protein material, in the form of butcher meat, fish and the cereals; vegetable soups; green vegetables, especially spinach; good fresh milk; and an abundance of fruit such as oranges and apples goes without saying. Cod liver oil is an essential if treatment is to meet with satisfactory results: indeed it has been thought to be a cure for the disease, by some people. Results obtained from the use of pure cod liver oil are much better than those obtained from the use of the emulsion or the combination with malt. The dose should be commenced small and gradually increased. Attention should be given to the condition of the bowels as many of the patients suffer from chronic constipation. The gastro-intestinal disturbance which is so frequent an occurrence usually clears up when feeding upon reasonably proper lines has been adopted for a short period.

That these factors relating to general hygiene and dieting play an essential part in the production of the disease, and in bringing about recurrences is amply shown by the way in which cases treated originally as out-patients fail to make headway until admitted to hospital, when recovery is often remarkably rapid, and by the regularity with which recrudescences occur/
occur amongst cases newly returned home from hospital as cured.

In view of the belief that there is a relationship between Phlyctenular disease and the functional state of the thyroid and other of the endocrine glands, the use of thyroid extract has been adopted by many, and the results are said to be good. The dosage depends upon the age of the patient, but a beginning may be made with anything from gr $\frac{1}{2}$ to gr III per day.

Ganguly, amongst others, is satisfied with results obtained by the use of Thyroid.

A variety of drugs and other methods of treatment has been recommended by various people. These include the use of warm sea water baths by Sedan, and the injection of milk in serious cases where there is no active tuberculosis present elsewhere. This latter method has not been found to prevent the occurrence of relapses.

Deycke-Much's partial antigens have been used by Blatt who has obtained good results by this method of treatment.

Seefelder/

Seefelder and Estrada, in the belief that many cases of eczematous conjunctivitis are due to Syphilis, have advocated the use of Salvarsan and its derivatives in treatment. Fietta and Berkhauser have been impressed by the value of iontophoresis. The current is weak to begin with (half to one m.a.) and should not be applied for longer than 30 - 60 seconds. Colmant has used rare earths of the cerique group in cases with tracheo-bronchial adenopathy. Whilst finally Withers has advocated the use of Radium and Wolff the application of X-Rays to the scrofulous glands in the neck which are present in many of the cases.

THYROID.

In the leuco-phlegmatic type of patient and in some of those older children in whom there may be enlargement of the thyroid gland, the giving of thyroid/


Thyroid Extract is of distinct value. The amount
given should be small to begin with; the dose being
$\frac{1}{4} - \frac{1}{2}$ gr. each night and continued for a week.
Increase may subsequently be made by the addition of
$\frac{1}{4}$ gr. until the physiological limit is reached.
In every case the dose should be regulated by the
results obtained, and all patients who are taking
thyroid substance regularly should be seen by their
medical adviser at stated intervals in order that
there may be no risk of ill-effects from overdosage.
That satisfactory results have been obtained in cases
of phlyctenular disease from this form of treatment
seems to suggest that there is a deficiency in the
output of the internal secretion of the thyroid gland
in some instances. It is probable that the interval
between recurrences is delayed in some cases, and that
fresh outbreaks are prevented in others by the prophy­
lactic use of small doses of thyroid extract at short
intervals after cure, the aim being to make up for
the natural deficiency of thyroid secretion. The
use of iodides in various forms has also been advocated
in cases whose symptoms seem to suggest an iodine
deficiency in the system. It has been thought that
there may be an analogy between the condition of
these children and that of myxoedema in the adult.
McCarrison and others have established the fact that
changes/
changes in the Thyroid gland can be produced by nearly all the organisms normally found in the intestinal canal. It is therefore of the utmost importance that treatment be directed towards the removal of any septic or toxic factor existing in cases of thyroid disturbance. The working efficiency of the various endocrine glands may be very unfavorably affected by the presence of a generalised Toxaemia in the system. Any derangement of the gastro-intestinal mechanism is therefore worthy of particular attention. In this connexion care should be taken to see that the patient receives a well-balanced diet including a sufficiency of vitamin content. The use of thyroid in treatment, in cases where there is any question of active tuberculosis is held to be undesirable. In view of this, it would seem that those cases of Strumous ophthalmia who do well on it, are not likely to be victims of tuberculosis, at least to any great extent.

AUTO-INTOXICATION: DIETING.

It is by no means unusual for ocular inflammations to result from the absorption of toxins from various parts of the body. Perhaps the commonest disease of the eye, which may claim to be derived in this manner is irido-cyclitis, and the principal source of the offending toxins, the alimentary tract. In infants and young children the main activities of the body are directed towards the assimilation/
assimilation of food. In comparison with the amount taken in by an adult, the quantity of material ingested is enormous. It is no wonder, therefore, that this over-activated function of the digestive apparatus requires but little to upset it. There are several reasons for the peculiar liability of young children to derangements of the digestive mechanism. In the first place, as the result of a relatively increased demand for food, a strain is put upon the process of digestion. Secondly, there is in very young children a low immunity against the various forms of catarrhal infection, and lastly: The nervous system is highly sensitive and uncontrolled. In these children a faulty diet, and especially one deficient in fat, leads to a lowering of immunity against infection. Then again, with each infective process there comes a lessened tolerance for food of all kinds, but especially in the tolerance for fat.

Primary indigestion may be brought about in some children by over-feeding alone, and this is particularly liable to happen where the diet includes an excess of sugar and fat. In other children there appears to be an inherent inability to cope with the average amount of sugar, starch and fat, so that whilst many of the nutritional disturbances of infants and young children probably result from errors in dieting and from organismal infections; there are cases in which it/
it is the constitutional peculiarity of the child that is at fault.

Czerny\(^1\) has pointed out that the milder manifestations of the "Exudative (i.e. strumous) diathesis" are extremely common, that their effects last much longer than those of rickets, and that they are often seen in families which are otherwise healthy. Much can be done, he says, if treatment is begun early, taking into account the proper regulation of the diet and the state of the nervous system. This particular state or constitution is regarded by John Thomson\(^2\) as being a congenital abnormality, which prevents the child from being able to digest certain of the elements of a normal infant's diet. He is of opinion that it may or may not be hereditary, and that it often affects all the members of a family although with varying degrees of severity. The symptoms are mainly associated with the skin, mucous membranes and lymphoid tissue, and in the eyes the diathesis manifests itself in the form of blepharitis or phlyctenular conjunctivitis. The symptoms usually begin during the first year of life, although in some they are present from the beginning, and in others may not appear until later on in childhood.

In/

In older children manifestations of the diathesis include various symptoms and tendencies to disease which used to be regarded as characteristic of scrofula although they have no essential connexion with Tuberculosis.

Any attempt at treatment of phlyctenular disease must fail in its intention if the existence of such an inherited predisposition as has been referred to, be not borne in mind. Due care must be given to the dieting since digestive disturbances are often aggravated if not actually initiated by neglect of this matter. In some cases the factor responsible for causing trouble is rather, the continuance in an apparently normal child, of a hopelessly disproportioned diet and one deficient in essential elements, than the existence of any constitutional defect. It is common knowledge that in order to keep the body in a fit state of health, vitamins or accessory food factors are necessary. Recently it has been found that the amounts of the vitamins required for this purpose vary considerably under different conditions.

Mellanby\(^1\) has shown that many factors in a diet, and in particular the amount and quality of the cereals it contains, may determine the amount of fat soluble vitamin necessary to prevent or cure rickets.

That/

That the amount of Vitamin B necessary for the maintaining of health alters according as there is variation in the amounts of protein, fat, and carbohydrate and total energy value of the diet. It is not sufficient that there should be vitamins present in a diet. There must be a balancing of the quantity of vitamins with the other constituents. Mellanby has shown too, that the fat soluble vitamin may influence very greatly the structure of the teeth, and by means of experiments on animals, has found that the teeth may develop well or otherwise, according as the mother has had a sufficiency or not of Fat Soluble A in her diet during pregnancy and lactation. Deficiency in Fat soluble vitamins predisposes to infection, but whether this is due to deficiency in Vitamin A or Vitamin D is not yet known. Experiments have indicated that Vitamin D is concerned in raising the resistance of tissues to infection. Exposure of the skin to Ultra Violet Rays (the action of which is similar to that of Vit. D. in other directions) increased the bactericidal power of the blood. The occurrence of infantile diarrhoea, respiratory diseases such as bronchitis and Br. Pneumonia and rickets may be much influenced by an adequate supply of fat soluble vitamin in the diet. Phlyctenular keratitis/

keratitis may well be added to this list. The improvement exhibited in this eye condition when those affected have been put on an appropriate well-balanced diet containing a sufficiency of this vitamin, leaves little room for doubt.

Proper attention to the state of the alimentary tract and the giving of a well constructed diet are of the first importance in dealing with strumous children who as a class are incapable of making proper use of the fat contained in their food. In such children the ill-effects of an unsuitable diet may continue to act for a long time after the dietary has been altered for the better.

An efficient dietary should consist largely of fresh vegetables, in season, (spinach is particularly valuable) and vegetable soups. In those children who are of an age at which a fair quantity may safely be taken, appropriate amounts of porridge, milk, some carbohydrate and meat, may be given, together with a generous allowance of fresh fruit or fruit juice. (oranges and tomatoes are of high value in Vitamin C content). Of foods such as butter and cream, which are rich in fats, only a sparing allowance should be made, and all such things as cakes, sugar, jams and sweets must be rigorously excluded. Regularity in the times at which meals are taken is also a point of considerable importance in dealing with a dietary, and/
and this should be emphasised in dealing with parents.

A specimen diet is here given, suitable for a child of about $1\frac{1}{2}$ to 2 years of age.

<table>
<thead>
<tr>
<th>Time</th>
<th>Meal</th>
</tr>
</thead>
<tbody>
<tr>
<td>8 a.m.</td>
<td>3 oz. Strained oatmeal porridge.</td>
</tr>
<tr>
<td></td>
<td>2 oz. Cream</td>
</tr>
<tr>
<td>10 a.m.</td>
<td>2 oz. Orange juice.</td>
</tr>
<tr>
<td>12-30 p.m.</td>
<td>1 oz. Minced Tripe or $\frac{1}{2}$ oz. Raw meat, or $\frac{1}{2}$ oz. Fish $\frac{1}{2}$ oz. Fish and Spinach Junket and cream or Milk pudding and cream.</td>
</tr>
<tr>
<td>4.30 p.m.</td>
<td>Lightly boiled egg ($2\frac{1}{2}$ mins.) and whole meal bread or Tomato and whole meal bread.</td>
</tr>
<tr>
<td>7.30 p.m.</td>
<td>Milk to drink and Rusk.</td>
</tr>
</tbody>
</table>

To a diet such as the foregoing, Cod liver oil should be added, commencing with one drachm spread over three doses in the day. This oil has been found of immense value in all phlyctenular cases, and is ordered as a routine. The pure oil gives more satisfactory results than when in the form of an emulsion or prepared along with malt, but no matter how taken, its value cannot be questioned whether used for prophylactic purposes or therapeutically. Cod liver/
liver oil is rich in Vitamin D, and as in the case of its use in rickets, it goes far towards making up for the lack of sunlight from which the children in the slums of our cities so frequently suffer. This particular vitamin is believed by some to be formed in the skin, as well as in certain foodstuffs, by the action of Ultra Violet Light, but this is open to question. There is no doubt, however, that its activity is increased by light treatment. It follows from this, that the amount required in any diet will vary according to the degree of exposure to light. In infants treated with cod liver oil, it has been found that the amount of infection of the respiratory passages is very much less than it is amongst those not so treated.

IRON.

Anaemia is very commonly met with amongst young children, and especially in those who suffer from Strumous Keratitis. Iron, together with a protein and a pigment, is essential for the formation of the haemoglobin in the blood. In young children the supply of iron is often inadequate. It is stated that the iron content of human and cow's milk is low, and is in itself insufficient to supply the needs in this direction, of the growing child. This being so, the organism has to fall back to a great extent upon the iron/
iron store present in the liver at birth. This dependence continues until the child is of an age at which it is capable of receiving a mixed diet, the iron content of which is sufficient to satisfy the need at the time.

Most of the iron is stored up in the later months of pregnancy so that the premature infant born with a marked deficiency of iron is a constant sufferer from anaemia. Lack of an adequate supply of iron is also very prevalent in full time children, and in them is found up till about the end of the 2nd year of life.

In these children, if iron is given by mouth to make up for the natural deficiency, many of the ill-effects found at a later stage of life and resulting from this early anaemic phase, may be prevented.

**ECZEMA.**

An eczematous condition of the lid margins is usually associated with scrofulous children, and it is frequently found in children with phlyctenular ophthalmia. Pustules are formed at the orifices of the hair follicles, these burst and give rise to the formation of scabs. The edges of the eyelids become red, swollen, ecoriated and infiltrated, and are often covered with a purulent exudation which forms crusts and binds the eyelashes together. A considerable degree of local deformity may result if the condition becomes/
becomes chronic, and lacrimation is a not infrequent accompaniment.

Eczema in other parts of the body is often found along with that of the lid margins, and as a rule it commences on the cheeks, or elsewhere about the face, or on the scalp. There may be papular, vesicular and pustular lesions and sometimes there are, in association with these, urticarial elements. Itching is severe, and the scratching which results so modifies the skin lesions that they are liable to develop an impetiginous character. The condition may be very tiresome to treat, since it is bound up with a peculiar vulnerability or susceptibility to infection of the skin, and which is akin to the predisposition to phlyctenular disease of the eye which many of the children also possess. It is curious that only one child in a family may be affected although the conditions of life for all appear to be the same.

Mention is made here of this eczematous condition of the skin because of the close etiological relationship to the strumous eye manifestations which one believes it to have.

Both conditions are probably brought about by the same inherent constitutional weakness, and it is felt that any treatment apart from general measures must not fail to have in view the successful arrest of both disease processes at the same time.
TUBERCULOSIS.

In a series of 194 post-mortem examinations performed at the Sick Children's Hospital in Edinburgh in children under 12 years of age, Tuberculous lesions were found in 42 cases, i.e. 22%. The ages of the Tuberculous children ranged from 4 months up to 10 years, and in only 6 of the cases, i.e. 3% was tubercle found unsuspectingly, death being due to the disease in the rest. Those figures seem to indicate that advanced tuberculosis is really very prevalent amongst children of the more tender years. Two of the conclusions drawn from a study of the series of cases above referred to were:-

(1) That when tuberculous infection occurs in young children the lesions tend to assume an active and often fatal character. (2) That the toxaemic manifestations in tuberculosis are of great importance, but are the actual cause of death in children less often than in adults. This latter statement does not fit in very well with the view held by many that phlyctenules in the eye are developed as the result of tuberculous toxins. A proportion of children suffering from phlyctenular disease is possessed of definite tuberculosis. One is inclined to think, however,

however, that on the whole the numbers are comparatively small, but of the cases studied for this thesis undoubtedly tuberculous lesions were found in a variety of situations: - T.B. of the spine; T.B. of the abdomen; T.B. of the hip joint; T.B. caries of the facial bones and T.B. of the lungs; in addition to tuberculosis of the cervical glands. Whilst the percentage of cases having demonstrable tuberculous lesions was small, there was doubtless a considerable proportion of others who suffered from the disease in an undemonstrable form. It is most necessary that specific treatment should be adopted in such cases since effectual cure of the eye condition is apt to be protracted and frequent recurrences result, unless the tubercular element is held in check.

**LIGHT TREATMENT.**

Ultra Violet Light, particularly of wave-lengths 2,500 - 3,000 Angstrom Units, exerts a very definite biological action on the skin, with the production of an erythema followed by death and desquamation of the most superficial layers. Activities of great therapeutic value result, and are comprised partly of electrical forces set free in the change of potential involved in the atomic disintegration, and partly of chemical factors, the result of the destruction/
destruction and partial destruction of the cell proteins, the products of which, being set free into the general circulation increase the non specific immunity of the body. In the benefits of these activities the eye shares in common with the rest of the body. Finsen in his early work with the carbon-arc lamp on Lupus was impressed by the fact that improvement was not confined to the areas exposed. From this, treatment of other tuberculous conditions by exposure of large areas of the body surface to the sun's rays and to the rays of the mercury vapour and carbon arc lamps (both of which are rich in rays of less than 300 μm wave-length) was adopted. Exposure on these lines is now extensively used for psoriasis, lupus, bone tuberculosis and in other forms of tuberculous disease.

In the last few years great advances have been made in the treatment of rickets, which for reasons which we have already indicated can be cured by exposure to the mercury vapour quartz lamp (Haldchinsky 1919-20). It has been found too that Xerophthalmia may be favorably affected by the same means. Amongst those who have experimented in the use of ultra violet rays may be mentioned Hertel, Chotzen, Schanz, Kuznitski and Birch-Hirschfeld. The last named worker/

worker has treated various forms of corneal ulceration in this manner during the past 8 or 9 years and has had very favorable results. He found the beneficial action appeared to be increased after sensitising the cornea with Sod. fluorescin, - out of a total of 40 cases, unfavorable results were obtained in only six.

There are two ways in which eye diseases may be treated by ultra violet light: (1) In the form of light baths to the surface of the body generally, (2) by means of local application to the eye itself.

Leonard Hill and Eidinow have employed at the National Institute for Medical Research a technique which aims at giving the optimum intensity of radiation over the optimum area of the body surface. The only means by which it is at present possible to gauge the systemic effect produced by the radiation is by estimating the bactericidal power of the blood.

It has been shown that after exposure to ultra violet light this property of the blood is increased, sometimes in a marked degree, the effect being largely due to the formation and biological action of photochemical products liberated from the leucocytes.

Excessive/


Excessive dosage diminishes the bactericidal power of the blood and is accompanied by mental and physical depression. The best results are obtained with radiation of such intensity as to produce a mild erythema over about a quarter of the body surface. Susceptibility to light varies very greatly; it is therefore necessary to test the reaction of the patient by discovering the time required to produce the faintest erythema. This is done by exposing small circular areas of skin on the inner surface of the arm or elsewhere, to the mercury vapour lamp at about a distance of 3 or 4 feet for varying lengths of time. The intensity of the flush over the areas exposed is examined on the following day when the most appropriate exposure is estimated. The body is divided into 4 areas: the chest; ventral aspect of abdomen; and front and back of legs, and Radiation takes place on alternate days. Certain parts of the body are more sensitive than others, and on this account it is necessary to vary the dose to suit the particular area exposed. Broadly speaking the initial dose is about 2 - 3 minutes for the mercury vapour lamp. (K.B.B. atmospheric, 200 volts, 2 to 3 amperes). Increase may be made fairly quickly up to 10 or 15 minutes where it remains for a considerable time. Now just a word with regard to local treatment. All waves shorter/
shorter than 2,950 Angstrom units are completely absorbed by the cornea. Above this level more and more of the rays are transmitted until at about 3,100 practically all are transmitted to the lens and iris. That part of the incident energy which is absorbed produces a reaction which is either thermal or abiotic depending upon the length of the wave. By means of a filtering screen it has been found that the upper limit of wave length in the cornea for abiotic response is about 3,050. Radiation with rays above this produce a thermal lesion and may cause burning if of sufficient intensity.

Since phlyctenular ophthalmia is a disease of children whose health is largely debilitated through lack of sufficient sunlight and of vitamin content in the dieting, it is not surprising that the results obtained by treatment with ultra violet light should have proved eminently satisfactory. In London, the Provinces, the Continent of Europe, and in other centres where this method of treatment has been adopted, the results have been uniformly good. Ultra violet rays do not take the place of vitamins but when small quantities of the latter are present they may be mobilised in such a way that growth continues. It is necessary to give vitamins during treatment, however, and this may be done satisfactorily by means of cod liver oil and hypophosphites.

In/
In the cases treated in Sheffield there has been marked improvement in all. The general condition has shown this too in extraordinary degree, the appetite improving, the weakness, anaemia and irritability soon becoming things of the past. In the few cases where relapses have occurred, the interval between the attacks has been lengthened, and the symptoms have been less severe. General exposure is adopted, beginning with about 10 mins. and increasing up to 1 hour. In London both general and local exposures have been used. There too a few relapses have been noted, but on the whole the distressing symptoms have disappeared in a day or two and the lesions in the conjunctiva have quickly resolved. There would seem to be every reason to suppose that there is in this form of treatment an effectual substitute for sunlight, and one which may do much towards reducing the incidence of Phlyctenular disease amongst the children in our slums.

Finally, in regard to this question of treatment one would refer to the crying need for improved conditions in the home life of so many of those who become victims of Strumous Keratitis. Unless some steps are taken in this direction, all other efforts towards the amelioration of the disease must be greatly handicapped. Short of segregation in publicly supported hostels or homes of some sort, an acceleration of the various activities under the control of the public/
public health, education and municipal authorities might lead to satisfactory results. Consideration would require to be given to certain or all of the following points: housing reform; the provision of a more generalised system of open air schools; the better education of parents in the matters of general hygiene, dieting and spread of infection, by means of propaganda etc.; an extension of the existing system of Infant Welfare centres; schools for mothers; Babies' Nursing homes; ante-natal clinics; school clinics; and the visiting of homes by health visitors.
CONCLUSIONS.

From my study of this subject I have been led to form the following conclusions:—

(1) That Phlyctenular kerato-conjunctivitis is essentially a disease of children; the greatest incidence occurring between the ages of three and five years. It may occur for the first time in those of adult age, but much more often in adults one finds that an attack is really a recurrence of a condition which has been carried on from childhood or adolescence.

(2) That girls are more susceptible to the infection than boys; the proportions being eight girls to every five boys. Recurrences in adults are much more prevalent in the female sex.

(3) That this form of conjunctival inflammation is not of Tubercular origin. It may, however, co-exist with tubercular lesions elsewhere in the body. Results obtained by the Von Pirquet Tuberculin test would seem to indicate the presence of Tuberculosis in the vast majority of cases. That such is the case, is not borne out by clinical study.
That the patients have inherited a peculiar type of constitutional defect, of which perhaps the most obvious symptoms are associated with 
(a) an inability on the part of the digestion to cope with certain of the constituents of a normal diet. (b) A certain hyper-sensitiveness of the epiblastic tissues.

That in addition to the aforesaid predisposition there is a definite toxin at work, which is probably specific in its action, and is responsible for the production of the phlyctenular inflammatory process. From this it may be gathered that the writer holds the view that the condition is not exogenous in origin.

That all children possessed of this particular constitution or diathesis do not of necessity show symptoms of Phlyctenular disease in the eye. There may be an apparent concentration of the predisposition in connexion with the gastrointestinal functions, in which case the eyes may not become the seat of obvious symptoms. In other cases the inherited weakness seems to be concentrated upon the epithelial tissues and in these cases the eyes are very constantly involved.

That there is close relationship between the eczematous condition of the skin and the ocular manifestations.
manifestations. It is probable that the etiological factors are the same for both.

(8) That there is a considerable variation in the degree of the inherent susceptibility, and this factor together with the effect produced upon the health by environment, dieting and general hygiene, is responsible for the time of onset of the symptoms of Phlyctenular ophthalmia.

(9) That very frequently it happens that in large families only one member may develop this form of eye trouble. In those cases it is usually the youngest or one of the younger members who are so affected.

(10) That the state of nutrition of the mother during pregnancy and while nursing is of vital importance in determining the incidence of the diathesis.

(11) That little importance is attached to the exanthemata as etiological factors.

(12) That not all children who have inherited this lowered immunity to infection possess the grosser facial stigmata (e.g. lack of development of the nasal bones and hyperplasia of the upper lip, etc.) so characteristic of the diathesis. Many children however with typical facies do not suffer from phlyctenular disease. They are of course of the constitution nevertheless.
(13) That in a proportion of the children there is a disturbance in the balance between the various glands of the endocrine system. In others there appears to be a generalised hyperplasia of the lymphoid tissue.

(14) That in cases where recurrences continue over long periods of time and especially in those which extend into adult life, there is invariably present some obvious co-existing debilitating factor. This may take the form of Pyorrhoea; necrosis of the teeth; refractive errors; chronic inflammation of the Tonsils; in-appropriate dieting; bad hygienic conditions; unsuitable occupation, etc.

(15) That phlyctenular disease is preventable.

(16) That the importance of intensive preventive measures should be brought to the notice of the Public Health, Educational and Municipal Authorities.

(17) That treatment with Ultra Violet Light is proving to be of infinite value. It enables children to have the benefit of rays to which they have but little access in the ordinary course of events. As a substitute for exposure to the sun Ultra Violet Light increases the resisting/
resisting powers to infection, mobilising the vitamins present in the body in such a way that use may be obtained from quantities which must otherwise have been too small.

(18) That a properly balanced diet, with a sufficiency of vitamin content, and regularity in the observance of meal hours, are essentials in treatment.
With regard to a few of the numbers in the following list, no precise references have been made. The writer has been however indebted in a general sense to the authors concerned.


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