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On Granular Disease
of the Eye. By James
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pital, and Curator of the
Hospital.

Through the first quarter of the century diseases now known as granular disease of the eye were first described. For the first time much attention has been made by ophthalmologists during and after the Egyptian campaign and articles on the subject were written. The commencement in the other European armies and 1818 (Portugal) drew the part of medical men from each country of Europe. bestowed on it, and partly of ophthalmia did not come from one European army, although disease was not obtained entirely blinded by it in any instance, both by the most violent destructive ophthalmia in the present generation the disease which were called "catarrh," or "Egyptian ophthalmia" given to these ophthalmia is, however, a direct transmission of a healthy and morbid nature to changes which were not without the light of a disease very fatal disease in earlier days when the habits of people, present relatively unimportant ad

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On Granular Disease of the Conjunctiva and Contagious Ophthalmia. By EDWARD NETTLESHIP, F.R.C.S., Surgeon to the South London Ophthalmic Hospital. Late Clinical Assistant and Curator of the Museum at Moorfields Ophthalmic Hospital.

DURING the first quarter of the present century the group of diseases now known collectively as contagious ophthalmia received for the first time much attention. It was chiefly in relation to the havoc made by ophthalmia in the English and French armies during and after the Egyptian campaign that the many monographs and articles on the subject which appeared about that time were written. The commencement of destructive outbreaks of ophthalmia in the other European armies at various times between 1814 (Russia) and 1849 (Portugal) drew much attention to the subject on the part of medical men (and especially army surgeons) successively in each country of Europe. As a result partly of the study and skill bestowed on it, and partly of other circumstances, the violent forms of ophthalmia did not continue for long to prevail extensively in any one European army, although this comparative freedom from the disease was not attained till large numbers had been partly or entirely blinded by it in several countries. The importance attached however, both by the medical profession and the lay public, to prevalent destructive ophthalmia, has to a large extent been inherited in the present generation by its milder congeners; by forms of the disease which were common enough long before "army ophthalmia," or "Egyptian ophthalmia," were current phrases. The attention given to these milder and more protracted forms of ophthalmia is, however, due in part to other circumstances than the direct transmission of a newly created interest. Advances made in healthy and morbid anatomy have been the means of attracting notice to changes which could not have received the necessary attention without the light of our fuller knowledge. The superior claims of various very fatal diseases, *e. g.*, smallpox, typhus and dysentery, in earlier days when these were very prevalent in closely packed bodies of people, prevented close attention being given to such relatively unimportant affections as epidemic ophthalmiæ until a

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recent time. The higher standard of public health which has slowly grown up, and is still growing, has extended to contagious diseases of the eye as to all other maladies, so that far more importance is attached to the slighter forms of ophthalmia and other non-fatal affections than was the case fifty or sixty years ago.

At the present time ophthalmia, as a disease largely destructive or even injurious to sight, is unknown in the English army, and the number of cases diminishes almost yearly.¹ The same is, in general terms, true of the other European armies. In Great Britain it is chiefly among the children of the poor in large towns, especially of the Irish poor, that ophthalmia is now to be seen; while public attention to it is limited to those moderately severe forms which still occur in some of the poor-law schools.

Notwithstanding the abundant literature of the subject there is still, in this country at least, some uncertainty and want of agreement on the whole question of ophthalmia, more especially as it occurs in large institutions. That ophthalmia has within the last ten or twelve years occurred in a severe enough form to destroy eyes in more than one metropolitan poor-law school; and that in a less severe, but still a serious form, it has been for several years and still is, a very familiar disease in many of these schools, are facts requiring serious attention. It may here be observed, however, that the apparent increase of the disease in some schools within the last few years is doubtless partly due to the fact that much more attention is now given to the slighter forms of ophthalmia in pauper schools than was the case when a lower standard of health was applied to them. For this, among other reasons, the word "ophthalmia," if used without any qualification, is very misleading as to the real amount of harm done by the diseases which it is intended to define, being used, as it often is, to describe cases of every possible degree of severity and of several different kinds. It thus happens in the first place that those to whom the word has a very serious meaning are certain to over-estimate the real amount of the evil if they go no further than the number of cases returned under this heading by different practitioners, while it is probable that, from the want of a uniform standard, cases which one surgeon would regard as ophthalmia might be placed by another in a different category. I shall afterwards show that the number of cases which stand on this debateable ground is, in some instances at least, very considerable.

¹ Thus, the number of cases admitted into the Royal Victoria Hospital, Netley, for ten years, 1861—70, was 328, 230, 266, 233, 205, 126, 79, 97 (this increase in 1868 was due to the Abyssinian Expedition), 72, 39 (in 1870).—'Army Med. Rep.' for 1870, p. 351. The diminution is attributed to improvements in barrack hygiene at foreign stations. It seems probable that part of it is due also to the fact that since 1868 cases of gonorrhœal ophthalmia have been returned separately, no such distinction having been made in the returns up to that date. I am indebted to Professor Longmore for this information.

Then there is still much uncertainty as to the percentage of cases in which permanent damage to sight and incapacity for earning a living result from that kind of ophthalmia known as "granular." That bad granular ophthalmia often gives rise to very serious permanent corneal damage is of course undoubted. It is not, however, equally clear that the disease, even when severe, gives such a large percentage of bad results as is often attributed to it; and it is very doubtful whether, when mild or moderate, it is so serious an affair as we are sometimes led to believe. On the other hand, it is probable enough that some to whom opportunities for studying the disease on a large scale have been wanting are not fully aware of the injury caused by it. The principles of therapeutic treatment are well founded; there are yet a few points to be determined, however, with respect to the details which are most suitable, the length of time that treatment should be kept up, and the effects it should be expected to produce. It is also desirable to settle in as much detail as possible what are the best hygienic and educational measures to be taken in respect to large collections of children suffering from the disease.

The contagiousness of many of the forms of conjunctivitis has long been settled beyond dispute. It is indeed a question (and one of some importance for administrative purposes in large establishments) whether the doctrine of contagion has not been pushed too far with some forms of conjunctival disease, and made to account for facts which are in reality due to other causes. Whilst it is essential that the prevalent opinion on this subject should err, if at all, on the safe side, it is very desirable that this error should be as small as possible, and that a safe and sufficient prominence should be given to other influences. Some light is thrown on the causation of the diseases in question by an examination of their early history in this and other countries, especially as to the alleged freedom of Europe from severe prevalent ophthalmia up to the date of the Egyptian campaign of 1798 to 1802. The possibility of entirely preventing or stamping out ophthalmia from large institutions also depends much on the causes which produce it, and our belief on the latter subject will of necessity influence our action with reference to the former. The fact that ophthalmic hospitals do not furnish opportunities for a prolonged study of the various cases of conjunctivitis has prevented a full investigation of these diseases by some of those who have devoted themselves especially to ophthalmology; while the very large and prolonged experience of the disease enjoyed by many army surgeons and by the medical officers to some of the poor-law schools furnishes most valuable material for completing the unavoidable deficiencies in the experience of oculists. It is by putting the opinions of these two classes of practitioners side by side that we may hope to gain a sufficiently full and exact knowledge of the

disease without over-valuing its importance on the one hand, or bringing to bear on it insufficient means of therapeutic treatment or general management on the other.

The action taken in 1873-4 in reference to ophthalmia in the North Surrey District School at Anerley gave me, as Medical Superintendent of the Branch School established for the temporary reception and separate treatment of the patients, the means of studying those forms of the disease which are now most prevalent in such schools. I had under care for twelve months nearly 400 cases of the disease in its various milder phases, and had also the opportunity of observing to some extent the conditions under which it occurred at the Anerley School. These facilities together with a few opportunities which have occurred of inspecting the eyes of children in other schools, and the knowledge gained by attending the practice at Moorfields, have placed me in a perhaps somewhat unusually good position for judging some of the points above mentioned in connection with those forms of ophthalmia which are most prevalent in this country at the present time.

Dividing diseases of the conjunctiva roughly into those which are at some part of their course acute and those which are chronic throughout, we have in the former group the various forms and degrees of conjunctivitis, while granular ophthalmia (trachoma) is the most important member of the latter.

The fact, which has now been clearly known for about thirty years, that a person affected by granular disease of the conjunctiva is likely to suffer from a superadded conjunctivitis much more severely and for a much longer time than if his conjunctiva had been healthy when the conjunctivitis set in, gives the disease much greater importance than it would otherwise possess. This is recognised more or less clearly in all modern text-books, but is still sometimes lost sight of in the complications due to the frequent occurrence of the two types of disease simultaneously in the same patient. There are many cases of the milder forms of acute conjunctivitis which are of very little importance when they occur in persons whose conjunctiva was previously healthy, but which have serious results if at the time of their attack this membrane was in a more or less granular state.¹ A third disease which, though not properly conjunctival, sometimes exerts an important influence for harm on conjunctival affections is the chronic inflammation of the follicles of the eyelashes and of the meibomian glands and neighbouring struc-

¹ Although the word "granular" is here, and throughout this paper, used to designate the disease whose essential feature is the "vesicular" or "sago-grain granulation," I would not be understood to doubt that prolonged or repeated inflammation of a previously healthy conjunctiva, either with or without implication of the eyelash follicles and Meibomian glands, may give rise to permanent thickening and some roughness of the palpebral conjunctiva. I should doubt, however, whether this is common in any but old people.

tures which furnishes the different types of ophthalmia tarsi. It is, so far as I have seen, less common in schools than the two first classes and there is no need to discuss it at length here since its characters and management are well known.

Granular disease of the Conjunctiva.—For practical purposes it is convenient to treat this part of the subject first, especially because in the patients from whom most of my experience has been drawn it is so common that from a clinical point of view it almost must be studied first in order to appreciate rightly the bearings of the two classes of disease on one another.

Granular ophthalmia is a specific disease characterised by the enlargement of the minute lymphatic follicles normally present in some parts of the palpebral conjunctiva, by the formation of new structures which, so far as clinical characters are concerned, are identical with the above, and later by the slow hypertrophy of all the other conjunctival structures. The earliest changes occur at the outer¹ part of the lower lid near to the oculo-palpebral fold; at a later period the whole lid is affected and similar changes are found on the tarsal part of the upper lid and on the part of the conjunctiva which is above the upper edge of the tarsus. In the upper lid the disease begins at the extreme outer or inner end, or at both simultaneously, gradually advancing from these two points until the greater part or the whole of the tarsus is affected. In very mild cases the upper lid is scarcely involved.

The enlarged follicles are described in their early stage as “vesicular” granulations. They are at first quite transparent and only just visible to the unaided eye; their contents are said to be fluid enough to flow out when they are pricked. A little later on, when they are somewhat larger, less perfectly transparent, and will no longer collapse, they are called “sago-grain” or “spawn-like.” They are sometimes compared to tapioca when, at a much more advanced stage, there are present at and above the upper border of the superior tarsus large tracts or mounds of greyish white, almost opaque, new tissue formed either by the coalescence of separate granulations or the diffuse infiltration of the conjunctival tissue with new material. From the fact that much adenoid tissue is present in the tarsal conjunctiva and oculo-palpebral fold in certain very young animals² before any lymph-follicles are developed, and that

¹ Dr. Littlejohn, resident medical officer to the Hanwell poor-law school, whose opportunities for observing this disease in its earliest stages are very large, tells me he thinks the first signs of disease are found in the minute vesicular-looking elevations so often seen forming a single line parallel to and about $\frac{1}{8}$ -inch from the border of the lid at its outer part. I have been in the habit of looking on these as of doubtful diagnostic value. They will repay further study.

² Diffuse adenoid tissue is stated by Schmid to form the chief part of the conjunctiva palpebrarum and oculo-palpebral fold in many very young animals. Blumberg says nearly the same with respect to the dog. (‘Stricker’s Manual of Histology,’ New Syd. Soc.’s Translation, vol. iii, p. 450).

these are formed from it somewhat later in life (third week), it seems possible that in after life a formation of similar diffused tissue may occur as the result of disease.¹

The disease may advance no further than the formation of sago-grains on the conjunctiva of the lower lid, with or without a slighter degree of the same change in the upper lids. In such cases there is often no increased congestion of any part of the palpebral or ocular conjunctiva, nor any subjective symptoms. There is in many cases, perhaps in most if the truth could be ascertained, a slightly increased secretion of mucus, just enough to remain as a film on the skin at the inner or outer canthus when the tears which often run over at waking have dried up. The "sago-grains" may thickly cover the lower lids and yet there may be no morbid redness whatever. Such a state, few or many indolent follicular granulations without any perceptible change in the other conjunctival structures, will often remain stationary for a long time (many months or a year certainly, probably several years) and lead to no further damage. After a time the granulations gradually change to a yellowish or brownish-yellow colour, slowly shrink and at last disappear, their site being often occupied for some time afterwards by a small rusty-brown dot or pucker in the mucous membrane from which two or three minute but somewhat enlarged blood-vessels may be seen to pass. In other cases minute ill-defined whitish dots or streaks (scars) mark the former position of the morbid growths.

The formation of sago-grain granulations is often accompanied, either at an early stage or after they have attained a moderate size and number, by enlargement of the papillæ and chronic congestion and thickening of all the other conjunctival structures, including probably the tubular mucous glands which in man are found in the oculo-palpebral fold and some parts of the tarsus. The follicular granulations at the same time become congested and larger, though they may be partly or entirely hidden in the swollen tissues and hypertrophied papillæ around them. The conjunctival tissue in many cases takes part in the sago-like change, becoming much thickened by greyish gelatinous-looking material. When this occurs the sago-grains attain a large size and may coalesce with one another, and we then find an enormously thickened conjunctiva covered with bossy greyish-red elevations (large sago-grain granulations) separated by florid or dull-red enlarged papillæ. The entire membrane, being much extended in area, often becomes folded on itself to a remarkable extent. The degree of thickening and the size of the follicular granulations is sometimes very unequal on different parts of the same lid. I believe that the final stage of such a condition, whether affecting the whole lid or only a part, is always

¹ A similar suggestion has been made by Frank (1860) and others.

the partial absorption of the new tissue and the conversion of the rest into tough scar-tissue of white or yellowish-white colour. This will form a more or less isolated streak or plate, or will occupy the greater part of the lower lid, according to the original extent of the trachomatous change. Such plates are sometimes slightly raised and at others a very little depressed; they are always less flexible than the normal conjunctiva. When thin they may have a streaky, tendinous appearance. Sometimes by slow contraction they cause stricture of the lachrymal puncta or canaliculi,¹ or both, and more or less troublesome epiphora is the result. Often they do no harm whatever. I have never seen them, in children up to sixteen years old, cause alteration in the direction or curvature of the edge of the tarsus, except very slightly at the punctum.

Granular disease, as a rule, begins rather later on the upper than on the lower lids. In cases of the first degree, where there is throughout little or no congestion and papillary enlargement on the lower lids, the upper lids generally remain nearly healthy from beginning to end. In these mildest cases, however, a few small sago-grains are often found close to the inner and outer ends of the upper tarsus. They are generally accompanied by more or less congestion and papillary enlargement at the same spot. Sometimes the papillæ enlarge without any sago-grains being visible, either because these are not formed, or being present are obscured by the papillæ. The rest of the upper tarsus and retro-tarsal fold is often normal. In the next degree either the whole length of the upper edge of the tarsus shows abnormal redness with some papillary enlargement, or the entire tarsal surface loses its polish, and, owing to uniform slight enlargement of its papillæ, reflects light imperfectly. Both these changes occur together in many, perhaps in most cases. Now and then, although there may be only the very slightest papillary change, the tarsus is found to be thinly sprinkled with small circular flattish elevations like minute sago-grain granulations. They are quite pale like the surrounding conjunctiva and can scarcely be detected except by looking obliquely at the lid. It is commoner, however, to find no appearance of sago-grains (except just at the inner and outer ends) until there is slight but quite decided papillary enlargement and congestion over the whole upper tarsus. The surface is then of a more or less uniform red tint, sprinkled over with small white bodies of a flattened hemispherical shape. The smallest are only just visible to the naked eye, the largest nearly a millimètre in width. They are absent from that part of the lid nearest to the ciliary border, and are less plentiful near the upper border of the tarsus than about its central area. Sometimes they extend quite up to and mingle insensibly with the sago-grains before men-

¹ This occurred in three cases.

tioned at the inner and outer ends of the lid; in other cases they are limited, or almost so, to the central part of the tarsus. Occasionally only one or two are present on the whole upper lid. They are generally smaller, and almost always flatter, than the granulations at the canthal parts of the lid or than those on the lower lids. These small sago-grains on the upper lid cannot be mistaken for the enlarged and congested papillæ by which they are surrounded and which give to the conjunctiva the appearance of the finest sandpaper. They are, however, not by any means always present on the general surface of the upper tarsus, for in a considerable proportion of cases there is nothing to be seen but uniform congestion and the finest sandy roughness of this part. This congestion may be uniformly capillary, the larger vessels being quite hidden, or the larger vessels may be the more obvious, there being then coarse congestion without much alteration of the normal smoothness of the conjunctiva. It is worth noticing that the congestion affects last and when not uniform is slightest at, a small linear part of the tarsus situated midway between the two ends and about 2 mm. from its ciliary border. The large vessels all converge to or radiate from this area, which is exactly the part where, as we shall see later, scarring begins in severe cases of granular lid. In the later stage of a slightly or moderately granular upper lid there is a varying amount of subconjunctival thickening, considerable papillary enlargement, usually much congestion and many whitish more or less prominent sago-grains. In the place of some of the latter small slightly depressed pale streaks or dots are often to be seen, indicating absorption of previously existing granulations. The whole lid at this stage has a peculiar mottled colour and irregularity of surface which are highly characteristic.

The relative development of the papillary and sago-grain changes vary greatly in cases of the degrees above described. In a good many instances all the papillæ are so much elongated as to form a surface like the pile of velvet, different patches or rows of papillæ often separating from one another and leaving fissures which appear at first sight to be cracks in the mucous membrane. There may be no sago-grains visible on the upper lids even if any are present, and those on the lower lids may be almost or quite hidden by the velvety hypertrophy of the papillæ. That the essential element in the disease, even in these cases, is the sago-grain granulation is I think certain in almost all cases. In most *early* cases sago-grains are obvious enough on the lower lids at least, and in many of these velvety cases they reappear much more clearly during conditions of partial cure when the papillæ have much diminished in size. The natural ending of the velvety type of cases is in a gradual condensation of the over-grown papillæ, followed by shrinking and devascularisation. There is at last left a pale surface, perhaps partly scarred

and quite smooth in some parts and in others occupied by small, pale, tough, firm papillary granulations, looking like coarse sand. These are most abundant and largest at and above the retro-tarsal fold of the upper lid. They often remain in this state for years, probably for life.

Hitherto the three elements in the disease, follicular granulations, hypertrophied papillæ and diffuse (? adenoid) infiltration of the conjunctiva and subconjunctival tissues, have all been more or less completely appreciable by obvious differences. Although the relative amount of each change has been seen to vary largely, still the sago-grain (lymphatic follicle) granulation is the primary and essential constituent in every one.

In the severer forms of granular ophthalmia, although the sago-grain granulation is an equally important primary change, the morbid action extends so largely to the papillæ and the other conjunctival structures that it is often quite impossible to distinguish between follicular and papillary granulations. The papillæ, which in an early stage of disease are increased more in length than width, become in the more aggravated conditions gradually thickened, until they form rounded masses indistinguishable either by size, colour, or apparent consistency from the true sago-grain bodies. In some cases the papillæ may be seen in all stages of enlargement on different parts of the same lid at the same moment. The subconjunctival tissues now always become more or less infiltrated with inflammatory material. The appearance of the conjunctiva at this stage, its surface thickly studded with large florid succulent rounded "granulations," needs no description. It is in this state that most of the patients seek hospital relief.

The final absorption of the effused products in these bad cases is always accompanied by the condensation of a part of it into firm, white, tendinous cicatricial tissue. It is unnecessary to describe in detail the form and arrangement of these scars, further than to mention that the chief one is almost always found as a linear patch or band midway between the inner and outer ends of the upper lid, between the centre and the free border of the tarsus and parallel with the latter. The precedence taken by this part in the retrograde changes is no doubt connected with the fact that it is the least vascular part of the lid. This point, as has been already mentioned, is beautifully shown in many upper lids when in a state of moderate chronic congestion. The depth of scarring depends chiefly on the degree to which the subconjunctival tissue has been implicated in the inflammatory process. Bad results from changes in the curvature of the lids and permanent shortening of the conjunctiva are likely to follow in proportion to the *depth* of the scar, and in proportion as it affects the oculo-palpebral fold. It must be distinctly borne in mind that scarring is the natural termi-

nation of granular disease, when at all severe, if not interfered with. From the constancy with which it occurs in cases of the same degree of severity, from the invariable occurrence of the chief cicatrix in exactly the same part of the lid and this the least vascular part, and from the fact that treatment of precisely the same kind as has been used in severe cases never produces similar scarring in mild ones, there can, I think, be no doubt whatever that most of the cicatrices commonly met with now, especially the worst ones, are due to the disease having been allowed to go on without sufficient treatment, not to the use of too powerful caustic applications.¹ The scars following the spontaneous cure of granular ophthalmia may be fitly compared to those following the disappearance of non-ulcerating deposits of lupus, or the spontaneous cure of nævi.

Symptoms accompanying Granular Ophthalmia.—There is the greatest variation in the subjective symptoms of this disease, a variation which bears no relation at all, in *different cases*, to the objective changes, although in the same patient this relation remains almost always constant. The great majority of children with abundant sago-grains on their lower lids and often a good deal of congestion and papillary hypertrophy, will tell you they have nothing the matter with their eyes. Generally there is no photophobia whatever. There is often more or less drooping of the upper lid from elongation of the tarsal ligament and this gives the patient a sleepy aspect. This total absence of discomfort is quite common even in much more advanced cases where the conjunctiva of the upper and lower lids is crimson, thickened and converted into a mass of mingled follicular granulations and enlarged papillæ. There is no redness of the exposed part of the ocular conjunctiva, but often, perhaps generally, the parts ordinarily covered by the lids are more or less congested. This condition is most intense at the oculo-palpebral fold where it merges into the redness of the palpebral conjunctiva; gradually diminishing, its last traces are seen in a few of the larger conjunctival vessels as they straggle towards the cornea. The state of congestion of the palpebral conjunctiva is

¹ Scars do sometimes result from ulceration of the conjunctiva produced by treatment, but these are different both in position, appearance, and character from those due to the natural cure of the disease. They are generally found on the lower lid near its centre in the form of short wide bands joining together two principal folds of the conjunctiva which is in this position very lax and often much plicated. They are always preceded by superficial ulceration, and this generally takes place on the two opposed surfaces of a sulcus in the folded conjunctiva, and is the result of a too free application of nitrate of silver or lapis divinus to that part. I have never seen any distortion of the edge of the lid follow them. It very occasionally happens that similar ulceration and scarring occur on a small patch of the upper lid from the same cause; these scars are, however, abruptly circumscribed, quite superficial, devoid of the peculiar tendinous glistening of the spontaneous scars, and especially have no uniform position on the lid.

often very accurately shown by that of the caruncle, which by its red fleshy aspect often reveals a condition that might otherwise escape notice. These remarks on congestion apply to children seen in the daytime. In examining a number of cases just after waking in the morning it is not unusual to find several with some congestion of the exposed ocular conjunctiva. This soon disappears, a result probably due in part to the constricting effects of exposure to cold air.¹ The permanent congestion of those conjunctival vessels which are constantly covered by the lids is caused partly no doubt by their being kept constantly warm, and partly also by their greater proximity to the chief blood-supply than those on the exposed part of the globe. In some cases there is photophobia; this varies in amount at different times in each patient, but generally remains for a very long time attached to the same cases. As far as my observation has gone photophobia generally bears some relation to the former or present existence of corneal ulceration. Probably in some cases constant winking due to photophobia (or more correctly to exalted sensibility of the conjunctiva) causes the ulceration in the first instance. In others an attack of phlyctenular ophthalmia sets up the intolerance of light for the first time. It is maintained in some cases partly by habit; whilst, on the other hand, the act of winking helps to keep up the conjunctival irritability which first gave rise to it.

The chief symptom remaining to be noticed is that of *discharge*. It is not quite so easy as it appears at first sight to prove the complete absence of discharge from the conjunctiva in a large collection of children. If there is any at all, it will be found early in the morning, before the face has been washed. It may either glue the lashes together into little pointed bundles, or if mixed with much tears may flow over the skin of the lower lid and dry into little

¹ Nocturnal attacks and exacerbations. Several interesting facts may be mentioned here. All observers agree in stating that attacks of purulent ophthalmia generally come on during the night, *i. e.* that the earliest symptoms are noticed on waking in the morning. It is also commonly mentioned that cases of acute ophthalmia of all kinds, including relapses, are worse in the morning than at any other time. This extends to the slightest cases and I have often noticed children who showed slight ocular congestion in the morning get quite well during the daytime. Even in health the eyes of many persons are a little "blood-shot" in the morning. The fact has often been used as evidence that contagion generally occurs during the night and through the medium of the air. It does not seem to me of much value for this argument, since the inoculation on this hypothesis must occur during the half hour or hour before the patients go to sleep. It appears much more likely to depend (putting aside cases due to cold wind) on the increased supply of blood which one would suppose must flow to the eyelids when the body is horizontal and the conjunctival vessels relaxed by the warmth following the closure of the lids in sleep. These would be the best conditions for the multiplication of a germ implanted during the previous day. No doubt the morning exacerbation during acute attacks is partly owing also to the irritation caused by pent-up discharge and tears.

white flakes like the dried slime of a fish, or may collect into a little pellet at the inner canthus, or may lie concealed in the form of a string or flake far back between the lower lid and the eyeball. From many careful and repeated observations of slight cases I have no doubt that in a large proportion of those whose palpebral conjunctiva is congested there is a slightly increased secretion of mucus. For practical purposes it does not appear of much consequence whether this mucous discharge proceeds from the hypertrophied tubular glands of the conjunctiva (Müller, Thiry), or from the epithelial cells shed from the general surface; probably it owns both these origins. It is of more importance to notice that it may from various slight causes become opaque and white or yellow from admixture with pus, that this change in quality (which is always accompanied by a slight increase in quantity) often takes place very quickly (in a few hours), and that it may quickly resume its former character and quantity. There is also sometimes increased secretion of tears so that some children's eyes always look "watery." The two kinds of secretion (mucus and tears) are not present in corresponding quantities; in some the discharge is always "watery," in others always "gummy." A great many cases never go beyond the following symptoms:—slight mucous and watery discharge; occasional slight ocular congestion and perhaps a little transient photophobia; constantly more or less congestion of the caruncle and of the larger remote¹ ocular conjunctival vessels. These may coexist with very granular lids. The course of the symptoms and the limits within which they vary, are as a rule remarkably constant in each child; but there is no fixed relation between them as occurring in different children. It is certain that many children with badly granular lids continue for long (probably several years) to show a little discharge, and that this in the same child will repeatedly go through the same changes, becoming at one time slightly purulent for a few days and then again diminishing to a mere trace of translucent mucus, and remaining in that state for weeks. There are others who (if not under treatment) constantly have rather more discharge, so that their lids will be generally glued together in the morning and more or less discharge will collect within the lower lids or at the inner canthi during the day. Beyond these, again, is another group in which the discharge, as a rule, gradually increases soon after treatment is omitted and at length becomes profuse and purulent, accompanied by ocular redness and often by photophobia; here, as in the slightest cases, the symptoms bear no fixed relation to the *degree* of granular disease. Whether the discharge in these two groups of cases is to be looked upon as the normal result of the uninterrupted granular disease, or, on the other hand, as having

¹ *i. e.* remote from the cornea.

originated in a superadded contagion or in some irritation of the conjunctiva, the cases are for clinical purposes distinct from those in which there is never any, except very slight mucous, discharge, and will be best considered under the subject of contagious ophthalmia. It may be mentioned here, however, that the majority of these cases of persistent discharge occur in young children (from three to eight), and that from the constancy of the symptoms in each case it is almost certain that the gradual relapses which occur in them, after treatment has been omitted, are due to the return of that morbid action on the part of the conjunctiva which had been much reduced and kept in check by local applications.

Termination and results of the Granular Disease.—There is much difficulty in ascertaining the proportion of cases in which permanent injury to sight is a result of granular lids, and notwithstanding all that has been written there is, I think, still some misapprehension on the subject. While fully admitting the very serious consequences to sight which result from ulceration of the cornea and pannus in bad cases of granular lids and going so far as to say that a considerable proportion of the opacities met with in children are due directly or indirectly to this disease, I think it is an error to assume that such consequences follow the majority of cases of granular lids. From what has come under my own observation I can have no doubt that the opinions expressed on this subject in various forms by many army surgeons are substantially correct and that most cases of moderate or even tolerably severe granular ophthalmia pass through their stages, recover, with or without scarring, and are not afterwards followed by any harm whatever. No doubt almost all cases of partial and complete pannus and of organic entropion, and some cases of trichiasis and of changes in the position and size of the lachrymal puncta and canaliculi, are the results of granular ophthalmia. So long as the lids, especially the upper lids, are considerably roughened, either by chronically enlarged papillæ alone, or by a mixture of sago-grain and papillary granulations, or by prominent rigid cicatrices, there is always a risk that they may set up ulceration of the corresponding part of the cornea with development of vessels in its superficial layers. Cases of repeated superficial ulceration of the cornea, resulting in numerous facets, are also not uncommonly the result of granular ophthalmia complicated with severe ophthalmia tarsi. There is also the risk that, short of these results, granular disease may bring on prolonged and repeated photophobia of a degree quite enough to interfere with everyday occupations. When all these have been allowed for, however, there will still remain a large proportion in whom no serious results happen during the several years that the children stay in the schools. It is stated that entropion comes on as long as ten or twelve years after chronic granular ophthalmia (Snellen). Without questioning that this may occur in

certain cases, I venture to think that without much qualification such a statement is apt seriously to mislead. I have seen a great many children whose eyelids are extensively scarred by this disease, some of them having certainly (from their history) been in this condition for several years, who suffer no inconvenience and in whom, though I have had them under constant observation for twelve months, not the slightest alteration has occurred in the curvature or position of the lids.

From the very long course of the disease and the erratic habits of patients, it is practically out of the question to follow cases to their termination in civil hospital practice. The same objection applies in a great measure to poor-law schools, where the children are sent out to service when fit and of proper age and it becomes difficult to trace them for more than a short time afterwards. Some of the worst cases come under care again at the ophthalmic hospitals; but then it is not of the worst cases that there is any question. It is in respect to the cases next in order of severity, where there is disease enough to produce permanent change in the structure of the palpebral conjunctiva and subconjunctival tissue and not infrequently to invalid the patient for a long time unless under treatment, but in which the permanent detriment to the cornea is generally either slight or nothing, that the completion of the clinical history is most wanted. Cases of this degree form a very large majority of those who come under the surgeon's hands for ophthalmia in our pauper schools, and probably also in the army. It is likely that the older inmates of workhouses would furnish as fair a field for inquiry on this question as could be found. Among them we should not expect to find many persons to whom the disease had proved extremely serious, for probably in many of these life would be indirectly shortened by the malady while others would obtain provision from various charitable bodies or by pensions. If it were the case, however, that any considerable number of poor persons had once suffered from the disease in tolerable severity but had not received from it any permanently disabling result, we might expect to find a fair sprinkling of them among the ordinary old and "infirm" inmates. A full inquiry of this kind would occupy much more time than has been at my disposal for the purpose, and I therefore give the results of such inquiries at two of the workhouses rather as indicating the direction in which a useful investigation might be made than for the purpose of drawing final conclusions. So far as they go, however, the cases given below confirm the hypothesis that attacks of granular ophthalmia (complicated or not with purulent ophthalmia), severe enough to give rise to considerable scarring of the tissues of the upper lid, are often not followed by any remote ill consequences from the slow contraction of the scar.

The following table shows the remote effect on the curvature of

the eyelids, direction and growth of the eyelashes, and functions of the lachrymal puncta and canaliculi, in twenty-one persons (for the most part forty years old and upwards) whose eyelids showed more or less scarring the result of previous attacks of granular ophthalmia. The inquiries were made at two metropolitan workhouses, from the medical officers of which I received permission to examine the eyelids of every inmate. The method adopted was to ask each person whether he or she had ever had "bad eyes" of any kind. If the answer was "no," and there was no distortion of the eyelashes, epiphora, thickening and redness of the edges of the lids, or discharge, I usually did not evert the upper lids. Whenever, from the answers given or from external signs, a previous attack seemed probable, I always examined the inner surface of the upper lids. In almost every inmate I looked at the inner surface of the lower lids.

Besides the cases tabulated below, which include all in which there was scarring of the palpebral conjunctiva, there were a good many cases of the chronic ophthalmia common in old people, characterised by thickening of the free borders of the lids with or without alterations of the puncta and lashes, sometimes with muco-purulent discharge and chronic thickening of the palpebral conjunctiva, but in no case with scars on the inner surface of the lids. These are not included in the table.

In examining the upper lids for conjunctival scars it is necessary to be aware that the appearance of an incipient linear cicatrix in the typical position already mentioned may be rather closely imitated by the blanching, due to pressure, which often occurs at exactly the same part while the lid is everted. Now and then I have found it almost impossible to be certain whether there was or was not any actual scar, but in the great majority of cases it is only necessary to be aware of the fallacy in order to avoid it.

The number of inmates so examined was about 400 in one workhouse and 450 in the other. The great majority of those examined were more than fifty years old.

No. Sex. Age.	Race.	Scarring of upper lids; extent, &c.	Date of attack.	(Present effect on margins of lids and lashes, &c.	State of corneæ.
1— F. 68	Irish.	Both upper lids and both lower lids.	"Blight" 15 years ago; never before.	None.	Old nebulæ.
2— F. 87	Irish.	Both upper lids very extensively scarred.	Bad eyes on and off since age of 20.	Slight sycoosis tarsi; no distortion.	Clear (has cataracts).
3— F. 39	Irish.	Right upper lid scarred, and still somewhat rough.	Eyes bad for first time 19 years ago (at age of 20); never before.	None.	Right somewhat vascular and nebulous; left very nebulous.
4— F. 70	Irish.	Both upper lids slightly scarred, and still some roughness.	Cannot tell; memory bad.	None.	Clear.
5— F. 68	English.	Right upper lid scarred.	Says eyes were never bad till 2 years ago; probably incorrect.	None.	Clear.
6— M. 50	Born in London. Parents Irish.	Both upper lids well-marked scars, still some roughness where not scarred; minute scars on lower lids also.	At æt. 10 had bad eyes for 2 years in a workhouse-school; got well and earned a good living for self and family. At æt. 35 had second attack and was disabled for 2 months; since then well.	None.	Clear.
7— M. 86	English.	Slight scarring of right upper lid; both upper lids red and thickened by papillary granulations.	"20 years" ago had "sore eyes" on board a man-of-war (probably more than "20 years" ago).	None.	Clear.

8— F. 48	English, but father Irish.	Well-marked scar of left upper lid; right eye lost and shrunken, probably by a violent attack of same disease, but attributed by her to "nitrate of silver," running into it while the inflamed left eye was being treated.	Bad eyes 31 years ago (at æt. 17); were bad on and off till æt. 26; since then no trouble at all.	None.	Left clear.
9— M. 68	English.	Right upper lid slightly but definitely scarred.	51 years ago (æt. 17) inflammation of right eye for "6 months" on board ship.	None.	Right cornea slight central haze and a very marked arcus at upper part; left clear, except moderate arcus. Large diffused haze of each, but no vascularity.
10 M. 33	Irish.	Slightly irregular but definite scarring of both upper lids.	Eyes bad about 13 years ago for 3 years, while in New Zealand Army; discharged from Army for defect of sight in consequence. Operation (probably peritomy), by Mr. Hutchinson, 8 years ago; eyes as good as now 7 years.	None.	
11 M. 68	Irish.	Well-marked scar of both upper lids; rest of each lid somewhat rough.	Does not know that he ever had bad eyes.	Slight marginal blepharitis; edge of each upper lid a little straightened by shortening, but no inconvenience.	Clear.
12 M. 60	Irish.	Well-marked scars on both upper lids.	30 years ago (at æt. 30) had bad eyes for "10 weeks."	None.	Slight haze of a narrow segment of upper part of each, but no interference with vision.
13 M. 70	Irish.	Very extensive scarring of both upper lids.	17 years ago had "bad eyes," brought on by getting a "blade of wheat into left eye whilst in the harvest-field;" never before or since.	None.	Left, large leucoma and anterior synechia from perforating ulcer; right, slight central haze and probably old iritis.

TABLE—continued.

No. Sex. Age.	Race.	Scarring of upper lid; extent, &c.	Date of attack.	Present effect on margins of lids and lashes, &c.	State of corneæ.
14 M. 73	Irish.	Patchy scarring and old granular lids; all the lids intensely congested.	Bad attack 3 years ago, "could not see for 3 months;" was under treatment; eyes liable to "stick" in the morning for about 12 years.	None.	Clear.
15 M. 64	English. Parents Irish.	Very extensive scarring of both upper and both lower lids.	"Blight" 10 years ago, whilst in a workhouse; "15 others" had bad eyes at same time; his eyes were bad for "5 years, and for the last 5 years or so have been as well as now, and free from discharge;" says emphatically that he had no treatment of any importance.	None (perhaps slight shortening of the oculo-palpebral part of conjunctiva, but not enough to do any harm).	No note.
16 M. 30	English. Parents Irish.	Left upper lid only has well-marked linear scar in usual place; lower lid nearly normal; right lids normal.	8 years ago inflammation of left eye after getting lime into it.	None.	Large old haze from inner margin to centre.*
17 M. 37	English.	Slight scarring in usual position in both upper lids; much redness and thickening of whole conjunctiva.	7 years ago had inflammation; fresh attack lately.	Slight eversion of edge of each lower lid; bad old syco-sis tarsi and loss of lashes.	Old central haze of each.
18 M. 22	English.†	Superficial reticulated scars of all the lids and in left upper lid a well-marked linear scar in usual position.	Was never in the infirmary for "bad eyes" and does not admit that they ever were bad.	None.	Perfect.

19 F. 41	Irish. Slight scar on right upper lid in usual position; conjunctiva of all the four lids very red and thick but not granular.	No definite history of inflammation; probably began as sycosis tarsi, which has spread to the conjunctivæ; left eye "hazy" for "12 years."	Entropion of both upper lids; left the worse.†	Left, a diffused haze.
20 F. 53	English. Right upper lid extensively scarred all over the tarsus, and scar especially dense in usual position; lower lid also much superficial scarring.	7 years ago both eyes bad for "4 months," right was worse; treated by "caustic" to insides of lids, at Charing Cross Hospital; since then quite well; no relapse.	None.	Extensive arcus, wider at the upper segment, and probably there in part due to former ulceration from granular lids.
21 F. 43	Irish. Moderate scarring of right upper lid in usual position; still some old pale papillary granulations on both upper lids.	"20 years" ago eyes "weak and watery" for "12 mos.," never very bad.	Edges of lids thick, and lashes a little distorted, but no inconvenience.	Clear.

* The corneal haze here is doubtless due to direct injury by the lime. Probably the scar on the lid being in exactly the position for granular ophthalmia is due to that disease, greatly aggravated and made active by the lime injury.

† Brought up in a London workhouse-school from æt. 2 to 16. Always weakly. Now phthisis. Memory good; remembers correctly some details about the school. May have had a bad attack when very young, but if so it would probably have lasted long enough for him to remember something about it. Probably a case of pure uncomplicated granular ophthalmia of considerable severity which never produced subjective symptoms.

‡ The entropion is worse in the lid which shows no scar.

In granular ophthalmia, more than in many other diseases, it is necessary to be very cautious in giving a prognosis from a single examination of the patient. The relation between the organic changes and the symptoms is so variable in different persons that a mere view of the conjunctiva, however careful and minute, will form a very incomplete basis for an opinion of the patient's future prospects. The following points will be of much service:—1. The approximate duration of the disease, if it can be ascertained; the future risk of serious symptoms or secondary structural changes will be small in proportion to the length of time that has already elapsed without them. 2. The present existence of subjective symptoms; these, if present, damage the prognosis, since the liability to them (*cæt. par.*) becomes greater after they have once appeared than it was before their first occurrence. 3. The same rule applies to corneal opacities and ulcerations; a large majority of ulcerations occur as relapses in patients who have already suffered from them. 4. The presence of ophthalmia tarsi (sycosis tarsi) in addition to granular conjunctiva increases the risk of corneal ulceration, as well as the liability to alterations in the curvature, &c., of the lids and lachrymal puncta.

Causes of granular ophthalmia.—Although this disease has long been known and more or less perfectly described, no great care seems to have been bestowed on its etiology until it began to be recognised as forming a very important element in the epidemic ophthalmia which has occurred in most of the European armies since the year 1800, and which has been a serious disease in Egypt and some other hot countries for centuries.

Granular disease, as distinguished from contagious ophthalmia, was well described as a prevalent one among large collections of men by O'Halloran, in 1824. In speaking of the common error of comparing the "granulations" of this disease to those of an ulcerated surface, he says, ". . . . we see in the eyelids of persons who never suffered from the disease (*i. e.* purulent ophthalmia) an appearance similar to what is commonly designated 'granular.'" He goes on to say that this may be verified in "any body of men, viz. a military corps or regiment." And again, "In every large body of men persons are to be found whose eyelids are overspread with villous flocculencies, or fungous productions analogous to what has been denominated 'granulations,' notwithstanding that from youth they may have enjoyed health or absolute immunity from the affection under notice." After describing with some accuracy the chief varieties in the appearance of granular lids, he has the following passage as to the nature of the disease. The granulations are "simply enlargements of a fungous nature from the glands and vessels; the former, if I mistake not, being far more numerous than has been supposed;¹ that similar enlargements take place in scrofu-

¹ He does not seem to know that J. B. Müller had, in 1821, concluded that con-

lous habits where the glands in other parts are diseased; that in such cases the affection of the glands of the eyelids is sometimes the cause, and not the effect, of what is called inflammation." The full importance of follicular or "vesicular" granulations as predisposing to severe attacks of conjunctivitis was not pointed out till some years later. They were accurately figured by Eble in 1828¹ and described by him as forming the first stage of contagious ophthalmia, and in 1839 Hairion gave them an important position in the disease. The fact, now universally admitted, that they especially predispose to attacks of severe ophthalmia, was observed by Loëffler in 1848, and has since then been abundantly confirmed.

The gradual discovery of the important rôle played by these granulations in the destructive ophthalmia of European armies led to the assumption in the first place that they, as forming one of the symptoms or results of the so-called Egyptian ophthalmia, had been imported into Europe from that country about 1800. When it was at length discovered that they are not the result of purulent or other acute forms of conjunctivitis it was asserted by many authors that two distinct diseases of the conjunctiva had been imported into Europe from Egypt — the vesicular granulation, or "vesicular exanthem of the conjunctiva," and purulent ophthalmia. With regard to various forms of acute conjunctivitis, it was allowed that they had been known to occur both sporadically and epidemically in Europe long before the Anglo-French Egyptian campaign; but it was contended that granular ophthalmia proper, not having been described as a prevalent disease, could not have existed in Europe (or at most only sporadically) until introduced from Egypt, and that, in fact, it had been so introduced. Inasmuch as the true nature and importance of vesicular granulations was not discovered until long after the alleged importation of the disease from Egypt, it was thought by some that descriptions of similar appearances by early authors could not safely be taken as referring to the disease in question. Further, it was held that the negative fact of these granulations not having been noticed by modern observers in a given country until the occurrence of severe ophthalmia in the army or civil population of that country drew attention to the subject, was equivalent to proof that they had no existence until they were seen. That granular ophthalmia was introduced from a distant part and afterwards spread very widely among the military and civil populations of almost every European country, necessitated the doctrine of contagion, and we accordingly find that several authors adopted, with some modifications, Thiry's hypothesis of a special

tagious ophthalmia was "a disease of the mucous glands of the eyelids." *Congrès d'Ophthalmologie*, 1857, 'Compte-Rendu,' p. 291. I have not yet been able to examine the treatise of 1821 here referred to.

¹ These are the best illustrations I have seen.

“granulous virus.” This was supposed to be generated in the vesicular granulations and thence to escape into the air in a “gaseous state” after their rupture (Landau), and to propagate itself both by direct aerial infection and by contaminating bedding, clothes, &c., from which it might again be given off in an active state after as long a period as three years (Hairion). It was further asserted that the disease never originated *de novo* in Europe, its origin in this way being confined to Egypt, and, perhaps, some other hot climates. To this a few authors added the still more startling proposition that it was a constitutional blood-disease.

Many writers have now abandoned the theory that contagion is the cause of follicular granulations. The expressions in most of the text-books are now to the effect that granular ophthalmia is contagious when accompanied by and in proportion to the amount and purulence of the discharge.

Although evidence that granular ophthalmia existed in Europe before the date referred to would not weaken the hypothesis that it is contagious, this would be the effect of evidence showing that other more probable hypotheses would account for the facts equally well without recourse being had to a supposition which is quite without parallel in pathology.¹

It is difficult to understand how the evidence that this disease was present in Europe prior to 1800 can have been disallowed by any one. Many authors have asserted it and quoted early writers in support of their opinions, among the most recent of these being Welch in his very able and valuable paper in 1869. As there is still some want of conviction on the subject however, it may not be amiss to repeat some of the best known evidence, much of which has been quoted in a more or less scattered form by various authors.

The accurate description of the various kinds of trachoma given by Aetius, including an account of one kind which can refer to no other disease than vesicular granulations, I omit, as it is probable that his experience was drawn largely from oriental countries where, as in Egypt, it is admitted by most authors that the disease has existed for centuries. Scheffer’s brief description (1678) of an ophthalmia in Lapland can scarcely refer to any other disease, since it may be safely asserted that granular ophthalmia is an essential part of any permanently endemic eye disease which destroys or seriously injures the sight of a large number of persons in a given

¹ The hypothesis (unconfirmed by demonstration, as in ringworm, &c.) is that a contagium is given off by a very small part of the mucous surface of the body in a state of extremely chronic and purely local disease, of so volatile, active and long-lived a nature as to be capable of infecting the great majority of those exposed to it, and of being transmitted, after long preservation, through the medium of infected objects.

country or locality. He says, "Diseases of the eyes, which they inherit in an inflamed, watery and bleary condition, is their commonest malady, and is very often followed by loss of sight. The smoke with which their cabins are always full, summer and winter, and the light of the fire, in the front of which they sit all their lives, cause this disease." The next instance, occurring in Ireland, though more detailed and circumstantial, may be objected to on the ground that a mere acute purulent ophthalmia would have caused the same results. This is, however (as in the case above quoted), so unlikely in a civil population living under their ordinary conditions, that it may be put aside. It was doubtless an epidemic of purulent ophthalmia in persons who were already the subjects of granular disease. The instance referred to is mentioned as follows by Mr. (now Sir) W. R. Wilde:—"So long ago as 1701 an epidemic of this nature (*i. e.* destructive ophthalmia) broke out near Castle-town-delvin, in the county of Westmeath, by which vast numbers lost their eyesight." It is much to be regretted that the original manuscript by Sir Thos. Molyneux should not have been published under Mr. Wilde's direction; it is entitled, 'Queries proposed by Dr. T. Molyneux to John Hill, curate of Castle-town-delvin, in the county of Westmeath, concerning the extraordinary distemper that took away the sight of many in that parish.' It occurred, like many subsequent epidemics, during a time of general distress in Ireland, during which many thousand woollen manufacturers had to emigrate for want of employment, and "the whole kingdom was reduced to the greatest poverty and distress." Sir Wm. Read was evidently acquainted (about 1710) with various kinds of granular lids, including primitive vesicular granulations, eyes so affected, showing "an inequality and roughness of both the eyelids in their inward part, with an hard ruggedness, as if the seeds of millet were within them." The last comparison would be still more valuable if it were not identical with that used by Aetius. Maitre-Jean, in 1740, described granulations on the lids; and a year later St. Yves, writing on 'Tetter of the Eyelids,' says, "if the *eyelids* be turned out they appear red in their *inside*, and seem to have *inequalities* somewhat like the *small grains* of figs."¹ In his inaugural dissertation (1751) Koenigsdoeffer describes soft, yielding, but solid, prominent "tubercles" on the inner surface of the eyelids. He adds, in order to distinguish them from the villous lid and the harder granular lid of Aetius, that in the disease he was describing "there was no roughness of the lids." He gives (p. 10) a case of general scrofula in which the eyes had been inflamed for two years, and "the morbid matter of the disease having gone to the eye, had not only affected the Meibomian glands but had raised tubercles on the inner mem-

¹ The word "sycosis" was used by the very early writers to designate advanced and prominent granulations on the conjunctiva.

brane of the eyelids, which appeared to increase the inflammation of both eyes excessively." The glands in the palpebral conjunctiva (which he carefully distinguishes from the Meibomian glands), are, he says, more easily seen in the lower animals than in men, are found all over the upper lid and on a part of the lower lid, "consist of very close and minute lenticular particles, varying in size and shape," and they "secrete serous and not sebaceous matter." It is extremely probable that granular disease existed among the horses of Ireland more than a century ago. In the winter of 1750-51 there was in Ireland "a universal catarrhal fever among horses;" "and many of the labouring horses who had this disorder suffered so much in their eyes as to have become blind." The same thing occurred again in 1760, and, writing two years later, Rutton says it was computed that one horse in every ten affected had been permanently blinded. Lymphatic follicles are known to exist in the normal conjunctiva of the horse. The 'Trachoma herpeticum' of Plenck (1783) clearly refers to vesicular granulations.

The above extracts appear to show that granular ophthalmia in all stages and varieties was well known in several widely separated European countries between one and two hundred years ago, and that consequently it does not own an Egyptian origin. Whether it was relatively as common then as now it is impossible to say, but it would probably not be so if the best supported theories of its cause are true. The negative fact that it was not known to be prevalent is of no value considering the state of medical knowledge at that time. Nor can I attach any great importance to assertions that it was unknown in Strasburg till 1851 (Stoeber), in Belgium till 1814 (Hairion), in Algeria till 1859 (Hairion, Furnari), in Denmark till 1848-51 (Bendz), in Russia till 1816 (Kabath), &c. We are nowhere told that vesicular granulations had been carefully looked for and found absent, but only that they had not been observed until a severe outbreak of contagious ophthalmia drew attention to the state of the conjunctiva in those who were supposed to be healthy. In the case of Algeria, moreover, statements differ, and even the same author gives evidence in one part of his works which is inconsistent with assertions in another. Thus Furnari, while denying its existence in Algeria in 1859, describes sequelæ of ophthalmia (granulations, pannus, entropion) in that country in 1844 which leave little doubt that the true granular disease was at the latter date far from rare. Cuignet, in his recent book, maintains the identity of Algerian and Egyptian ophthalmia and believes that it was well known in Algeria long before the French conquest, which was, according to Hairion and Furnari, indirectly the means of its introduction into that country by way of Europe.

With respect to the contagious character of granular ophthalmia

there are various shades of opinion. Some observers hold that not only are follicular granulations caused by contagion and in no other way, but that the contagium is not of necessity associated with any perceptible conjunctival discharge, is given off by the simple sago-grain granulations, becomes volatilised and acts at a distance, and may have a long period of latency in the conjunctiva. To this a few add that the virus may be absorbed by the pulmonary mucous membrane as well as by the conjunctiva, and that the disease is a constitutional one. Others, who do not go to this length, believe that though the granulations are caused by contagion, the contagium does not exist or cannot act unless there is conjunctival discharge, and that this is indistinguishable from the product of an ordinary conjunctivitis (*i. e.* inflammation of a non-granular conjunctiva), except by its specific power of reproducing vesicular granulations. According to a third school, contagion is only one out of several causes of granular disease, and also requires purulent or mucopurulent discharge as its condition of action. A fourth group maintains that contagion has no part in the matter, that follicular granulations are due to various faults in the conditions of life and will always be reproduced when those conditions are allowed to come into play. De Condé and Schmidt, in 1841, held that granular ophthalmia should be compared to typhus in being a blood disease of which one attack was protective against a second, and attempted without much success to support this position by statistical and clinical evidence intended to show an antagonism between this disease and typhus, dysentery and intermittent fever. Many others, such as Müller, Bendz and Hairion,¹ held that it was a local specific disease propagated by aerial infection, with a period of latency during which the granulations, though invisible to the naked eye, might sometimes be detected by a lens and were at any rate liable to grow and become active on very slight provocation; and that "it is transmitted without the conjunctiva being the seat of any visible morbid secretion, solely by contagion, and generally by miasmatic means" (Bendz), by the agency of a special "granulous" or "vesiculous virus." Marston and Frank, though they do not express themselves in so unreserved a manner, appear to hold very much the same opinion, as also do the French editors of Mackenzie's treatise. Thiry may be taken as the leading exponent of the second school. According to him the "granulous virus" is the product of a peculiar, though acute and virulent, inflammatory process, and has for its result the formation of granulations and reproduction of the same specific purulent discharge. He considers that true granular ophthalmia is the result of an acute process, and does not admit "vesicular" and "fleshy" chronic granulations within the pale of

¹ Dr. Hairion was still of the same opinion in 1873.

the true disease. Wecker represents the third school when he states that granulations are contagious because of the purulent secretion accompanying them and in proportion as this approaches the characters of pure pus, while granulations unaccompanied by discharge are but rarely contagious. An almost identical opinion is expressed by Stellwag, and other recent writers appear to take nearly the same view. The ordinary cause of chronic granulations Wecker places in prolonged exposure to air rendered impure by overcrowding, though he does not specify which constituent, if any in particular, of this impurity is the actual cause. Soelberg Wells is still rather ambiguous, and "has little doubt that vesicular granulations are contagious," with the qualification that this is especially true when they are accompanied by swelling of the conjunctiva and by a little muco-purulent discharge. Overcrowding and prolonged exposure to impure air, to which some add exposure to smoke and the exhalations of domestic animals, are mentioned as the cause, with more or less clearness, by Rust, Scheffer and many other early authors, and more recently by Anagnostakis (1857) and Schweigger (1870), and by many of the authors who believe that contagion is in part a cause. The view that contagion plays no part at all in the causation of follicular granulations was more distinctly put forward by Welch in 1863 and again in 1869. He concludes against contagion on account of the almost invariable symmetry of the disease and because it does not spread among a body of men in any relation to the facilities for direct contact. The argument from symmetry would be worse than worthless if directed against infection through the air at a distance or by fomites, but is of some value as against direct contagion. The second reason is a very potent one. He gives much evidence in favour of the intimate relation between nocturnal impurity of air in dormitories and the appearance of vesicular granulations, and thinks it probable that living habitually in an atmosphere contaminated by organic matter (not, as he is careful to say, epithelial or pus-cells) is the actual cause, but that warmth and moisture of the air are essential conditions of its action. Dr. Leith Adams also concludes in favour of crowding and bad ventilation, and mentions habitually impure air in bed-rooms as a possible cause of the disease among persons living under apparently good hygienic conditions. Brudenell Carter suggests that the decomposing organic matter contained in fustian may have something to do with the greater prevalence of the disease among the boys than the girls in schools. Many firm contagionists are also believers in the great importance of anti-hygienic conditions, especially Marston, whose conclusion "that the state of the conjunctiva offers a delicate test of the hygienic state of a regiment" has almost passed into a formula.

Welch's hypothesis, supported as it is by many careful observa-

tions, that excessive moisture of the air is essential for the production of vesicular granulations, if it be not the cause itself, appears to me a very important one, more especially as it bears out the opinion so very often expressed by authors, that moisture is one cause and an important one, of various forms of epidemic ophthalmia. I shall therefore go somewhat into detail in the quotation of opinions and facts bearing on this subject, keeping to such as refer to or at least include in their account granular ophthalmia, as well as the forms of conjunctivitis proper.

One or two negative facts may be conveniently mentioned first. Such negative evidence is not altogether free from fallacy, since in a country where the soil and air are generally very dry the population is almost sure to be thin, and thus there will be an absence of other probable causes besides damp. In Egypt, Power and Anagnostakis tell us that the Arabs of the Desert parts, "where the heat is intense but the air very dry," do not suffer from ophthalmia; and Burton says the same with respect to the inhabitants of Western Arabia. "Every one knows," he says, "that ophthalmia is unknown in the Desert, and the people of El Hajez, who live in an atmosphere of blaze and sand, seldom lose their sight." Ophthalmia is well known to be very common and severe in Algeria, but Lustreman tells us that the inhabitants of the mountains and sandy plains of that country are free from it.

The evidence as to the effect of moisture (both of air and soil) may be divided into two parts. First, there are the general facts as to the prevalence of the disease in countries which are habitually moist and in damp districts or towns in otherwise dry countries; and secondly, some more precise statements as to the observed effects of moist or dry climates or localities on the conjunctiva of persons living there. The second part is more scanty, and perhaps not always so reliable as the first. Evidence of the first kind is of course not free from fallacies; nor do I wish to attempt anything like a complete exposition of all the facts that might be collected but only to mention some well-marked instances pointing in this direction. The two most important fallacies are, that the largest and most crowded cities are usually built on low and more or less damp sites, and that acute catarrhal forms of conjunctivitis are also extremely common in damp changeable climates and sites, so that it is often impossible to distinguish, from a written account, how much of a prevalent ophthalmia is due to them and how much to granular disease.

A very striking instance of a habitually damp country where granular ophthalmia is known to be very prevalent is Ireland. It is far commoner among the Irish than either English or Scotch, so much so that the tendency to it is not only permanent in natives of Ireland wherever they live, but is to a great extent hereditary, the

children of Irish parents being much more subject to it than those of some other races, even though they do not live in Ireland.¹ Egypt furnishes another equally prominent and instructive instance, although less simple, the element of moisture being there combined with other agencies which are more or less prejudicial to the conjunctiva, especially dust and intense light and heat. It is the case, however, that in Egypt ophthalmia (of which the granular disease is as important an element as in the ophthalmia of Ireland) is most abundant in the dampest parts of the country. According to Dewar and Power almost the only parts of Egypt which remain wet all the year round are at and near the rice-grounds; and the latter author tells us that "those employed in the cultivation of rice are peculiarly affected with blindness." The soldiers of the French Army suffered less from the disease in Upper Egypt in the dry season than those in Lower Egypt (Dewar). The "warm and moist climate of Egypt" is considered by Landau to be the birth-place of the "vesiculous virus." According to Anagnostakis the atmosphere of Lower Egypt during the flood period of the Nile is extremely damp, and in Alexandria, he says, this dampness prevails from the end of spring till November.² Scoresby Jackson makes statements of a similar general character with respect to the atmosphere of Lower Egypt, and especially of Alexandria, as compared with that of Middle and Upper Egypt. In Algeria "low and damp country" is specified by Cuignet as one of the most powerful predisposing causes of ophthalmia. Furnari describes the dwellings of some of the Arabs in Algeria as "swimming in mud" in the winter. Laveran says that purulent ophthalmia in this country affects particularly the "planters of the low unhealthy villages, the Arabs of the towns, and especially the inhabitants of the oases crowded together in infected huts built on a wet soil under the palm trees." According to Lustreman those Arabs of Algeria "who live in the damp coast stations, or in huts surrounded by water in the oases, show all the ocular changes which have gained for Cairo the title of the city of the blind." In Malta, where granular ophthalmia has since the beginning of this century (and probably long before) been very prevalent, Hennen says that the air in autumn is excessively moist and hot, and that the island is by no means free from marshy districts, between two of which Valetta is situated. Suez, where ophthalmia is sometimes very destructive, is also subject to inter-

¹ I first learnt these facts from Mr. Hutchinson.

² The Nile begins to overflow its banks in Egypt about two months after the summer solstice, *i.e.* about the end of the third week in August. The inundation continues for two or three months, more or less, and its bad effects have ceased by the end of November. — 'Encyclop. Brit.,' Article "Egypt." Scoresby Jackson. 'Medical Climatology.'

mittent fevers and is situated on or close to a large swampy surface of seashore which is left bare at certain seasons. Florio is emphatic on the efficacy of damp air and buildings as one of the most important causes of the disease. The coincidence of prevalent and prolonged ophthalmia among soldiers with an especially marshy and foggy site on the plain of Marengo, where intermittents and dysentery were common, is mentioned by Carron du Villards.

Of more precise statements we have the recent and valuable observations of Welch to the effect that in a given regiment, while living at Malta in barracks where a high rate of aerial moisture was, among other bad conditions, pretty constant, follicular granulations increased vastly; although even here they varied at different times according to the quality of the barracks occupied and were, as a rule, worst in those "companies" which occupied the worst ventilated and dampest quarters. When the same men were moved to New Brunswick where, among other things, the air was on the average much drier than at Malta, the disease receded in those previously affected and did not occur in any who had been free from it in Malta. The same was the case also with a number of men who were sent from the home *dépôt* to join the regiment in New Brunswick; their lids, which on their arrival in Canada showed nearly half to be affected, very much improved while there. The first recorded severe outbreak of ophthalmia in Portugal was in a large school of several hundred boys and girls who lived in a dark and damp underground building. Dr. Massy in 1851, says of Athlone (in county Westmeath, Ireland), that "the atmosphere is perhaps the dampest that I have ever experienced, except, perhaps, in India, during the rains;" that it "is well known as a locality where ophthalmia constantly prevails," and that almost every regiment quartered there suffers from it. The 31st Regiment, of which he is writing, had suffered slightly from the disease before being quartered at Athlone in 1848, but after being there nearly twelve months the disease became much more prevalent among the men, and during the next year some very severe cases occurred. Hennen gives interesting details as to the effect, in Malta, of moist air in aggravating half-cured cases of military ophthalmia. In 1807 Mr. Vetch drew up a special report on the effect of moisture on ophthalmia, in which he gives many interesting details of the bad influence of damp localities and foggy wet weather on cases of military ophthalmia in Kent, and the benefit of drier situations and dry weather in favouring the recovery both of chronic and recent cases. In his opinion the hottest weather is best for convalescents, *if clear and sunny*. He thinks the greater moisture of England accounts for the disease having been more violent and destructive in the Army in this country than at Gibraltar, and, as he thinks, even than in Egypt.

In the case of the Metropolitan pauper schools, it is worth while to remember that their inmates have in the majority of cases not only lived in much overcrowded houses, but are also natives of the Thames valley. It is true that several of the schools which have suffered most from the disease are situated on a level much above the Thames, but there may be other facts which would diminish the value of this objection. It is not impossible that a difference of climatic aerial moisture may have some share in the absence of troublesome ophthalmia from many pauper schools in the country districts. Excess of moisture is, under ordinary conditions, a constant constituent of air rendered impure by animal respiration, so that it is quite possible for persons who spend a large part of their lives in ill-ventilated rooms to be thus exposed to the effects of moist air, even though the climate of the country or district may be dry. It would be worth inquiring whether persons (especially children) who work in hot, dry rooms where the air is not often changed,¹ show a smaller average of follicular granulations than others living in the same place but employed in other ways.

Whether the essential cause of follicular hypertrophy be moisture, either of air or soil or both, or some form of organic matter as Dr. Welch and many others suppose more likely, there can I think, be little doubt that moisture is an important condition in the development of the disease, and that in all probability it would be practically exterminated if the air habitually breathed could be kept dry enough.

It is of practical importance, even at the present time to determine whether pure granular ophthalmia is contagious or not, and to my mind the evidence is quite conclusive against this view. All the known facts go to prove that, whatever may be the cause, lengthened exposure to it is requisite (probably of many months). Welch thinks twelve months necessary. Massy's statement as to soldiers getting ophthalmia after nearly a year's residence at Athlone, though less definite, would appear likely to point to the same fact. Wecker thinks exposure for a *long time* to air made impure by overcrowding is one cause of chronic granular ophthalmia (he however, like Müller and especially Thiry, attempts to draw a distinction between granulations proper to contagious ophthalmia, and those elevations or "vesicular granulations" due to simple hypertrophy of the normal lymphatic follicles and mucous glands of the conjunctiva, a distinction quite impossible in practice, as he afterwards, in fact, admits). Gulz specifies "about one year" of exposure to great "overcrowding only" as necessary in order to cause granulations in a number of robust Austrian countrymen previously free from them. Gradman, with less precision, gives two months of garrison

¹ I am told that such conditions can be found in cotton factories.

life in Denmark as generally giving rise to the early stage of the disease in about half the men. I am aware that some authors (especially Hairion) give instances in which a short exposure of healthy men to supposed sources of contagion, either by other men or by fomites, has caused the disease. The value of such observations is, however, much diminished by two facts. Most authors (Hairion prominently) believe that the disease may be latent for a certain time, during which it cannot be detected, or, at least, only with the aid of a lens; it is most unlikely that such a lengthened and elaborate inspection could be made in the case of any large body of men at one time, and so some men with "latent granulations" might easily escape detection. Secondly, any one who has examined a large number of persons for early granulations must, I think, have been puzzled sometimes to know whether on a given conjunctiva there were granulations or not, and it is no reproach to the care or skill of the observer to say that very slight cases (and it is to such only that the present observations of the contagionists refer) may be passed as healthy one day and as diseased a few days later, without any material change having occurred in the interval.¹

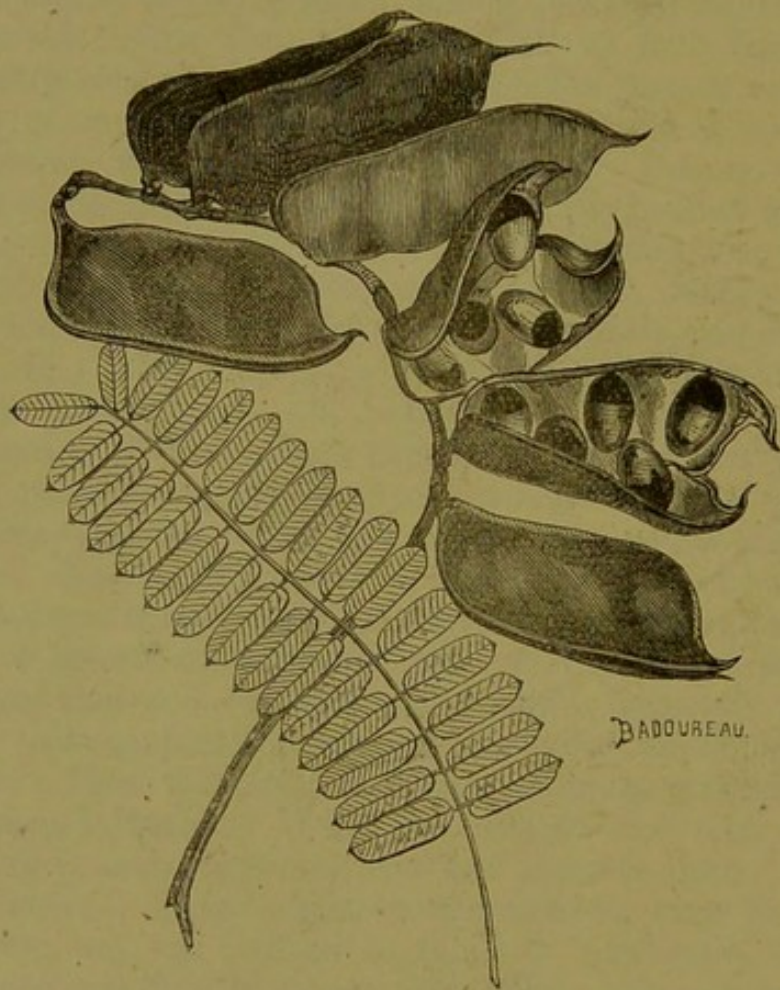
If granular ophthalmia, while free from muco-purulent discharge, were contagious at all, it must be so by means of a very volatile and yet very powerful *contagium*, since so many of those who live permanently together suffer from it. But if the *materies morbi* were of this subtle and volatile nature, it would be most unlikely that other persons who, though not living with the diseased ones, come into frequent and prolonged relations with them, would escape. We are told, however, that military officers are seldom affected by the disease though they are known to suffer from the (hypothetically) much less contagious purulent ophthalmia. From the nature of the case it is, however, impossible in the present state of knowledge, to look upon the hypothesis of contagion as absolutely disproved; indeed, the virus is supposed to be so subtle, so powerful and so longlived, that it would be extremely difficult to

¹ The chief difficulties in examining the lower lids for granulations are found in thoroughly exposing the oculo-palpebral fold of the lower lid, and in the congestion which comes on almost immediately after the lid is everted. Without exposing the oculo-palpebral fold at the outer part of the lower lid it is impossible to be certain that there are no follicular granulations, since they almost always begin in this part. If the patient will not look up enough to bring the part well into view when the lid is drawn down, or if from prominence of the orbital rim or tightness of the skin no effort will suffice, slight pressure on the eyeball through the upper lid will generally be successful in making the fold start forwards. The second difficulty can only be partially avoided even by practice in quick observation and gentle handling; when every care is taken it often happens (as Frank has observed) that the congestion obscures even very obvious granulations (they almost disappear as one looks at them), and renders the detection of incipient ones very difficult.

devise experiments showing the spontaneous production of the disease which would not be rejected as fallacious by a thorough-going contagionist such as Dr. Hairion. It can only be shown to be extremely unlikely.

Among predisposing causes the general health of the children will have an influence on the development of sago-grains. Allowance must also be made for inherited tendency to the disease in children of Irish race (and, according to Scheffer and Burton, for those of Lap and Egyptian parentage respectively), and for original differences of tissue, by which, indeed, inherited tendency is probably expressed. The proportion of Irish or half Irish children is probably much larger in the Metropolitan pauper schools than in those of any other part of this country (with a few well-marked exceptions, such as Liverpool, perhaps). This, no doubt, contributes to the frequency of the disease in the London schools. Some of the worst cases of pure granular conjunctiva that I have seen in children have been in those who had thick, fleshy, red lips, thick skin with abundant subcutaneous areolar tissue, and coarse, straight, dark hair. Thick fleshy lips, I think, more frequently accompany it than the thick skin and coarse hair. Then the tendency to inflammation of the eyelash follicles and Meibomian glands, which often precedes severe forms of granular lid with great papillary hypertrophy of the tarsal part of the conjunctiva and considerable corneal damage, often runs in families, the special details of each case being almost exactly the same in several brothers and sisters. I have several times noticed that children whose skin is fine in texture, thin and fair, and whose hair is generally sandy or red, show thin conjunctivæ without any great development of sago-grains. These differences in disease no doubt correspond to similar variations in health. Welch has noticed that men with fair hair and ruddy skin sometimes have less than the normal vascularity of conjunctiva. I have several times noticed the same thing in healthy children, but am inclined to think it is generally seen in those whose skin is thin, who have little cellulo-adipose tissue, and *bright* coloured hair. Very fair hair, or light hair of a dull tint with thick lips and perhaps "fleshy" skin, not uncommonly accompanies bad granular disease with considerable implication of the tissues at the edge of the lid (*sycosis tarsi*).

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Abrus precatorius, famille des légumineuses, tribu des papilionacées. *Jequirity* (Brésil). *Liane à réglisse* (France). *Arbol del rosario* (Espagne). *Paternosterstrauch* (Allemagne).

L'*abrus precatorius*, ainsi désigné par Linnée fut rapporté en Europe par Leonhard Rauwolf du voyage qu'il fit en Syrie et en Arabie de 1573 à 1575. Ce même échantillon se trouve encore dans l'herbier du physicien d'Augsbourg que possède actuellement la Faculté de Leyde. La gravure sur bois et la description qu'il en donna apparurent in « *Beschreibung der Reise in die Morgenländer* » quatrième partie publiée en 1582. Trois siècles se sont donc écoulés jusqu'à ce que l'on s'occupe de nouveau en Europe de l'*abrus precatorius* au point de vue médical.

L. DS W

L'OPHTALMIE JEQUIRITIQUE

ET

SON EMPLOI CLINIQUE.

