

Granular ophthalmia / by Assistant-Surgeon Welch.

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GRANULAR OPHTHALMIA.

BY

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22nd Regiment.

With the Compliments of the Author



GRANULAR OPHTHALMIA.*

By Assistant-Surgeon WELCH, 22nd Regiment.

THE important position which this disease maintains in the Medical Statistics of the British Army, both in reference to temporary inefficiency and permanent loss ; its existence among the poorer communities of these islands, and common to all countries where squalor and impure air—the concomitants of poverty abound ; the gravity and chronicity of the local lesion compared in extent to other structural diseases, consequent on contiguity with the visual organs, with the frequent defects or total loss of sight as sequelæ by which youth is marred or able-bodied adults rendered helpless and a burden on the community at large, with all the attendant wretchedness and misery ; demand the assistance of all for the elucidation of its phenomena and deductions for its eradication. The following observations on the disease, dispersed over a number of years, are mainly derived from the 1st Battalion 22nd Regiment, supplemented by data from the military and civil elements indiscriminately. It is in the former that the opportunities of watching the early phase of the malady and its development are most frequent, while among the applicants at civil ophthalmic hospitals, the profound organic changes from long continued morbid action predominate ; the constant supervision, the great controlling influence, the variations in climate, the massing of large numbers under known conditions, existent in the military element, allow of accuracy of data and general deductions not obtainable in civil life ; while the identification of the disease—the elementary structures and phases discernible alike in one or other community under similar conditions being acknowledged—renders the observations gleaned from one segment generally applicable, unmodified but by the forced circumstances pertaining to military life as contrasted with the civil section.

Ophthalmia in the Army generally.—The most cursory examination of the records emanating from time to time from the Army Medical Department will demonstrate that this disease did, and still does, play a most prominent rôle in the production of sickness and invaliding in the British Army—a rôle which demands a much greater share of attention than has hitherto been accorded to it. “During a period of 27 years, ending 31st March, 1854, 2,648, or 5·8 per cent. of 45,411 invalids were discharged from the service for impairment of vision. During the last six years of this period the percentage had risen to “7·5.” “Of 16,654 soldiers found unfit during the six years ending “December 1860, 1,393, or 8·4 per cent., had been rendered ineffective by “diseases of the eye ; and during the year 1860, 9 per cent., or nearly 1 in every 11 invalids, were discharged on account of defective eye-sight.”†

In this category is included *all* diseases of the eye followed by defective

* I limit the term “granular ophthalmia” to that variety of conjunctival inflammation preceded by chronic follicular hypertrophy ; the latter phrase synonymous with “sago grain bodies,” “vesicles,” “grey granulations,” and expressive of an abnormal state of certain physiological elements of the conjunctiva normally invisible to the naked eye—the closed solitary follicles.

† The numerous instances of blindness among the occupants of asylums, the beggars, and lower class in the south of Ireland, from disorganization of the eyeball, and the partial defects of sight from corneal opacities so common among servant girls, the sequelæ of this ophthalmia, substantiate its existence equally with the applicants at the various ophthalmic hospitals studding the larger towns of the British Islands.

‡ Frank, “Ophthalmia Chronica,” Army Medical Report, 1860, p. 400.

vision, and at first sight might appear ill-adapted for expressing any accurate idea of the prevalence of the conjunctival lesion designated in statistical nomenclature by the term "ophthalmia chronica," yet, as it is indubitable that the major part of the lesions terminating in defective vision and causing invaliding in the Army have, as a commencement, follicular conjunctival disease, the inference of its wide-spread existence and virulence during the period 1827-60 from the above data is not invalidated.

From 1861-67 inclusive, while the annual average ratio of admissions from all diseases for the whole Army, calculated per 1,000 of strength, was 1,114, ophthalmia contributed 42.9—the one disease furnishing rather more than 1-26th part of the whole temporary inefficiency in the Service; and during the same period the permanent loss was 1,572, or 4.8 per cent. of total discharge from the Army.

As contrasted with the decennial period 1837-46, during which the average annual admissions from ophthalmia mounted to 80 per 1,000 of strength, or rather more than 1-12th of whole sickness, a marked decrease in the prevalence of the disease is apparent, more especially during the later septennial period 1861-67, ranging from 1-20th of total admissions in 1861 to 1-32nd in 1867, with a corresponding decrease in discharges from the Service from 5.4 per cent. in 1861 to 3 in 1867—an all but gradual subsidence both in prevalence and amount of impairment characterizing this period.*

Thus, while adding in nowise to the mortality, this disease, in spite of the progressive decrease marking the later years, still plays a most important part in producing temporary and permanent loss of service in the Army, constituting on foreign stations, where endemic, "the most frequent cause of permanent inefficiency and invaliding," and throwing an able-bodied man, unfit for a soldier, a burden on the community for his maintenance.

Although, at first sight, the frequent movements and varying conditions under which the troops are cast during a tour of foreign service might appear to militate against any general deductions drawn from the Army as a whole, yet a careful perusal of the Annual Medical Reports will furnish several very important items in reference to the relative prevalence of ophthalmia under the diversified climates and stations occupied by the Army, and especially in the individual regiments and corps forming the garrisons from time to time. It will be apparent, taking as an exponent the data furnished by the Blue Books for 1861-67, that:—

- (a) The ophthalmia in the Army quartered in the United Kingdom is mainly derived from the dépôt battalions,† the receptacles of those invalided from foreign stations, but not discharged from the Service, or a regiment endemically affected during its late tour of foreign service.
- (b) The prevalence of the disease under different climates varies greatly, constituting 1-11th part of admissions, with 16.7 per cent. of discharges, at the Cape of Good Hope; 1-15th, with 12.47 per cent., in the Mediterranean; 1-37th, with 2.8 per cent., in North America; 1-38th, with 6.3 per cent., in India,‡ and 1-51st with 2.1 per cent. in the United Kingdom.
- (c) Malta, the Cape, and some of the stations in India—notably the northern and Scinde districts in Bombay, and certain garrisons in the plains of Bengal and Madras,§ are the quarters of the Army

* The respective annual admissions for the whole Army for 1861-67, calculated per 1,000 of strength are,—59, 57.5, 48.4, 35.4, 33, 35.5, 32; the discharges from the Service for the corresponding years expressed as a percentage being 5.4, 5.3, 5.2, 5.8, 4.6, 3.8, 3.

† The average annual admissions during the period per 1,000 of strength were: Household Cavalry and Foot Guards, 6.3; Dépôt Battalions, 29.5; with 1 per cent. invaliding in the former, 4.3 in the latter.

‡ The averages per 1,000 of strength were:—Bengal, 43.6; Madras, 33; Bombay, 49.2; the division of the stations from elevation above sea level, as exemplified in Madras, being—seacoast, 22.4 per 1,000; plains and table-lands, 39.3; hill stations, 22.9, the latter fluctuating from a yearly average of 4.2 to 41.3, consequent on the prevalence or otherwise of infected corps.

§ Army Medical Report, Vol. 8, p. 153.

- on foreign service maintaining a high general average; the remainder fluctuating very greatly.
- (d) In those stations maintaining a high general average and regarded "as hot beds of the disease," "fostering seats of ophthalmic germs," the remarkable manner in which some regiments escape entirely, others only slightly infected, or severely, with no corresponding ratio to length of service, indicate that some cause essentially of a limited nature—*e.g.*, certain barracks—affecting individual corps, and not dependent on climate as its direct agency, must be sought for in elucidating the etiology of the disease.
 - (e) A high sick list from ophthalmia in the "variable ratio" stations is directly traceable to the importation of an infected corps, the disease assuming high proportions on its advent, and departing with it, the previous and subsequent absence clearly contra-indicating climate or local peculiarities of soil or barrack as cause; to wit, the excess in Dublin in 1861 from presence of 87th Regiment from China; in the Windward and Leeward Command in 1861-62, from the 21st Regiment from Malta; in Canada in 1859, and in Bermuda in 1860 from the 39th Regiment, and the reduction in the former station from 35 per 1,000 of admissions in 1859 to 11.7 in 1860, on its departure; in Jamaica, in 1860, from 1st Battalion 14th Regiment from Mediterranean (disease originating in Malta, and furnishing 120 out of 190 total admissions from ophthalmia in 1859 in Corfu) from 102.7 per 1,000 in 1860 to 8.8 in 1865, when regiment removed; in the Mauritius, in 1863-64, from the 2nd Battalion 13th Regiment from Cape, and in 1865, from the 2nd Battalion 22nd Regiment from Malta; in New Brunswick, in 1864-65, from the 1st Battalion 15th Regiment; and in 1866, from 1st Battalion 22nd Regiment from Malta; in New Zealand, in 1865-66, from the 2nd Battalion 14th Regiment, and 50th Regiments; in 1865, the decrease at Aden and excess at Kurrachee by the transference of the 95th Regiment; in Australia, in 1866 on transference of 2nd Battalion 14th Regiment from New Zealand, and in Japan, in 1866 from 2nd Battalion 9th Regiment, from China.
 - (f) The frequent instances of European Regiments suffering whilst the Native force and inhabitants generally permanently exposed to climatic agencies remain exempt, the limitation of the disease as exemplified in the band and drums of the 70th Regiment, in New Zealand, in 1862, the wing of the 50th Regiment in Ceylon from 60.3, the marked contrast between corps in the same district, the remarkable exemption so frequently displayed on the part of the Cavalry, Artillery, and Engineers quartered in a station with their infected brethren of the Line—the segment of the Army constantly producing a relative high ratio of admissions and invaliding—all demonstrate indubitably an agency otherwise than climate.
 - (g) As few battalions escape a sojourn during foreign service in Malta, the Cape, or an "hotbed for ophthalmic germs" garrison in the plains of India, few avoid the taint of the disease among the rank and file; and that, while a regiment or corps may remain in Malta or the Cape for four or five years and enjoy an immunity (no doubt from escaping a residence in certain barracks), yet, as a rule, a two years' occupation of unsanitary quarters in these stations renders "follicular disease" of the conjunctiva all but universal among its components.*

* Other points also to be noted are—the remarkable persistency of the disease in certain corps for several consecutive years, *e.g.*, 1st Battalion 15th Regiment and 76th Regiments, stated by the Surgeons in 1859 as "prevalent for a number of years," and the effect of removal of corps from stations originat-

* "169 cases of chronic ophthalmia passing through Chatham in 1860 as invalids represented 57 different regiments, three only of which belonged to the Cavalry, the rest to the Line." Report, 1860, p. 404.

ing the disease, followed by a gradual subsidence under favourable sanitary conditions, or an immediate severe exacerbation, provided rude climatic influences are in the ascendant, the latter not incompatible with a retrogression of the morbid follicular elements, *e.g.*, the 1st Battalion 22nd Regiment on transference from Malta to New Brunswick in 1866.

In the face of the wide-spread existence of ophthalmia in the Army at the present day, in spite of all the means of isolation, segregation, &c. (on the presumption of the disease being maintained by contagion) at hand in a strongly disciplined community, it becomes an important point to ascertain, in view of its eradication, whether we are to search for its origin and diffusion in an introduced ingredient disseminated by contact, or as springing up *de novo*, developed from, and maintained by, a primary independent element; the direct sequel of the combined conditions under which the soldier is placed in certain barracks on foreign stations during his terms of service. The history of the disease is adduced in favour of the former assumption.

History of Ophthalmia in the British Army.—The author of "Practical Hygiene"* states that "epidemics of military ophthalmia (grey or vesicular granulations and rapid purulent ophthalmia) seem to have been uncommon and perhaps unknown on the large scale in the wars of the 18th century. The disease as we now see it is one of the legacies which Napoleon left to the world. His system of making war with little intermission, rapid movements, abandonment of the good old custom of winter quarters, and intermingling of regiments from several nations, seem to have given a great spread to the disease, and though subsequent years of peace have greatly lessened it, it has prevailed more or less ever since in the French, Prussian, Austrian, Bavarian, Hanoverian, Italian, Spanish, Belgian, Swedish, and Russian armies as well as our own. It has evidently been propagated among the civil populations by the armies, and is one more heritage with which glorious war has cursed the nations."

Whether the ophthalmia as exemplified in the English Army of the present day is identical with (and dependent on introduction by communication) that characterizing other armies during the early wars of the present century is a fairly debateable ground. Egypt is the assumed focus of diffusion, and that a severe form of ophthalmia decimated the French and English troops in that country cannot be questioned, as well as that in the large standing armies of that period constant opportunities must have been in existence for the wide diffusion of any contagious malady; yet a study of the characteristic features of the disease then existent as ascribed by Mackenzie, Larry, and Asalini—its excessive virulence and quickness of involvement of the ocular tissues with destruction of the eyeball, and a contrast with the follicular conjunctivitis of the present day—its frequently slow and insidious approach, its postponement of implication of other tissues, and a limitation in the majority of cases to the conjunctival membrane, must tend to the inference that either two distinct pathological entities are here in question, or that change of time and place has brought about a strange modification in disease. The nature of the present lesion, the elucidation of its early stage, its *de novo* origin and persistence in spite of all attempts to extirpate by isolation, its prior existence in the Mediterranean†, Malta (Hennen), Lapland (Scheffer), "ophthalmia is bad among them, and sooner or later, for the most part, they go blind from closeness of their dwellings and smoke," its undoubted presence among the poor of Ireland anterior to the present century (Mackenzie), its general existence at the present day‡ where-

* Dr. Parkes' "Practical Hygiene," 2nd edit. p. 466.

† "Hippocrates, Galen, &c., in the ancient literature of Greece and Italy, describe clearly purulent ophthalmia, as well as the chronic form in the watery ophthalmias with pains, fungous excrescences of the lids, externally and internally, called *fici*, which destroyed the sight of many persons."—Commentaries in Adams' Translation of Hippocrates' Works, Sydenham Society, Vol. i, pp. 356 and 503.

‡ Not a town on the borders of the Mediterranean, whether in North Africa, Southern Europe, or Asia Minor, but illustrates the disease among the denizens of the low haunts; in Egypt the chronic form, common elsewhere, prevails, not the virulent ophthalmia of old. The poorer Irish, the Russian peasant (Wecker), the degraded drunken specimen of North American Indian, indicate its wide range; it is a link in the chain of common humanity universal as pauperism.

ever squalor and poverty assert their authority, are not corroborative of its introduction during the Napoleonic wars. One feature characterized occasionally the Egyptian and invariably the present ophthalmia, "granular lids," which, "although endemic in Ireland before the campaign, yet received little attention until the severe outbreaks among the regiments in Egypt and its disastrous sequelæ directed the attention of writers to the point." (Mackenzie.) Other facts militating strongly against the idea of introduction are "that while the troops from Egypt after their return were on the improvement, the English regiments most notoriously affected two years subsequently had never served in the campaign;" also, the Portuguese troops who fought side by side with the English in the Peninsular War were not affected by ophthalmia until 40 years after their separation, *i.e.*, "1849;" "and from the association with the Belgian troops in the Pedro-Miguelite War no such cases occurred in Oporto or elsewhere."*

Equally with the Greeks and Romans, from time immemorial the Egyptians have suffered from ophthalmia. Burton remarks, "Herodotus has two allusions to eye diseases which seem to have afflicted the ancient Egyptians from the most ancient times. But in the old days of idolatry the hygienic and prophylactic practices alluded to by Herodotus, the greater cleanliness of the people, and the attention paid to the canals and drainage, probably prevented the malarious disease becoming the scourge it now is."† Asalini, Mackenzie, and Larrey, all looked upon the form of ophthalmia from which the troops suffered in Egypt as only an aggravated variety of catarrhal ophthalmia, and attributed it to the usual excitant agencies intensified by locality; the latter states that "the only means of its becoming contagious was by direct conveyance of the matter from one to another," that "the officers who were well hutted and tented and observed hygienic rules did not get it," and that "when the troops generally were placed under like conditions the cases became fewer and less virulent;" he also remarks "that the same form from which the troops suffered could be produced in any country having the same atmospheric peculiarity as Egypt." Mackenzie substantiates the presence of eye disease "more among natives than strangers, the lower than the higher classes of society, and in cities than the country; rarely seen in private life;" features no less common to the chronic ophthalmia of the present day.

That the causes productive of follicular ophthalmia were exceedingly rife among the troops during the latter part of the 18th and early years of the present century cannot be doubted, and such as read by the light of present

* Adduced by Surgeon Marques in the Portuguese Army Returns for 1849-50 (quoted in *Medico-Chirurgical Review*, April 1863, p. 399) in support of his views of the granular ophthalmia in the Portuguese and other armies being of a catarrhal nature and origin. The history of the disease in the former is very instructive. Although always common among the civil population, the Army did not suffer until a year or two before 1849 among men quartered in the Destero at Lisbon (the disease endemic in this building, a civil establishment previously, for 23 years), slight granular lids being present. The spring of 1841, however, is regarded as the date of origin,—“the weather favourable to catarrhal attacks,” “preceded by wind and rain,” it affected all of the regiments in Lisbon, especially the Grenadiers and the 3rd Regiment at Vianna da Castello, 63 leagues distant; very irregular, however, in the Army generally. Surgeon Marques regarded it as severe catarrhal, and not introduced; the presence, however, of grey granulations, before the general attack of the men at Destero, and their wide prevalence subsequently (the early stage of the follicular lesion unmodified by any conjunctival inflammation being graphically depicted) are clear. In spite of the most rigorous quarantine, every precaution against communication, separate towels and basins, daily inspections, separate hospitals, classification of all ophthalmic men apart into classes, even the discharge from the Army in 1852 of all men with chronic lesion of the lids, did not prevent fresh cases in 1859. He attributes the prior immunity to the system of billeting the soldiers in the towns as well as in barracks. Hygiene and the abandonment of quarters (equally with the Danish troops) were most efficacious in reducing the disease. Its dependence upon a prior follicular element seems clear, and the whole phase of the outbreak is identical with those only two common in the British Army of the present day.

† “El Medina,” Vol. 3, p. 176.

knowledge are universally associated with its *de novo* origin and endemic persistence. All the armies in Europe had become excessive in numbers, accumulated in camps and barracks* under unfavourable hygienic circumstances—the many being crowded into the space previously occupied by the few. It is well known the extent to which this was carried in the British Army when two men slept in the same bed, arranged in the barrack one tier above another, using the same basins and towels, with a complete ignoring of comfort, cleanliness, and ventilation, and continued long after the bustle and turmoil of warfare could be adduced as an excuse. Here were the circumstances favourable for the development of follicular enlargement, equally with the spread of any contagious affections. No wonder the importanee to which eye diseases attained, and no wonder that, not having been previously met with to such extent, with Egyptian experience fresh and deep-rooted, the French troops had to bear the onus.

That a strong line of demarcation differentiates the ophthalmia (retained as distinct by Larrey, Mackenzie, &c.), due to peculiarities of service in Egypt, from the follicular disease of our day (probably identical with that existent for centuries in the Mediterranean and Ireland) is clear; and while analogy from the occurrence of granular lids as an occasional sequel in the former would suggest the oft coincidence of the primary element† inseparable from the latter—"follicular hypertrophy," the causation of which most unquestionably must have been very rife, predisposing to any exceptional excitant under which the troops were cast,—yet, the phenomena characterizing the existent lesion and the circumstances under which it springs into an existence in regiments would unquestionably decide against its derivation from without, leaving as a problem its *de novo* generation and cause of endemicity.

The present century has witnessed standing armies as a permanence; hygiene has had but little scope until recent years, and the elucidation of the "grey granulations," with their requisites of development, explain fully the persistence of ophthalmia in the military world of Europe since the Napoleonic wars.

Phases characterizing Early Ophthalmia.—As exemplified in the Army Medical Returns three features assume great prominence in a body of men commencing ophthalmic:—(a) The general diffusion of the disease, *e.g.*, 120, 216, 133, 239, 137, 264 annual admissions in a regiment; (b), the slightness of the early cases—"mild, readily yielding to usual remedies," "of a mild type" and amenable to treatment," "simple conjunctivitis and generally yielding speedily to appropriate treatment;" (c), the absence or extreme variability of any clear definable cause: the subsequent progress depending upon a continuation of the conditions under which the disease originated, and the amount of exposure of the susceptible follicular lids to external climatic excitants or any slight irritant.

History of Follicular Disease in the 1st Battalion 22nd Regiment.—The history of the 1st Battalion 22nd Regiment may be quoted as illustrative of the generation and development of the "grey granulations" as follows:—In 1860 this battalion was ordered to Malta on a tour of foreign service, arriving there during the summer. It was quartered in the Cottonera district, occupying the barracks at Isola Gate, Polverista, Zabbar, and San Francesco, all casemated; the first and last very deficient in light and air, and ill adapted for maintenance of health in a Mediterranean climate. The battalion

* In the *United Service Magazine* for March 1870, on "Soldiers' Dormitories," it is shown, p. 413, that until 1792 barracks might be said not to have an existence, "soldiers being principally billeted on the inhabitants." "In consequence of prospects of war a considerable impetus was given, so that in that year and the eight immediately following, over nine millions of money were expended in their construction." "It was not until 1830 that bedsteads were introduced as necessary articles of barrack furniture."

† The occasional chronicity of Egyptian ophthalmia from the supervention of "granular lids," is highly suggestive of a prior follicular element, the severe inflammation being engrafted on it (equally as seen at the present day) effecting its direct ravages, its indirect chronic sequelæ depending on the anterior "grey granulations."

suffered severely from ardent continued fever,* and in March 1861, was transferred to the Valletta district, with head-quarters at Floriana and detachments partly in permanent barracks (Strade Torre) and partly in huts (Ravelin and Horn Work). As regards sanitation, the Floriana Barrack (7 companies) might well be classed under the same category as those previously occupied. Originally a storehouse, casemated and situated for security in the fortification wall, the atmosphere was damp, and utterly incapable of being renovated; gloomy, from inability of light to penetrate from without; an improvement was effected by piercing the fortification wall and formation of windows. Under these ameliorated conditions the battalion was in June 1863, when a careful inspection was made of the eyes of the men as previously detailed†, the objects being to detect and note any departure from the healthy state which the conjunctivæ of the lids might betray for future reference, and to illustrate, if possible, the natural history of follicular disease and its relation to chronic ophthalmia, granular lids—a prior immunity from these diseases, and their prospective prevalence in the face of a lengthened service in Malta, suggesting a probability of obtaining accurate data for the clearing up of debateable points. This inspection demonstrated a general diffusion of “grey granulations” in what to ordinary observation appeared healthy lids, the lesion varying in extent and severity in different segments of the battalion, very prevalent among the occupants of the larger barrack-rooms, all but absent among the serjeants and married families, and intimately associated with hygienic deficiencies. Of the descriptive details of the lesion, its stages, the individual susceptibility and grades of severity in relation to age, and accompanying symptoms, it is not necessary to recapitulate here, having been fully entered upon in the paper above referred to. A further inspection of the men in December 1864 and in January 1865, an interval of 18 months, showed that during the occupation of Floriana Barracks, with its sanitary reforms and hut life in the outworks, a marked improvement had ensued, expressed by a restoration to two-thirds of men to average healthy lids, and foreshadowed by an atrophied condition of the follicles in many at the previous inspections, with the exception of one company, sufficiently explained by the very impure damp air characterising the room occupied. While the majority of the men previously affected displayed either a latency or retrogression of the morbid follicles with an atmospheric deterioration expressed by rather more than twice the amount of carbonic acid with an excess of humidity, this company indicated growth of the lesion in barrack air in a Mediterranean climate with 1.5 per 1,000 of carbonic acid, and relative humidity 90. Corroborating the deduction of the main cause of the extensive follicular disease in 1863 being due to the hygienic defects under which the battalion was placed during the first year’s service in Malta in the Cottonera district was the sequence of events upon a return to these same quarters in March 1865, and although the fostering agency of barrack atmosphere was modified by a tent encampment of several of the companies during the cholera epidemic, and the deleterious results further diminished during the year 1865–66, in contrast to 1860–61, by a decrease of numerical strength and sanitary improvements effected in the interim, yet the impetus then given to follicular growth received a full exponent under the rude atmospheric vicissitudes of a New Brunswick climate in the year following.

As before remarked, at the end of 1864 these “sago grain bodies” were in a quiescent or retrogressive state in two-thirds of the afflicted men of 1863 with decreased severity, and although in many instances either their atrophied remains, or a somewhat villous conjunctiva at the outer canthus of the lower lid, indicated their prior existence, yet the tendency towards a healthy re-instatement of the lid structures was strongly marked during the latter portion of the occupation of Floriana Barracks and huts, with the exception of K Company, under the conditions previously detailed. The companies most deteriorated in 1865 were in order of severity, K, A, C, F, G.; the least, I, B, H; the maximum 33 per cent., against a minimum of 5. On change of quarters

* “The first summer the men were confined to barracks at midday, subsequently discontinued with the best possible results.”—Annual Report of Surgeon-Major Adams, 1st Battalion 22nd Regiment.

† Army Medical Report for 1863, p. 494.

A, B, C, D were located at Polverista, E, F, G, H at Isola Gate ; I, K, band and drums at San Francesco. It is unnecessary to enter into any lengthened description of these barracks,* suffice it to say that at Polverista, although the small rooms are deficient in ventilation, yet this is somewhat counterbalanced by the advantages of light and freedom from all surrounding buildings intercepting air, the barrack being situated high up in the outer fortification wall, a large open glacis in front and the country behind. At San Francesco are centered sanitary grievances, the atmosphere in its casemated rooms being dark, damp, and stagnant, superadded to its position in a crowded dirty neighbourhood. At Isola Gate the conditions are intermediate, the casemated rooms have a large window in the fortification wall opposed at the end of room by a large door, and as the windows are above the level of the adjacent houses, a current of fresh air, amounting to draught, an ascribed cause of several cases of ophthalmia, may be said to have existed when the wind was favourable, yet under ordinary circumstances, and on account of the elongated shape of the room, the light was defective and the ventilation unsatisfactory. The battalion occupied these barracks one year, there was no overcrowding, but during the summer D, E, G, and subsequently H, I, K, and part of C, were encamped on the glacis ; the convalescents from ophthalmia were also rigidly excluded in a separate barrack and tent from all possible contamination of others directly or indirectly. At the end of March 1866, prior to embarkation, an examination of the lids was instituted with the following results, as compared with the condition existent in December 1864 and January 1865. Companies K, I, band and drums much deteriorated, with scarcely a single man free from morbid lesion of the conjunctival membrane, especially K ; the condition of the lids in many were fast merging into granular, in fact, in some of the younger members of the band this disease actually existed, entirely free of all engrafted inflammation, composed of morbid hypertrophied follicles resembling hemispheres of opaque firm jelly in rows studding the lower lid, with great vascularity and gelatinous infiltration of the conjunctiva, and papillary enlargement of the canthus of upper lid and along the upper edge of its tarsal cartilage. A Company was in much the same state as in 1864 ; B, C, D, E, and G slightly improved ; F presenting many cases of relaxed conjunctivæ—convalescent ophthalmia ; and H still retaining the minimum percentage of affected. Thus the San Francesco section fully substantiated the influence of grave hygienic barrack defects in spite of a temporary evacuation during the summer, the other sections remaining in *statu quo*, with the exception of a slight improvement in those enjoying a long encampment on the glacis.

During the service in Malta in two series of quarters, the last year's occupation the same as on arrival in the island, the battalion having enjoyed a prior immunity from all ophthalmia, demonstrated a strange fluctuation in the follicular disease of the lids ; a general diffusion and origin, succeeded by a retrogression on change of quarters diversified by variations in companies in sequence to sanitary defects, and followed by a stability in the majority of the afflicted and a marked exacerbation in one segment on a return after four years to the barracks first occupied, improved during the interval, yet presenting in a modified form the conditions under which the disease originated and sprung into proportions potent for evil, as exemplified by ophthalmic admissions.

In March 1866 the battalion left Malta, and in the month following was quartered in Fredericton, New Brunswick, remaining until May 1869, when it returned to Ireland. During these three years in a North American climate the companies were broken up in three barracks, two permanent, one temporary, the former, one stone, one wooden ; the latter, a large wooden building (the exhibition), designated for the purpose its name indicates, and furnishing ample accommodation for seven companies. There was no overcrowding ; the permanent barracks had little to object to as to light, ventilation, and purity of atmosphere. In the Exhibition the main fault consisted rather in an excess than a deficiency of ventilation, owing to the general slight construction of

* The features of Maltese service (barracks) are thus summed up by Dr. Parkes:—"This appears to be a dry climate ; the condition of Malta is parallel to Gibraltar" (p. 533, 'Practical Hygiene') *i.e.*, more than half the garrison is in casemates, which "are mere receptacles of foul air—damp, dark, and unwholesome." (p. 528.)

building. As a summary it may be stated that the indoor and outdoor conditions under which the men were placed in New Brunswick were inimical to the production and growth of any disease of a miasmatic character. It would be difficult to surpass the health-giving quality of the climate, in every respect the opponent of the Mediterranean; the dry cold of the long winter, with an occasional minimum of 25° below zero, arresting all organic change; the short, rapid, high, equable temperature of summer, with moderate humidity, after the prolonged duration of ice and snow, wooing the individual to an open air existence and the flooding of the dwelling with light and ventilation. As an exponent of three years' residence under the circumstances stated are the data derived from an inspection of the regiment in April 1869 prior to embarkation. Of 435 men present who had served in Malta, a percentage of 33 was characterized by a more or less abnormal state of the lids, 25 of which consisted of follicular disease unmodified by inflammatory action, and 8 associated with varying degrees of morbid thickening and vascularity of tissues, the sequel of severe engrafted ophthalmia.

Analysing the 25 per cent., demonstrating what may be termed the natural history of follicular disease, we find that in 2.5 only the grey granulations were numerous, showing no indication of retrogression; in 10.5 they were sparsely present, generally limited to the outer canthus, and often associated with slight vascularity and roughness of conjunctival membrane; in 12 per cent. atrophy had ensued, probably permanent in its nature.

Of this section of the battalion no individual in 69 presented grey granulations who had indicated a prior immunity in Malta, and the relative percentages, as above expressed, point to a condition of circumstances antagonistic to follicular development, the general tendency being retrogressive, but often associated with permanency of atrophied follicular elements. It was only in the 2.5 per cent. that the disease could be said to be active, presenting the same features so generally met with in the same body of men in 1866, expressive of vitality and suggestive of growth and development under favouring conditions; in the 10.5 per cent. various degrees and modifications of retrogression are incuded, the follicular enlargement in the majority limited to the outer canthus, the remainder of the conjunctiva healthy; in some a few isolated, irregularly scattered grey granulations occupied the lower lid, either separately or in groups, those intermediate having disappeared; in others, slight roughness of the conjunctiva (hypertrophied papillæ) was the only evidence of their prior existence:—while these 10.5 per cent. indicated approaching healthy lids, the 12 per cent. demonstrated passive degenerative products, probably permanent. Beyond a slight roughness and occasional tortuous enlarged vessels of the palpebral conjunctiva, frequently associated with calcareous degeneration of the cell elements of follicles, I could detect no change in the membrane of retrogressed follicular disease unaccompanied by inflammatory action.

It is difficult to elucidate the agencies in operation in maintaining in activity the 2.5 per cent. in view of the general tendency to retrogression, as well as, owing to the frequent interchange between one company and another, it is impossible with any accuracy to institute a comparison of their present and previous condition illustrative of phases of the structural lesion; yet by contrasting the percentage of afflicted to gradations of age and degrees of severity in 1869 with the same in 1863 certain deductions are arrived at.

ANALYSIS in 1869.

Gradations of Age.	Number Examined.	Number Affected.	Percentage Affected.	Granulations Numerous.	Few and Retrogressive.	Degeneration.
Below 15 ..	1	..	..	..	..	..
From 15-19 ..	2	..	..	..	..	..
" 20-24 ..	25	10	40	..	70 per cent.	30 per cent.
" 25-29 ..	173	47	27	8 per cent.	55 "	36 "
" 30-34 ..	137	33	24	15 "	36 "	48 "
" 35-39 ..	47	13	27	7 "	15 "	77 "
" 40-44 ..	11	5	45	..	..	100 "
" 45-49 ..	2	1	50	..	..	100 "

In 1863 the tendency of the conjunctival follicles to morbid cell proliferation under exciting agencies in ratio to the rapidity of growth and development of the tissues of body generally, as exemplified by the high percentage of the affected, and severity of the cases during the earlier years, was clearly indicated, and, although in 1869 the same periods are characterized by a proportionate excess in number, yet the proneness to restoration of normal lid structures in obedience to the same law under favouring circumstances is not the less apparent, as exemplified by the slight degree of severity and small proportion of permanent degeneracy during the quinquennial period 20-24, especially when it be remembered that during these years in 1869 are for the major part included the proportionate excess in numbers and severity in 1863. Taking the years 30-34 as a neutral ground, characterized by a tardiness of structural change, whether as regards development or retrogression, the earlier years are expressive of involution of the hypertrophied follicles terminating in normal conjunctiva, the later of atrophy and permanency of the degenerated elements,* semi-cartilaginous in appearance or calcareous, the progressive tendency to which with advancing age is apparent, the latter form predominating.

Thus it is clear that, while the six years of service in Malta and the conditions there accruing may be regarded as the period of origin and maturity of the "grey granulations" in the battalion, the three years' residence in New Brunswick witnessed the decline.

Markedly distinct from that portion of the battalion which may be designated as the Malta segment and above narrated, was the segment composed of the various drafts from the dépôt during the North American service. On joining head-quarters, between 1866-68, a percentage of 47 had "follicular disease," and on carefully examining them in 1869 the degree of severity was as follows:—63 per cent. moderate, 22 severe, 15 atrophied. The contrast between this segment, much resembling the state of those in Malta in 1863, and the condition of the latter in 1869 merging on recovery, was very apparent. The follicular disease had much improved since residence in New Brunswick, but had produced 29 severe attacks of ophthalmia.

Origin of Follicular Granulations.—The accumulation of independent observations points conclusively to the grey granulations having their primary origin in the solitary follicles of Krause, morbidly hypertrophied from hyperplasia of their elementary constituents, microscopic inquiry having demonstrated their existence as normal histological components of the conjunctivæ both of men† and animals. Independent, however, of this latter testimony, the pathological phases,—their gradual development, oft for a long time maintaining their individuality and isolation from the surrounding conjunctival structures, the defined system of lid involvement and limitation to a certain

* In this case the degenerated follicles were invariably limited to the lower lid, the upper presenting in the majority a perfectly healthy conjunctiva.

† For full details of the anatomy of the human conjunctiva, as well as accurate coloured delineation of the naked eye aspect of severe follicular disease and microscopic drawings, see Marston on Ophthalmia: "Beale's Archives of Medicine," 1862.

area*, their distinct course of retrogression,—substantiate their position as normal, physiological organs, leaving the *modus operandi* of morbid agency an open question.

Exciting Cause of Follicular Hypertrophy.—The independent testimony of continental inquirers,† and Frank and Marston of the Medical Department of the British Army, the general deductions from the yearly Reports of the Army as a whole, and the observed phenomena in the 1st Battalion 22nd Regiment, furnish an indubitable authentic causation in hygienic deficiencies, man and animals indicating the like phenomena under like surroundings. The fostering conditions may be defined as the vitiations of the dwelling-air accruing from the accumulation of the impalpable excreta of the breath, skin, and body generally, consequent on an absence or incompleteness of ventilation, and modified by light, heat, and moisture of the atmosphere. As a deduction from a number of observations an impurity represented by 1·5 per 1,000 of carbonic acid would furnish a nidus, provided great warmth and moisture be component associates. The necessity of these latter is unquestionable, and although in general terms the atmospheric deterioration may be expressed in the amount of carbonic acid‡, any method which would determine the proportion of organic animal matter in the air from body effluvia and its tendency to stability or decomposition (for this the sense of smell is no mean analyser) would indicate with greater certainty the deleterious results to be apprehended than a mere chemical formula. The decomposing animal excreta, in fact, would appear to be the excitant in the proliferation of the cell elements. Such a condition must be in the ascendancy during the night, when, for the sake of warmth in the sleeping apartment, the tendency to exclude fresh air is all powerful, and when a number of individuals are collected together to accumulate their exhalations in one common reservoir; the too often damp, badly lighted, overcrowded, ill ventilated resorts of poverty furnish the requisite concomitants, to be intensified by the heat and moisture of climate, or diminished by its cold or dryness. It is clear that it is impossible to limit follicular disease to this or that country, springing up wherever the necessary conditions for its production exist, showing a predilection for hot climates from the average high temperature developing the essentials more quickly and to a greater extent than more northern countries, but in all originating under like concomitants, limited to the lower class of society, and exercising its baneful influence more especially upon those members of the limited community compelled by occupation or age to pass the greater part of the day in the vitiated atmosphere of the dwelling. The poorer segment of the populace in Ireland, whether inhabiting the wretched tenement in the overcrowded slums

* Marston, Wells and others have suggested an actual neo-plastic formation of gland substance under inflammatory action, to account for their presumed excess and position in disease as compared with health. I cannot but think, however, that more extended observation will show that other pathological elements, the products of chronic inflammation, have been confounded with them in the general coalescence consequent on continued morbid action in the conjunctival tissues.

† Beyond that adduced by German surgeons, and especially Stromeyer, as detailed by Staff Assistant-Surgeon Frank in "Army Medical Report for 1860," is a good illustration by Surgeon Marques, of the Portuguese Army, narrated in the "Medico-Chirurgical Review," April 1863, p. 400:—"The community of Casal Pia, some hundreds of boys and girls who inhabit the dark and sombre edifice of Desterro, at Lisbon, much filth in its vicinity, no eye complaints among the neighbours, the disease has clung to the inmates for 23 years in spite of all attempts to curtail its ravages, and originated in the soldiers subsequently occupying it."

‡ It appears beyond a doubt that the ratio of carbonic acid and the organic matter is not constant. The observations of Dr. A. Smith, as recorded in "Medical Times and Gazette," Nov. 20-27, 1869, indicate "that the evils of ill-ventilation arise not from accumulation of carbonic acid, but from the discharge of some kind of organic matter into the atmosphere;" but, although "an increase of carbonic acid is associated with this organic matter, and consequently may be employed as a sign of pollution," yet the origin, nature, and condition of the deleterious elements remain unexplained; one of the chemical products of decomposed organic particles is determined, while their presence in a vital potential form remains undemonstrated.

of the town or the country cabin, shared alike by humanity, fowls, pigs, and dogs, in its aged "blear eye," unable to face the light of heaven, the corneal opacities of middle and adult age, the acute ophthalmia of youth, and follicular lesion of the younger branches, will illustrate each phase of the malady equally with the Italian "lazzaroni" and the denizens of the underground habitations in the populous cities of the Mediterranean, or wherever poverty and its associates are rife.

An important question, however arises—are these morbidly enlarged follicles always to be regarded as solely dependent on miasmatic causes? That they may originate under long-continued exposure to dust or external irritants of like nature, associated with an injected roughened conjunctiva, as an occasional sequel to prolonged inflammatory action* (in this case eventuating in as stubborn a disease as when primarily present), or may be detected from time to time in lids apparently independent of the two former conditions, and where no malarious influence could be assigned as the agent, cannot be questioned; the rarity however, with which they are associated forbid them being regarded in any but the light of an occasional coincidence, and probably dependent on constitutional predisposition to glandular derangement on the part of the individual. Their endemic prevalence, their independence of prior hyperæmia or ophthalmia, their gradual development into mature tissue structures prone to permanence or slow in change, not their isolated occurrence, are the points at issue; and the co-existence of these on a large scale both in man and animals with miasm is too overwhelming for any rational doubt.

The frequency with which epithelial and pus cells have been detected in the atmosphere surrounding patients with conjunctival disease would also suggest the question—Are not these grey granulations dependent on such an origin? Without denying the possibility of such agency, adding no doubt when decomposing to the vitiation of atmosphere, and thus tending to produce the necessary nidus, especially if extended over a lengthened period, their development under conditions entirely opposed to such an explanation would render it highly improbable, especially when it be remembered how seldom the necessary concomitants could ensue in the British Army under the existing regulations of the present day.† The data of the 1st Battalion 22nd Regiment negative their dependence on any specific (or otherwise) conjunctival emanation, and the acme of ophthalmia attacks was coincident with their commencing decline.

Phenomena characterizing their Presence.—It would appear that these meretricious elements vary in the degree of predisposition to ophthalmia they engender in ratio to their stage of growth and maturity. During the earliest stage, slight conjunctivitis, probably excited by the active cell proliferation in the follicles, are very common; as they advance, a certain tolerance of their presence is observed, and provided the surrounding hygienic defects are such as to maintain them in a mature state, or foster further development, any inflammatory attack engrafted on them is proportionately more severe in character and intractable; in their retrogressive stage, while the tendency to disease diminishes, yet the superadded conjunctivitis consequent upon the thickening and vascularity of the surrounding tissues is invariably chronic; when permanent from calcareous or fibroid degeneration, their influence appears limited in the former to occasionally maintaining an irritable state of the eye from their surface roughness.

The objective features characterizing the period of growth and maturity of the grey granulations are a smoothness and tenseness of outline, glistening

* The structural identity of these follicles with the closed follicles of the intestines was pointed out as early as 1860 by Staff Assistant-Surgeon Frank. Glands in nowise to be discriminated from them can be observed studding the upper part of throat and pharynx occasionally in chronic disease of the tonsils. Judging from analogy and pathology, is it to be wondered at that those studding the conjunctiva should betray an occasional hypertrophy not to be classified under ordinary causation equally with their congeners elsewhere?

† I have carefully sought after evidence of such origin in patients and orderlies constantly in the atmosphere of ophthalmia, and have never found substantiating proofs.

semi-transparency of the mass, and progressive increase in size with accompanying hyperæmia and tissue proliferation of the conjunctiva, increased meibomian secretion, mucus and tears; while irregularity and indistinctness of outline, opacity of cellular elements, withering of the mass, with tendency to smoothness and normal thinness of the membrane as clearly indicate their retrogression.

Occasionally, under favouring circumstances, an arrest of the involution is to be met with, generally in individuals over 30 or 35 years of age; the follicles mature but few, and limited to the outer canthus of the lower lid, and apparently innocuous in character. The frequent instances in soldiers under good sanitation and free from all ophthalmia have led some to question their ascribed cause and importance. The explanation I believe is this—that the potency of the granulations is mainly limited to the stages of development and maturity—to the period of active cell proliferation, and that in the instances stated from no definable reason beyond that of comparative stability of structure characterizing the age of the individuals in which they generally are seen, the presence of favouring circumstances neither determines their involution and disappearance, as in earlier years, nor their degeneration, as in later, but a tissue permanency ensues which, as it is unaccompanied by morbid activity, seems also inert in consequences.

The facts previously recorded illustrate a development of the follicles under equal conditions most progressive in youth, from 73 per cent. between 15 and 19 years of age, to 35 per cent. between 40 and 44, their retrogression following the same law; and that while an exposure to the exciting causes, spread over months, and probably averaging one year, was necessary for effecting their origin and general prevalence, their disappearance was not to be compassed but by a continuance of good sanitation for at least twice that duration.

Presence of the Lesion among Recruits.—But while acknowledging the *fons mali* to be the vitiated barrack atmosphere, especially of certain foreign stations, a point not to be lost sight of is the condition of the lids of the recruits entering the Service, an exponent of the immediate domestic surroundings of the class from which they are drawn. From 1861–67, 39·2 per 1,000 of the total rejections of recruits in the United Kingdom are classified under “diseases of the eye and eyelids,” and during 1861–63 the respective proportions were 34·9 per 1,000 among recruits in England, 17·5 in Scotland, and 40·4 in Ireland. There cannot be a fraction of doubt that this large proportion represents no mean quantity of follicular disease, or granular lids. For example, between 1866–68 separate drafts of recruits from the dépôt joined the headquarters of the 1st Battalion 22nd Regiment in New Brunswick. Of 247 of these men carefully inspected on arrival, 47 per cent. had “grey granulations” in their lids, the major part being in a state of activity, a few presenting merely the atrophied remains, while two had complete obliteration of the lachrymal sac on one side, with extreme vascularity and roughness of the conjunctiva, and two were “blear-eyed,” with loss of eyelashes, the sequelæ of old disease prior to enlistment. From the extreme variability of the condition of the follicles among the affected men who had passed equal service at the dépôt, the remarkable contrast in the healthy aspect of others, and the presence of atrophy in a few, the evident conclusion was the existence of the lesion anterior to entry in the Service. Two facts stand clear: (1) the presence of the germs of granular lids among the class from which recruits are drawn; (2) a certain percentage (by no means small) in those received into the Army, too frequently to undergo without loss of time the fostering agency of barrack surroundings.

Ophthalmia in the 1st Battalion 22nd Regiment.—Prior to the arrival of the 1st Battalion 22nd Regiment in Malta no form of ophthalmia had been in existence for at least 20 years. From June 1860 to the end of 1862 it was noted that a marked increase had ensued as compared with the statistics anterior to the Maltese service, amounting to 90 cases, but the disease was mild, easily cured, left no chronic changes, and was followed by few relapses. What the exact nature of the conjunctivitis was is questionable. According to Surgeon-Major Adams, 1st Battalion 22nd Regiment, “it might fairly be “classified under simple conjunctivitis, and with much semblance of truth “have claimed dust or solar radiation as its cause.” How far it might have

been due to commencing follicular hypertrophy, which was extremely rife in 1863, is obscure, but the natural history of the "grey granulations" and the quartering of the battalion in badly ventilated and defective barracks, the same under which the disease reappeared in 1865, render it highly probable that many of the attacks in 1861* and 1862 acknowledged such a predisposition and origin. "During September of 1861 (in this respect coinciding with the popular idea of prevalence about the autumnal equinox) an epidemic of ophthalmia occurred among the children of the soldiers' families located in huts at one of the outworks exposed very much to the sun and weather; it was noted that the disease spread rapidly in families and was intensely communicable; no chronic changes ensued."† The officers were free from any form of the disease during the period embraced.

From June 1863 all doubt disappears as to the relation of grey granulations and ophthalmia, consequent on the data derived from careful inspections and detailed elsewhere.‡ From January 1863 to March 1866 (the termination of Maltese service) 119 admissions into hospital occurred from ophthalmia (not representing the actual extent of disease, inasmuch as numerous slight cases, especially in the latter part of 1865 and 1866, were treated outside), and from the latter date to December 1868 (New Brunswick service) 117, of which 83 were in men from Malta, and 34 among recruits; the acme of the disease being in 1866, subsequent to arrival in North America, 59 cases occurring during the last nine months, with only 8 cases during the first three months in Malta. The relative prevalence of the disease during the individual months of each year in Malta showed an absence of all periodical coincidence;§ as contrasted with the same periods of successive years the most marked discrepancy was apparent, with no deduction to be drawn beyond a diminution of the disease during the winter months; in New Brunswick the major attacks were during the variable months marking the change of seasons. Among the Malta segment, from June 1863 to December 1869, 206 admissions from ophthalmia occurred, representing 143 individuals; in the depôt segment 52, representing 33 attacks; while during the same period the officers furnished none, and the women and children 39, of which 32 were exceptional during three months of 1865, and will be detailed separately. Excluding the intruding section from the depôt, as tending to oppose accuracy in deductions drawn from the ophthalmia in relation to the follicular phases previously narrated, the statistics of the 1st Battalion 22nd Regiment furnished the following data:—

* Surgeon-Major Adams substantiated the existence of follicular disease among the men in September of this year; unfortunately no data were retained.

† Report of Surgeon-Major Adams. This outbreak is extremely interesting, and bears upon the question of etiology of follicular disease as a sequel to purulent ophthalmia, as a careful examination of the women and children in June 1863 indicated their all but complete freedom, while the men were tainted. The absence of all chronicity would show a prior healthy lid in this section of the regiment also in September 1861.

‡ "Army Medical Report," Vol. v. p. 494.

§ Popular opinion in Malta associates the exacerbations of ophthalmia and the sirocco winds. Although the statistics of the 22nd Regiment do not substantiate this statement, it cannot be questioned that the characteristic warmth and moisture of these winds must, by their relaxing tendency, augment any conjunctival vascularity and clearly predispose to any slight irritant; their effect in causing relapses (Hennen) and retarding recovery is indubitable, and explains the general idea, a relapse being invariably regarded as a fresh attack.

Year.	Admissions.	Attacks.	Proportion of Relapses.	Average Duration of Case.	Average Duration in Hospital of all other Diseases.	Proportion of Ophthalmic Attacks to all other Attacks of Disease.	Percentage of Ophthalmia in Hospital at end of each week.	Percentage of Cases under 7 days in Hospital.	Percentage of Cases beyond 31 days in Hospital.	Complications.
			Per cent.	Days.	Days.	Per cent.	Per cent.			Per cent.
1863 ...	35	31	11.5	12.3	15.27	6.1	4.1	77.4	6.4	...
1864 ...	20	16	20	22.6	13.70	4.9	10.7	43.7	18.7	5
1865 ...	56	36	35.7	33.3	14.84	13.1	30.8	50	33.2	16
1866 ...	64	41	35.8	36.4	13.04	30.2	90	17	41.5	20
1867 ...	16	10	37.5	57.9	14.89	9.5	42.5	10	70	25
1868* ...	11	6	45.5	49	13.38	11.3	54	16.6	66.6	33

Hence it will be observed that the attacks demonstrate the decrease in 1864 coincident with the general retrogression of the "grey granulations," the exacerbation in 1865 following their re-advance, reaching a climax in 1866 consequent on exposure of the weak lids to rigid climatic excitants in New Brunswick, succeeded by a gradual decline both in ophthalmia and follicular disease on healthy atmospheric surroundings. The augmenting severity and tendency to relapse (in two cases to a seventh time) in ratio to the duration and consequent maturity of the follicles is no less indicated, as well as the relative importance of the ophthalmia in the general sick list expressed as a proportionate percentage to all the diseases, which the progressive percentage in hospital at the end of each week, to the climax in 1866, equally substantiates as well as the advancing intractability of the malady, and strong tendency to chronicity proportionate to maturity of "vesicles"; the one disease in 1866 constituting one-third of total admissions, and preponderating most markedly in causation of inefficiency of the corps. Equally expressive of its progressive severity is the yearly advancing percentage of cases more than 31 days in hospital with the decline of those under 7; of the latter, the year 1864 corroborates the deductions from the number of attacks corresponding to decline of vesicles, leaving intact the severity of the cases occurring during that period from the maturity of the granulations as exemplified by the average duration of case, the percentage beyond 31 days in hospital, and complications. The tendency for these latter to ensue in proportion to the chronicity of the cases is apparent, a relapse being more frequently associated with them than a primary attack in the proportion of 4 to 1. Permanent defects followed complications at a percentage of 48, and invaliding 29 per cent.; the actual number discharged the service being 9, or in proportion to admission 4.4 per cent.

Of 176 primary attacks of all conjunctival lesions admitted into hospital from 1863 to 1869, 143 had clear follicular disease as a primary element—a ratio of 81.2 per cent.; in 17, or 9.7 per cent., the lids were healthy; in 16, or 9.1 per cent., the previous condition was doubtful (*i. e.*, not certified to in notebook, but not excluding the possibility of vesicles). While the average number of days in hospital from all ophthalmia was 35.2, the non-follicular was 12.3; 89 per cent. of relapses had follicles; 4.5 per cent. not.

Among these attacks no discrimination is made between the different varieties of conjunctival lesion, whether simple conjunctivitis, catarrhal, purulent, or granular, or as to causation; the proportionate dependence upon the follicles as a predisposing agent and productive of chronicity being, clearly demonstrated. Nothing, however, has tended so much to mystify the disease and to retard the elucidation of its etiology and pathology as the amalgamation of all conjunctivæ to which the soldier is liable under the one term "military or granular ophthalmia," as varieties of one specific form; the denial by some of the very existence of the grey granulations following, because that, forsooth, every case irrespective of causation cannot be brought under the same category, cannot indubitably exemplify their invariable presence as a primary element in the inflammatory attack. That the soldier is liable, in common with every individual of the community at large, to either of the distinct forms of conjunctival lesion of authors when exposed to usual causa-

* 1869 is not included, inasmuch as only four admissions occurred during the year from this segment.

tion is evident, and probably to a greater extent, inasmuch as the variations of climate and soil to which he is subjected on service, especially foreign, frequently exemplifying the ascribed causes in an intense degree, as well as that, common also with isolated segments of the community, he betrays a like follicular hypertrophy, potent for chronic disease, when exposed to similar miasmatic agencies. The more or less endemicity of grey granulations and its associated ophthalmia does not exclude the occurrence of ordinary catarrhal or purulent forms in healthy lids of the same community when exposed to the usual agencies, and moreover there is the secretion from granular ophthalmia, when endemic, always present (provided the strictest quarantine be not enforced) to assert its influence indiscriminately on follicular or healthy lids, hence the necessity of a cautious scrutiny into each case occurring, for the transference of it to its proper sphere of causation and right differentiation of the lesion, and consequent accurate data for prevention and eradication.

Of the 176 attacks, in 120 both eyes were primarily affected, or within three days of each other; in 31, the right eye only; in 20, the left; in 5, it commenced in one eye and extended to the other after a prolonged interval.

The relative prevalence of the ophthalmia in different segments of the battalion demonstrated that the presence of grey granulations is not necessarily followed by an inflammatory attack, and that the ratio of their prevalence is not always coincident with the admissions, so much depending on individual exposure to exciting agencies, but the latter operating on all with like intensity, the frequency of the conjunctival lesion will follow *pari passu* the diffusion of the grey granulations; *e. g.*, on transference of the regiment to New Brunswick, with its general climatic rigors, Companies B and H, with fewest instances of follicular disease, produced ophthalmic admissions 1.3 per cent. of strength; I, K, and Band, the worst, gave 14 per cent., with numerous slight cases treated out of hospital; the intermediate companies gave 6.6 per cent. of cases.

Relations of Ophthalmia to Grey Granulations.—The dependence of the granular ophthalmia upon prior follicular disease* being indubitable, the question arises, in what relation do they stand? That these follicles may, under favourable conditions, so become developed and associated with hypertrophy of the papilla of the conjunctiva, entirely independent of such inflammatory action as is cognizant to the observer by the usual objective symptoms, as to be in no way differentiated from the granular lids as a sequel to engrafted conjunctivitis, I have before stated,† and from my own observations, substantiated by unshaken evidence, it would appear that such a phase of the process is not uncommon where the surrounding conditions are uniform and free from external exciting climatic agencies, such as prevail in the underground cellars of the poor Maltese.‡ However, these are not the phenomena characterizing the daily life of the soldier. A forced exposure, day and night, wind and wet, dust or sunshine, hot guard-room and cold "sentry-go," engraft inflammation upon his predisposed lids with a severity out of all proportion to what the ascribed cause would have produced in a prior healthy conjunctiva. The character of the induced inflammation varied extremely, from simple conjunctivitis in the early cases to slight catarrhal or catarrho-purulent in the later, and dependent less on the nature of the exciting cause§ than the stage of development of the

* A strong analogy between grey granulations of the conjunctiva and miliary tubercles of the lung may be detected. Primary elements of disease, originating frequently under like conditions and presenting a great resemblance in morbid anatomical constituents, each may demonstrate the same retrogression, and leave the evidence of their prior existence in degenerate particles; or, developing, may predispose to from slight causes, or actuate *per se*, inflammatory process in the surrounding tissues, blending the products in one confused mass with deterioration, if not destruction of the normal histological elements.

† "Army Medical Report for 1863," p. 495.

‡ In these families every gradation of the disease can be seen, from the discrete follicles of the younger with no vascularity, to their hypertrophy in the elder children with general tumefaction, on to the granular lids of the adolescent, and "blear eyes," or corneal opacities of the adult.

§ It would appear certain that any external agent capable of acting as an irritant to the mucous membrane, no matter its nature, will induce inflammatory action in grey granulation lids, producing varied forms of conjunctivitis according to the degree of prior lid derangement.

grey granulations, one feature only being constant—the excessive involvement of the palpebral tissues in comparison to the ocular conjunctiva. In the slighter cases all morbid action was limited essentially to the eyelids, involving in decreasing degrees of severity the sinus and sclerotic reflexion; at the commencement of the superadded inflammation, the lower lid was invariably more involved than the upper; in some it was entirely limited to the former and the inferior segment of the sclerotic conjunctiva, the chemosis and vascularity not extending above a line drawn from one to the other canthus. While the nature of the engrafted inflammation from ordinary excitants varied from simple conjunctivitis to slight purulent, it must be remembered that the membrane was not exempt from the usual causations of the severer ophthalmia, demonstrating under these circumstances the intensity of the specific inflammation with the subsequent chronicity of the grey granulations.

Pathology and Morbid Anatomy.—The pathological condition above narrated is easily understood when we consider that in these cases prior to inflammation as a strong modifying factor, there are in existence not only the grey granulations studding the lower lid, but consequent on their presence and the developmental phase of which they are the seat, frequently also hypertrophy of the conjunctival tissue, especially the papillæ of the upper lid at each canthus and along the line of the upper edge of the tarsal cartilage, so that, on everting the upper lid, even within two or three days of the commencement of the inflammatory attack, granulations (hypertrophied papillæ) are already developed; in fact, the hyperplasia of inflammation has merely rapidly advanced what would have gradually been brought about by continued follicular cell proliferation in the lower lid.

Carefully watching the inflammatory phase a marked distinction will be observed in the morbid anatomical elements of the conjunctival tissues of the upper and lower lid. How far these are dependent on the histological constituents, the limitation of the closed follicles to the lower lid, or the excess of papillæ in the upper is questionable. The naked-eye aspect of the granulations of the lower lid, the hypertrophied follicles, is that of smooth, hemispherical, semi-transparent, firm, gelatinous-looking, pinkish structures, averaging 1-15th of an inch in diameter, situated in the sub-mucous tissue in regular linear series of about 1-5th of an inch in surface breadth from the inner to the outer canthus. Microscopically they are composed of nucleated granular cells floating in more or less thick granular fluid according to the degree of growth, surrounded by a fibrous tissue cell stroma, the thickened glandular enveloping membrane which, on further morbid action, merges into the neighbouring structures. The conjunctiva stretches over these morbid growths which, if large, produce an atrophy of its elements, giving a lighter hue in inflammatory injection compared to that beyond. At the palpebral sinus, the exudation into the meshes of the velvety and deeply-coloured membrane is gelatinous, at the sclerotic the chemosis is more watery. On the upper lid the surface is studded over by rough, closely-packed, superficial projections of every conceivable shape and size—elements of the inflamed conjunctival tissue—invariably more advanced at each canthus and along the line of the upper tarsal edge, from which they gradually involve the lid to the perpalpebral border; pathologically they are hypertrophied papillæ. The contrast between the smooth oval globules of the lower and the rough nodules of the upper, consequent on the predominance of sub-conjunctival in the one, and surface element hypertrophy in the other, is very marked, and probably dependent on the relative proportion of the normal histological components. Prolonged morbid action obliterates these distinctions.*

From these observations the inference is, that as regards the upper lid, the

* Whether the follicles as physiological organs are more numerous in the lower lid than the upper I am unable to state; but beyond a doubt, under exciting causes, they are seen primarily limited to the former, while, on the other hand, the papillæ predominate on the latter. On the supervention of inflammation the impetus given to development no less exemplifies this distinction, but after a long-continued morbid action, the products of chronic sub-acute inflammation are so matted with the primary elements as to defy differentiation; friction also, and "melting down" of surface irregularities of the upper lid from prolonged ophthalmia produces a beaded aspect approximating in appearance the lower, and assimilating both conjunctivæ to an ordinary granulating sore.

morbid anatomy differs but little from what may ensue in any conjunctival inflammation rendered from any cause sufficiently chronic in its nature—highly improbable in any prior healthy lid; and that the distinguishing feature in “granular ophthalmia” is the sub-conjunctival hypertrophied follicle as a primary element.

Diagnosis.—Proportionate to the degree of development of the grey granulations does the probability lessen of their being obscured by the injection and tumefaction of the inflamed conjunctiva. During their early growth it would be difficult or impossible to diagnose their presence in a severe ophthalmia, which however is very rare at this stage; intermediate it may be occasionally doubtful, but at a more advanced period the conjunctiva covering them is firmly bound down to their surface and atrophied, never developing papillæ, and presenting a marked contrast to the membrane at the palpebral sinus, no tumefaction can obliterate them, and consequently their existence is easily demonstrated.* However, even when obscure to the naked eye, the marked thickening of the palpebral tissues with their undue predominance of inflammation (chemosis of the sclerotic not at all common, even when the lids are œdematous), and the existence of enlarged papillæ on the upper lid at a very early stage, or even when the vascularity is mainly limited to the lower half of the eye, differentiates this disease, and renders the diagnosis easy. Other features also distinguishing it from idiopathic inflammation are the comparative less engorgement of the vessels and marked predominance of solid over the fluid constituents in the products of exudation.

Influence of the Inflammation upon the Vesicles.—On the subsidence of the tumefaction the follicles, which may have become temporarily obscured, are again apparent, increased in size, but constant in number†, or, if in an early stage, under the influence of inflammatory action, they may be seen to become milky white and opaque, to burst, leaving the membrane honeycombed, which regains subsequently its normal condition. Such a result is a very satisfactory termination, but appears limited to the early stage when the proportion of fluidity in the follicular mass is highest.‡ As

* Their gradual development can be watched to perfection when one eye sympathetically follows the other, unaccompanied but by the slightest tumefaction.

† It has been supposed by some that secondary glandular growth, neo-plastic products, ensues by a process of germination, and is invoked to account for their apparent excess under inflammatory action as compared to their numbers as physiological organs, and their presence, *e.g.*, cornea and sclerotic, where not normal constituents. The evidence afforded on the retrogression of inflammation does not support this opinion, and I cannot but think that the products of chronic disease have been mistaken for the grey granulation as the conjunctiva, especially of the sinuses, and occasionally of the sclerotic, after long-continued morbid action betrays a condition which undoubtedly, if not read by the light of prior phases, would support such an inference. The nature of the exudation into the conjunctival meshes is very gelatinous, and in the long run becomes semi-organized, betraying in its pathological features a great similitude to the follicular mass; however, at no time are they distinct structural components, but result from hyperplasia of the tissue elements, merging into them, and capable of production elsewhere under like action. The rapidity of their retrogression, and comparative amenability to therapeutical agents, markedly distinguish them from the grey granulations whose persistency and obduracy are explained by their origin from normal histological organs, and not mere circumscribed tissue hypertrophy from temporary abnormal conditions of nutrition. I observed in one case their presence (three in number) on the palpebral edge of one lower lid long after all subsidence of inflammation; but even here there was no clear definition from surrounding tissues into which the limited hypertrophy merged.

‡ A man of the 2nd Battalion 15th Regiment was in hospital with influenza; both lower lids studded with enlarged follicles at an early stage; “eyes generally weak.” On the lower lid of the right eye one of the meibomian glands inflamed. On the corresponding part of conjunctiva much injection present which extended to the sclerotic, the follicles were milky white in this zone. On the following day those occupying the central part had burst leaving depressions in the membrane; on the next day none were discernible, but ridges of tissues intersected the spaces left, which were occupied by a whitish film. No change ensued outside the zone of hyperæmia, nor in the other eye.

regards their ultimate disposal the conditions represented by 60 cases of severe engrafted inflammation at the inspection in May 1869, may be taken as elucidatory, a period varying from 5 years to 3 months having ensued since discharge from hospital. In 37 the lower lid was uniformly thickened and vascular, with the follicular elements and products of inflammation still present, the latter, however, not preventing the clear definition of the former; the upper lid showed but a few hypertrophied shrunken papillæ at outer canthus. In 23 all disease had disappeared, leaving the lids pale and smooth, except the slight unevenness from superficial cicatrices and an occasional papilla. One, more carefully examined, *post-mortem*, presented along the upper edge of the upper tarsal cartilage a band of tissue 1-10th of an inch in breadth, slightly more vascular than the rest, glistening on its surface with thin ridges of fibrous tissue traversing it in every direction (cicatricial tissue); here and there was an isolated shrunken papilla; a few (five or six) small, opaque, puckered spots (fatty degenerated follicles) were situated in the sub-mucous tissue of the lower lids; beyond this the conjunctiva was in no way different from the normal structure.

Association of Ill-health with Grey Granulations.—Deficient stamina and ill-health, as associates of follicular ophthalmia, have been observed from time to time, but whether regarded as predisposing agencies, as dependent on the same causation, or as a sequence is not clear. The evidence of the 22nd Regiment does not substantiate the concurrence of grey granulations and deteriorated health sufficiently frequent to justify an hypothesis of a dependence of the former on the latter or *vice versa*; the co-existence of these growths with apparently the most perfect health was frequent, as well as their occasional absence in debilitated frames; their dependence for origin on other conditions than age, sex, constitution, diathesis, or temperament, was too apparent to be overlooked. But while objecting to the elevation of defective health as a cause or necessary accompaniment of this abnormal state in the early stage, none can doubt of their association, provided the individual be left to imbibe the same pernicious atmosphere, or when, from increased development or presence of external exciting agencies, these bodies maintain a constant irritation which frequently leads the sufferer to retire from the fresh air and sunshine and seek the gloom of some retired nook. Let, however, inflammatory action be superadded, and a lengthened period of treatment necessary; see the individual at the commencement of average healthy aspect, with "nothing but a cold in his eye," to be contrasted with his blanched appearance at his exit, perhaps after months of hospital confinement, his thinned face, depressed countenance, and local defects of the malady! The inability to obtain amusement from books, the morbid frame of mind into which the individual falls from mental concentration on the malady; the want of appetite from deficient exercise, and consequent loss of strength, muscular development and vigour; the etiolated countenance from exclusion of light; all tell on the sufferer's constitution, independent of the actual local subjective symptoms of the lesion, and render it one of the most important points in the treatment how to prevent the wear and tear of mind and body, how to retain a healthy stamina of system compatible with the restraint necessary to effect a normal restoration of the diseased lids and prevent complications.

Subjective Symptoms.—Of the subjective symptoms associated with the early stage of this ophthalmia but little need be said. Pain (except after use of the eye) or photophobia were rarely present, the roughness and heavy feeling of the lids, the glueing together at night, and the discharge (generally slight and watery) were inconvenient, but seldom amounted to an actual complaint; the objective phenomena were the features inducing the individual to seek relief.

Complications.—In reference to the complications, or secondary lesions, to which the tissues of the eye were liable, in contradistinction to the direct result of the engrafted conjunctivitis, it may be stated that in no case did any ensue within 30 days' duration of the inflammation, in the majority postponed beyond six weeks; the probability of such being in direct ratio to the duration of the disease, and consequently more frequent in relapses. As has been before remarked, the severity of the conjunctivitis was concentrated on the palpebral tissues, always in excess as compared with the involvement of

the sclerotic reflexion; chemosis was rarely present to any extent, and only excessive in two cases, in both of which complete corneal opacity, with threatened sloughing, was the direct result of the severity of the inflammation,* the sole instances of primary involvement of the tunics proper of the eyeball. Early impairment of the tissues of the globe being of such rare occurrence, it becomes an important matter to elucidate the causation of the secondary lesions, supervening when much of the inflammatory vascularity, and especially that of the sclerotic, has subsided. Their all but invariable commencement in, and frequent limitation to, the upper section of the cornea† normally swept by the upper lid, their dependence on chronicity, with firm, rough, hypertrophied papillæ, and the evidence of treatment, determine their causation in the mechanical irritation of the granulations on the opposing surface of the lids. The necessity of educing the true causation of these lesions for the application of rational therapeutical measures is apparent, when it be remembered that in the majority of cases it is by a gradual involvement of the cornea, and subsequent implication of the deeper tissues, that partial or total impairment of vision, or even destruction of the eyeball is effected.

Photophobia, lachrymation, optical and circumorbital pain, previously absent, were the subjective symptoms indicative of a corneal involvement, and the palpebral roughness, mechanically irritating as movement of the eye caused friction on the cornea, was a great subject of complaint.

The most frequent corneal derangement consisted in a tumefaction of its coats, gradually progressing from the circumference to the centre. At first, the cornea was clear and transparent, but its surface was uneven and apparently nodulated, reflecting the light as from numerous different facets; subsequently the nodules became opaque (the disease at this degree very much resembling a premature arcus senilis), and numerous straight vessels proceeded from the sclerotic into the morbid zone. According to the progress of the complication this process was gradually extended, implicating section after section of the upper half of the cornea, or even its entire surface, producing, in its extreme degree, pannus. This lesion, slow in its operation, consisting in hyperplasia of the deeper corneal elements, was not uncommon after two months' duration of the disease, its extent various, and generally not productive of impaired vision after recovery from non-implication of the zone for transmission of rays of light. In no case was it associated with destruction of tissue, or active change in other tunics of the eye, but relapses were numerous.

Ulceration of the cornea was next in order of frequency, usually one, oval, sharp cut, and accompanied by one or more vessels, passing to it from the sclerotic. The seat of the ulcer was nearer the centre than the circumference of the cornea, and invariably in the upper half. In one case perforation occurred with staphyloma and collapse of globe.

Less frequently did corneitis ensue with effusion between, and separation of the coats, usually retaining much transparency. The conjunctival layer especially was thrown into folds and puckered, and on healing leaving a diffused haziness. Sloughing did not result, although its probability highly suggested itself. In two cases this lesion extended over a portion of the cornea rather larger than a split pea, near the outer circumference of the upper segment, and corresponded to a persistent patch of granulations near the outer canthus.

Occasionally a phlyctenula was observed, and in two cases small scattered patches of opaque exudation in the deep structure ensued over the upper half of the cornea. In six cases inflammatory action advanced beyond the cornea to the posterior tunics, producing in all very great defects of vision.

The progressive sectional vascularity and opacity, the most frequent complication, was extremely liable to return on the slightest relapse of the palpebral disease; ulceration and corneitis were invariably attended by great photo-

* In one of these there is every reason to believe that the transference of gonorrhœal matter to the eye was the cause of the engrafted inflammation.

† In only one case did the involvement start from the circumference of the lower segment of the cornea; here the lower lid, which ordinarily in the open eye covers no portion of that tunic, was in contact with its surface equally with the upper.

phobia and intense circumorbital pain, and produced the greatest number of permanent defects; the involvement of the posterior tunics occurred only after a very lengthened period; in two instances morbid interference with the nutrition of the eyeball (independent of complications above narrated) ensued, as evinced by softness of the globe;* and in one the movements of the eye, especially in an outward direction, were curtailed.

Of the lesions remaining in the lids, the most common, and a very frequent one, was the conjunctival roughness, vascularity, and tissue hypertrophy, with a great tendency to relapse—a constant source of re-admissions and inefficiency, and demanding incessant supervision and treatment. Occasionally, the palpebral tissues were so matted together as to produce permanent thickening, with partial immobility of the lids, especially the upper, and in one completely opposed the action of the levator palpebræ muscle. Laxity of the eyelids generally, and want of tone in the sphincter muscle often remained for some time subsequent to discharge from hospital, and in one occlusion of one canaliculus followed. Occasionally, after termination of all treatment, a man would return with a limited swelling of one of the lower lids; on separating it from the eyeball, a small abscess, the size of a No. 1 shot, would be detected in the submucous tissues, evidently suppuration of one or more of the follicles.

Exciting Causes of the Engrafted Ophthalmia.—The predominance of the dual over the single eye implication has been previously shown, and especially characteristic of the early cases, while in rather less than a third a complete limitation to one eye was present, with greater frequency in the severe and later cases; the explanation probably being that in the former the exciting cause was the growing follicular mass, and consequently bi-lateral; in the latter, external agencies, and often unilateral in operation and results. In a few cases the diseased action on the one side would produce sympathetic hyperplasia in the follicles of the other, the induced lesion, however, never arriving at the same intensity; while also a retrogression of the grey granulations in the non-involved lid was occasionally seen during a prolonged residence in hospital from single ophthalmia. Of the predisposing tendency to severe inflammation, from slight causes, of the follicles there could be no doubt, nor their capability of originating and advancing to granular lids under favouring circumstances, irrespective of active inflammatory action. The presence of the grey granulations substantiated, the nature of the agent determining the conjunctivitis seems of but secondary importance, any mucous membrane irritant sufficing; the engrafted lesion being invariably out of all proportion to what the ascribed cause would have produced in a prior healthy lid. The impossibility of establishing from interrogation of the sufferers, or by strictest scrutiny, a basis of causation for prophylaxis and eradication was very apparent. In reference to the experience in the 22nd Regiment, the only factor which was unquestionable was the exposure to night air and variations of guard-room temperature with general atmosphere,† not only productive of a few primary attacks, but very constant in determining relapses. In the majority, 68 per cent., there was no ascribed cause, but the remainder embracing smoke, dust, glare and heat, draughts of cold air, sleeping in open air while on guard, flash from nipple of rifle, irritation from snow, running of perspiration into eye—so uncertain and variable, however, as to be worthless for theoretical deductions or practical application. In three cases there was reason to believe that transference of purulent matter was the agent, and in one maliciously generated.

Corroborative also are the data furnished in the Army Medical Returns for

* It would appear to be a matter for elucidation whether the altered nutrition of the eyeball, consequent on long-continued hyperæmia and hyperplasia in the adjacent tissues in early life is not frequently productive of visual derangements. I have often been struck in recruits with the frequent association of defects in accommodating power of eye with evidence of early ophthalmia as to suggest a relation of cause and effect.

† "Exposure on guard is another of the causes assigned by Dr. Jennings. I have met with several instances, some among the invalids of the present season, who distinctly refer their first sensations of uneasiness to a night guard."—Remarks by Mr. R. Lawson, "Army Medical Report," Vol. v. p. 342.

the Service generally, opinions fluctuating vastly, the attempt to elucidate sufficient causation resulting in an avowed impossibility, or a refuge in "existent for a long time," climatic causes, or contagion.* Unquestionably the latter is the only one of the ascribed factors of sufficient potency to explain the endemicity of the disease; for while dust, glare, heat, draughts, solar radiation, and foreign bodies may separately or associatedly produce an occasional conjunctivitis, yet the connection between them and ophthalmic prevalence is based upon a very frail foundation. It must be remembered that the disease is not common to masses of men constantly exposed to the influence of one or other agency. The Arabs of the desert,† with their dust, glare, and heat; the Canadian exposed to snow irritation, solar radiation, and rigors of climate for six months of the year; the seafaring man; the Indian trapper, and those constantly pursuing their avocation in the open air; the upper stratum of the community,—all enjoy an immunity, while limited segments of the poorer classes living an indoor existence, under every variety of climate, furnish its victims in civil life, and isolated corps, all but limited to the ranks of the Line, exemplify the disease in the Army. Excluding these epidemic agencies as insufficient, the explanation of its endemic prevalence is demanded. The highest authority on Army sanitation‡ inclines to contagion as the method of its propagation, which is often adduced as the explanation of its diffusion throughout a regiment; a primary case granted, the transference of the malady from one to the other being sufficient, in the opinion of some, to account for the phenomena to be gleaned from an infected body of men,§ extending over years, and in spite of all the means at disposal which discipline and unlimited authority render available for the eradication of any diffusible virus. It is of paramount importance to arrive at a correct conclusion on the subject, for it is from accurate data on its origin and distribution that measures for its eradication must be deduced. The Medical Reports demonstrate the existence of endemic ophthalmia in the Army during a long series of years, and its presence at this time, notwithstanding constant repressive proceedings. The question then may be fairly asked,—Do the facts observed in an ophthalmic corps substantiate the hypothesis of contagion as the main element in diffusion, or as influencing it in but the slightest degree, and are the results obtainable from practice based on such a theory of so cogent a nature as to anticipate a probable early lessening of the disease and its eradication in the future? Experience decidedly negatives this, and bids us direct our attention elsewhere for the solution of the problem. It is impossible to deny the capability of producing an ophthalmia by transferring the secretion to a healthy individual, or that in a few instances of neglect its diffusion may not be traced in an infected regiment to such a cause; but it may be unhesitatingly asserted that in a given body of men with grey granulations in the lids, in spite of the most rigid isolation and complete seclusion of the ophthalmic from the healthy (and this I believe is the constant practice in the Army generally, and enforced by the Regulations), cases of severe disease will occur from agencies of the

* Extremely important are the deductions of Mr. R. Lawson (vol. v. p. 339, "Army Medical Report") from the ophthalmia at the Cape. He shows the necessity of "something to account for its irregular outbreaks and irregular appearance among different descriptions of force, beyond the usual assumed causation," "its development among certain persons often occupying a limited space, while others in their vicinity are nearly or altogether exempt," as well "as its presence in a given regiment or a barrack not being followed by like conditions in the succeeding body of men"; "something to account for its variations, the external conditions remaining the same, with little or no change for many years in succession."

† "Glare and dust alone seldom cause eye disease. Everybody knows that ophthalmia is unknown in the desert; and the people of El Hejaz, who live in an atmosphere of blaze and sand, seldom lose their sight."—Burton, "El Medina," vol. iii. p. 176.

‡ Parkes, "Practical Hygiene," p. 495-581.

§ Independent testimony scattered throughout the Army Medical Reports substantiate the earliest cases in a corps commencing ophthalmic as "invariably slight, easily cured, and widely diffused." Is not this opposed to pus inoculation, and all the evidence derived from indubitable instances of direct transference in a community?

most innocuous nature to lids uncontaminated by these follicular growths; and that provided only ordinary care be used to counteract diffusion, not one in fifty cases originating in an ophthalmic regiment can be fairly placed to contagion, while when extraordinary preventatives, such as frequent inspections, quarantine, &c., are observed, the transference of the disease, either direct or through the medium of the atmosphere, is out of question. It is not at all exceptional to find one company with men of relaxed lids, the sequelæ of acute disease, producing no fresh cases when a possible communication might be urged, nor, on the other hand, for a company hitherto free to furnish severe cases in succession when not the slightest foundation for intercourse with affected could be inferred, but traceable to external irritants on the susceptible lids. The frequency with which affected and healthy mingle together, with but slight limitation to free intercourse,* unattended by transference of the virus, certainly would suggest the inference that too great a value has been placed upon contagion as the usual method of dissemination, to the exclusion of other agencies, all potent for its origin and persistence. That all purulent discharges from the conjunctiva can originate an ophthalmia is unquestionable—that under bad hygienic conditions and overcrowding,† epidemics are traceable to such a cause, and subdued by practice based on such evidence, is also so—yet to infer that all ophthalmiæ are akin in nature and origin, and when endemic to owe this feature to contagion as a basis of extirpation, is certainly antagonistic to the data derivable from the British Army, and leaves the fountain-head of the malady intact to pursue its ravages year after year, with such modifications only as are fairly deducible from the extending sanitary reforms.

Endemicity of Ophthalmia.—That the endemicity of ophthalmia is due to the grey granulations predisposing to conjunctivitis would appear decided; a recognition of their *de novo* origin in a foul, long-continued, vitiated atmosphere, and the relation of the induced inflammation as engrafted—modifying but not producing these bodies, and dependent on them for chronicity—have been enforced. From this it follows that a basis for stamping out endemic granular ophthalmia, ignoring the germs, would be on a par with an attempt to banish the ophidians, unmindful of the ova deposited in the sand for maturation by the sun. So long as grave defects of hygiene characterize the barracks of certain foreign stations will ophthalmia maintain a high position in causing temporary inefficiency and permanent loss in the Service. It is only by an acknowledgment of the dependence of the inflammatory attack and its chronicity upon the primary element quiescent for a lengthened period until external agencies indicate its potentiality, that an explanation is furnished of the frequent irregularity of ophthalmic outbreaks in certain barracks in the successive bodies of men occupying them—a healthy site with free ventilation, full exposure, immunity from prior disease, suddenly showing

* Perhaps the most complete intercourse is that between mother and child, yet how seldom do we see the disease communicated in *Ophthalmia neonatorum*! The undoubted instances of transference of purulent matter pertains to children in schools or workhouses, seldom to adults when unintentional.

† As showing the influence which an atmosphere vitiated with the excretions from the skin, lungs, and body of human beings may exert on the conjunctiva, are the outbreaks in the slave vessels recorded by Mackenzie:—"In 1819, the 'Roheur,' a slaver, French crew all healthy; the inhabitants from amongst whom the slaves were taken had no trace of ophthalmia, neither had the slaves themselves until fifteen days at sea; the originating conditions being extreme crowding, partial absence of light, diminished supply of water, hot equatorial temperature; disease very virulent, quickly implicating the eyeball and destroying the sight; it continued to rage until arrival at Guadaloupe, when removal from the stagnant vitiated air to pure atmosphere and cold-water applications soon subdued the disease. The same vessel met a Spanish one in similar circumstances." Mayhew, in the "Horse Doctor," notes the intimate connection between specific ophthalmia, foul stables, and bad air, as well as its chronic nature and tendency to relapse, and slightness of the imputed cause to the grave local lesion. He says, "In the South of Ireland, where poverty prevails, humanity is obliged to shelter itself in strange places, and any hole is there esteemed good lodging for a horse. In that part of the kingdom, ophthalmia affects the majority of animals; it not only preys on horses, but seizes on mankind."

a high rate of admissions consequent on a change of corps;* equally seen also on transference of regiments from certain foreign stations to a healthy climate, but of rigorous atmospheric agencies, the clue unquestionably residing in the prior existence of the grey granulations.

Question of Specificity.—The impropriety of affixing the limiting term "military" to the disease, as though peculiar to this segment of the community, was pointed out in 1860 by Dr. Frank, yet it is much to be regretted that some qualification expressive of the morbid prodroma, as an adjunct to the term denoting the tissue implicated, is not in general use. The grounds for raising it into a specific form are not so clear, trending as they do upon the possibility of its producing the like through the medium of the secretions. The following facts strongly oppose any such deduction:—

Isolated outbreaks of ophthalmia occurred in the married families of the 1st Battalion 22nd Regiment, during the latter part of the summer of 1865, at Malta, as follows:—The quarters occupied were those of Burmola Curtain and Polverista in the Cottonera district. At Burmola Curtain the disease originated in a very dirty family, of which all the members, except a young child at the breast—father (sufferer in the year following from granular ophthalmia), mother, and two girls—had vesicles in their lids. On the 15th August, after a few days strong wind and dust, inflammatory action of apparently catarrhal nature was superadded to the unhealthy lids of the elder girl, followed by the same condition in the younger on the 18th. On the 24th a boy in another family, a schoolmate of the elder girl, had severe purulent ophthalmia, and transferred it to his sister on September 4. Between August 28 and September 4, all the children (seven) of the three other families, living in the same passage with the first family affected, suffered from the purulent form, which was easily prevented extending by the quarantine of the affected. Careful examinations, before and after, of these sixteen families in this block of quarters failed to detect the presence of the grey granulations in any except the Power family, the originators of the disease. In these, the nature of the superadded inflammation was rather catarrhal, and limited mainly to the lids, while that propagated to the nine other children was of the severe purulent variety, with great chemosis of the sclerotic conjunctiva; yet the subsequent progress of the cases demonstrated the influence of the follicles in prolonging the engrafted conjunctivitis, for, while the two Power girls presented anything but a healthy state of the lids three months after the attack, all the propagated purulent cases had terminated in convalescence within four weeks. In no instance did grey granulations ensue as a sequel to the ophthalmia, and the same was noted in the baby Power, who subsequently suffered from the disease, probably contracted from the sisters.

At the Polverista quarters, about one-third of a mile from the former, the disease dated from August 14, in a girl (Griffiths) 8 years of age, with vesicles in the lids, the exciting cause "dust and wind." Purulent ophthalmia was transferred first to the two sisters and children in the same block, and next, by means of a playmate, to a dirty family in an adjacent locality, where the four children and mother suffered. Twenty-two children in all were affected, and, as at Burmola Curtain, rigorous isolation at once put a stop to the propagation of the malady, which followed the same course in the one quarter as the other, with this exception, that one girl who had a previous remarkably roughened membrane (hypertrophied papillæ both in upper and lower lids) from frequent neglected attacks of conjunctivitis, suffered from prolonged chronic disease equally with those primarily vesicular. The propagated purulent ophthalmia in a prior healthy lid—although from the attendant chemosis, intense vascularity, and profuse discharge, apparently a more dangerous malady than the catarrhal affection engrafted on grey granulations—succumbed readily to treatment, and in every case terminated in a normal state of the membrane. In this respect the contrast was most marked, and beyond all doubt.

Another instance may be quoted in which two or three cases of chronic

* Exemplified as early as "1805 at Hythe on the arrival of the 52nd Regiment, 636 out of 700 (mostly Irish recruits) were ophthalmic. 43rd Regiment and "Lincolnshire Militia free; as well as the residence of the French soldiers in 1832, "in the Belgian barracks, without infection."—Quoted in the "Medico-Chirurgical Review" for April, 1863, p. 398.

granular lids, with purulent discharge, were placed with healthy men under bad conditions, highly conducive to propagation. Here two severe cases and twelve slight ones followed, while men immediately adjacent, and under the same general conditions, were entirely free. Rigorous isolation at once stopped the spread, and in no case did vesicles result when a prior healthy state of the lids was in existence.

From these facts we may deduce the following:—(a) The necessity of segregation of chronic ophthalmia with purulent secretion, unless good sanitation be present; (b) the independent origin of granular ophthalmia under ordinary agencies, when grey granulations are primary elements; (c) the nature of the communicated lesion—purulent; (d) the facility of eradication and the absence of chronicity in prior healthy lids; (e) the absence of grey granulations consequent on the transference of the secretion from a granular lid to a healthy eye.

If then specificity in disease is to receive the same rigorous translation as in the animal world, and to include those sections only capable of, and invariably producing like, the justice of raising this ophthalmia to such a basis receives a rude shock,* which does not lessen if we exclude the superadded inflammation as non-essential, and limit our attention solely to the primary and essential elements, the grey granulations; yet, excluding the capability of propagating the like, inasmuch as the enlarged follicles are the fundamental principles, both in a clinical and etiological point of view, the propriety of differentiating this into a distinct variety of conjunctivitis cannot be questioned.

Source of Inefficiency in Campaigns.—In order to estimate at its proper value the latent elements of inefficiency and sickness always present in a regiment or corps endemically affected with follicular conjunctival disease, and ready to assume grave proportions as soon as ultra exposure, such as invariably happens in camps and on active service, shall give the necessary impetus, we have the teachings of the excessive admissions from ophthalmia in the garrison of Malta in 1857-59, consequent on the arrival of nine regiments from the Crimea, from 76.28 per 1,000 of strength in 1856 to 205.27, 155.5, 108.96 per 1,000 from 1857 to 1859 respectively,† indicating it clearly as one great source of inefficiency during the war; the Chinese war in 1860, when “ophthalmia was twice “as prevalent during the campaign as in the preceding period, chiefly in the “1st Battalion 3rd and 67th Regiments, imported with them from India, and “following them throughout the whole campaign, while the Native troops “were exempt from it”;‡ the outbreak in “the detachment of the 1st Battalion 3rd Regiment, wrecked at the Cape on its voyage home from China”;§ and the prevalence of the malady in 1862-63 in New Zealand, in the 70th and 40th Regiments, especially under the exceptional circumstances of camp and hut life, constituting during the period “the most prominent cause also of “invaliding.”||

Treatment.—From what has been previously stated, it follows that the prophylactical and therapeutical agencies applicable to the primary follicular lesion and subsequent ophthalmia merge the one into the other—sanitation predominating in the former phase, medicinal applications in the latter. The essentials of this ophthalmia (grey granulations) being granted, with their endemic dependence on vitiated atmosphere, but little doubt is left as to the necessary measures to oppose its *de novo* origin in the Army—a rigid exclusion

* Wells on “Diseases of the Eye,” p. 51, states,—“It,” *i.e.* the discharge from acute granular ophthalmia, “does not necessarily produce the same affection but “may give rise to catarrhal, purulent, or diphtheritic conjunctivitis”; and at p. 28, after repeating the same of purulent ophthalmia, continues,—“The special form of “conjunctivitis which may arise will depend on atmospheric, local, and constitutional causes, and also upon the age of the patient.” A question arises from this: Is there any specificity in conjunctival inflammations especially in regard to propagation, and are they all varieties merely of one form of lesion; and if so, dependent for variation on such elements as above mentioned, what is the worth of the clinical differentiations set forth in textbooks on the subject, to say nothing of the etiological basis attempted?

† Marston, in “Beale’s Archives of Medicine,” 1862, p. 15.

‡ “Army Medical Bluebook,” 1860, p. 107.

§ Ibid. p. 135.

|| Ibid. 1863, p. 109.

of recruits, with the germs already advanced, from the civil hotbeds of the malady; a healthy dry atmosphere, day and night, in every barrack occupied by the soldier. The evidence on this head substantiates that afforded by the presence of phthisis, continued fever in the Army, added to struma and anæmia in civil life, and demonstrates that the safeguards against climate and atmospheric vicissitudes, human habitations, contain within themselves the components necessary for the origin and development of the disease; the light and fresh air, against which such barriers are erected, being found the most efficient factors in its eradication. The frequency of origin of the granular ophthalmia in certain foreign stations—*e.g.*, Malta, the Cape, and especially in certain barracks, notoriously in the former Ricasoli, San Francesco di Paolo, and lower St. Elmo—and the necessity of residence during at least twelve months for the complete endemicity of the grey granulations have been before observed; careful enquiry would no less clearly indicate the barracks serving as foci at the Cape and the plains of India, and would suggest the desertion of these hotbeds,* or at least their occupation by one regiment or corps short of a year, followed by a succession of healthy quarters. However, the existence of the follicular lesions being certified, the course for their suppression would appear no less clear—removal of the men from the fostering dwelling air,† and transference to an equable atmosphere with good hygienic constituents, devoid, as far as possible, of external exciting agencies capable of engrafting inflammation upon the already predisposed lids.

Characterising the presence of the grey granulations are numerous cases of "weak eyes," the lids glued together at night from slight discharge, the early stage of the adult granular ophthalmia. The advantage of frequent inspections, twice a week, for the isolation of the advanced cases, and attempted arrest of development of the vesicles by therapeutic measures, is fully attested by results. In the 1st Battalion 22nd Regiment it was the custom to segregate these men and to enforce daily attendance at hospital, with attention to the general surroundings in barrack. The application of a solution of nitrate of silver (10 gr. to 1 oz.), by means of a small narrow brush, carefully employed, with surplus of fluid removed, to the lower lid, with simple ointment or tannic acid in glycerine (1 dr. to 1 oz.) at night, was very efficacious in restraining the growth of the granulations, and by diminishing the general irritability of the conjunctiva, rendering engrafted inflammation less probable. There was no relief from duty for these men, and the results were often very satisfactory, a curtailment of the associated vascularity being invariable, and occasionally followed by a cloudiness and rupture of the granulations, the honey-combed conjunctiva gradually regaining its normal condition.

The occurrence of severe cases of ophthalmia among follicular lids, from external agencies, being certain, despite rigid inspections and isolation of the more advanced granulations, it becomes an important point to withdraw the individual from the mass, for prevention of possible communication of purulent ophthalmia, before and subsequent to discharge from hospital, and to bring the case as early as possible under treatment. The therapeutics of the milder forms resolve into fresh air, cleanliness, rest of organs, astringents, and counter-

* As has been constantly observed by competent authorities, putting on one side all ideas of humanity and duty of State to its *employés*, there can be no conceivable doubt that the cost of erection of new barracks on proper sanitary principles, on well-chosen sites, would in a short time amply compensate, by the saving of life and service, through curtailment of preventible sickness and death.

† Irrespective of the experience of Stromeyer as regards good ventilation in the Hanoverian Army, and the evidence furnished by the Danish and Portuguese as to desertion of barracks, numerous instances could be adduced to show the beneficial results of removal to a good sanitary quarter, the climate remaining the same: *e.g.*, 2nd Batt. 3rd, 2nd Batt. 15th, 2nd Batt. 23rd, and 2nd Batt. 22nd Regiments exemplify this by transference from the town barracks in Malta to the country one at Pembroke Camp. In the 2nd Batt. 23rd Regiment, a removal to a crowded, badly ventilated barrack again witnessed the return of the disease with redoubled force, to be again subdued by a transference to Pembroke Camp. Of the results of removal to a different climate, the Army Returns are full: the 22nd Regiment well demonstrated it, Malta originating the disease, a departure of one Battalion to New Brunswick and the other to Mauritius witnessing its decline.

irritants for the subduing of the inflammatory process; the severe, with complications, are extremely varied. Left to pursue a course unmodified by medicinal applications—the adoption of *laissez aller* system, with its universal curator, time—the severe forms unquestionably advance from bad to worse, to complications and impairment or loss of sight. The duration in hospital being invariably long, the necessary restraints upon personal liberty, and the mental weariness consequent upon exclusion of books from the presence of diseased action in the adjacent tissues of an organ of so vital an importance as the eye, the wear of the moral faculties from brooding over sensations and feelings ever reflected and intensified, render the general treatment no less important than that demanded by the local lesion. Photophobia is all but absent until complications ensue, hence there is no demand for the shutting out of light, which undoubtedly tends to produce, in no small degree, the etiolated figures so frequently met with in an ophthalmic corps. To ensure abundance of equable healthy air, to leave the lids free from all excluders of atmospheric contact, curtailing the direct rays by a properly adjusted shade, to surround the patient with hygienic conditions, and absence of all exciting agencies, to enforce rest of organ, rigid cleanliness, and prevent the transmission of the virus either to an eye not primarily involved or to another individual, with attention to general health, and maintaining cheerfulness* and hope, are essential as generalities.

The tendency of the engrafted inflammation is to develop quickly to an acme, and, receding more slowly, to pass into a chronic state of vascularity, limited generally to the lids and palpebral sinus, with a few isolated, enlarged, sclerotic vessels, under which the granulations (grey and papillary) are rapidly advanced. To curtail this inflammation, as far as possible, is the first element in the curative process by the usual remedies; subsequently to attack the chronic passive hyperæmia and its attendant lesions, by far the more difficult, inasmuch as the vascularity and hypertrophy of the upper lid papillæ (whose prior or early presence demands recognition) react the one upon the other, and receive mutual support from the follicular elements studding the lower lid, the least influenced by medicinal applications. Leeching and sedative fomentations (hot or cold, according to the degree of relaxation present and feelings of the patient), with counter-irritants frequently repeated, as well as a leech occasionally applied to the conjunctiva at the outer canthus for the chronic condition, are adjuvants; but unquestionably the local applicants to the inner surface of the lids are the most potent. To prevent the development of the papillæ in the upper lid, or to reduce them if present, and so to diminish the probability of corneal involvement, is of vital importance. Discarding strong escharotics, difficult to limit in action, such as nitric acid or potassa fusa, the most useful among the medical armamenta is nitrate of silver of different strengths proportionate to the required results. From 10 to 15 grs. to 1 oz. of water, the astringent action predominates, possibly also with destruction of germs in the secretion; from 20 to 30 of strength, the escharotic, intensified in the solid form;† by a small, delicate brush or pointed end, carefully applied,

* The system of segregating ophthalmic patients has many points which may be reasonably criticised. Provided hospitals be fit receptacles of sick—i.e., ample in cubic space, free general sanitation, good means of ablution, with separate towels and careful supervision—the improbability of communicating the disease to others by general commingling may be fairly assumed, unless maliciously sought for, while the advantage to the ophthalmics by diffusion (not resident constantly in the concentrated atmosphere of one apartment), and the general increase of cheerfulness from conversation with, and enjoyment of the readings of, their fellow patients is evident, especially when the depression and weariness of the occupants of the ophthalmic ward, wandering in search of a method for passing time, with intensified feelings reflected from one to the other, is taken into consideration. The necessity of a separate room for exclusion of light, when complications ensue, is seldom in its occurrence.

† The effects of solid nitrate of silver and potassa fusa upon the mucous membrane of the cheek are carefully delineated in Sir H. Thompson's "Stricture of the Urethra," p. 196, and apply with equal force to the palpebral membrane:—"The application of argent. nit. for 20 or 30 seconds is followed in 10 minutes by the detachment of a layer of epithelium, usually none or a very slight smarting, succeeded by a slight increase of vascularity, and terminating in 72 hours in a healed

with warm water or solution of common salt at hand to wash away or neutralize any surplus, delicacy of localization can be produced. As regards the period of utility of the caustic, it would appear to be limited to that stage when the intensity of the conjunctivitis has been reduced by treatment, or subsided into the chronic hyperæmia (in the early stage it rather adds to than curtails the vascularity), and as long as the granulations exist. Locally applied to these latter early, it unquestionably prevents their advance and limits their development; while used in the solid form, or escharotic solutions, to the mature hypertrophied papillæ, the potency of disintegration of the caustic is no less evident. The theory of its action in the solid form, and the purpose intended by the cauterization, is, according to Stromeyer quoted by Wells, "not that of chemically destroying the granulations, for this would lead to great and lasting injury of the conjunctiva, from the destruction of its secreting organs and the formation of dense cicatrices, but to maintain a certain degree of hyperæmia and inflammation of the conjunctiva in order to hasten the absorption of the granulations."* It has been previously stated that at the examination, in April 1869, of the 22nd Regiment, all the lids completely recovered from severe ophthalmia demonstrated the existence of cicatrices, not deep but superficial in their nature, resembling those depicted by Sir H. Thompson; and the quickest recoveries were those where, from the early application of solid nitrate of silver along the upper tarsal edge, a small slough separated, leaving the white cartilage visible, subsequently obscured by the temporary increased vascularity. The rough tuberculated papillæ of the upper lid being the cause of the corneal involvement, their removal suggests itself, advantageously effected, if very large or pedunculated, by scissors, or, if close set and small, by caustic, the adoption of such treatment being followed by great relief to the patient. The possibility, however, of removal of these granulations (the hypertrophied surface elements) is limited to the early period of the inflammation, inasmuch, as it has been previously pointed out, that from friction and melting down of superficial structures from long-continued action, these rough papillæ disappear from the upper lid, leaving a surface intimately blended with the deeper tissues, and resembling the granulations of an open sore. In this stage it would be equally impossible to remove these as to attempt the extirpation of the follicles of the lower lid by caustic or otherwise, destruction of tissues necessarily following such attempt in both. It would appear that it is to the later stages that the remarks of Stromeyer, of very valuable import, apply; certainly they are not borne out by experience in the earlier stage. No cauterising agency seems of so much efficacy, or accompanied by so little inconvenience, as the nitrate of silver; and its best results are seen on those cases where the hyperæmia is in the minority, and the granulations of the upper lid hard, firm, thickly studded, and of a bluish hue; their destruction is easily accomplished, with less tendency to return. The necessity of carefully and cautiously applying either the nitrate of silver or any other application cannot be too strongly enforced, as well as the avoidance of all "dropping into the eye" of solutions. Compresses saturated in cold astringent sedative lotions, and applied to the lids for a lengthened period, especially so long as heat or great vascularity exist, are productive of much good. The rubbing in of powdered acetate of lead between the granulations, as practised by Buys, is prominently brought forward by Wells,† the result being a dwindling away and disappearance, with a rendering of the secretions non-contagious. Whether the medicinal agent or the mechanical friction is the

"whitish surface, depressed, with faint radiating lines converging to the centre, with a degree of contraction around." A piece of potassa fusa (1-12th of a grain) applied for 30 seconds produces a slough the size of a split pea in 3 or 4 minutes, which subsequently increases in size and depth to 1-10th of an inch, with tenderness, swelling, and increased vascularity, terminating "on the 14th day in a depressed cicatrix with thickening around." He remarks on the latter, "I confess I was not prepared to witness results so active and enduring from the use of a portion of potash weighing less than the 36th part of a grain."

The mixture of nitrate of silver with one-half or two-thirds nitrate of potash is suggested by Wells, p. 33.

* "Diseases of the Eye," p. 57.

† Ibid. p. 58.

more potent in this practice is not stated; if the latter, then it is a scientific exemplification of the process in vogue among the lowest class in the Mediterranean; if the former, the question suggests itself, whether a strong saturated solution might not be of equal efficacy, and with less annoyance to the patient than the irritation of rough particles. If its anticontagious quality be substantiated, "so that soldiers with granular lids need no longer be separated and confined from the others, but may, if they are able, resume their duties without danger of spreading the disease,"* all prevention by transfer lies in a nutshell.

The riddance of the rough granulations is not, however, the difficulty; a smooth upper lid, extra vascular, having been brought about, the prevention of the relapse and re-sprouting forth of the papillæ is the problem—the curtailment of development to such extreme degrees as characterise the cases in civil hospitals. The destruction of the hypertrophied follicles of the lower lid is therapeutically impossible; their recession after severe inflammation cannot be ensured without long-continued careful treatment, good sanitation, and freedom from all exciting agencies, yet it is their presence which sustains the palpebral hyperæmia, stimulating the growth of conjunctival elements. The astringent solution of nitrate of silver, or strong proportion of tannic acid or alum in glycerine, require to be carried long into convalescence and for the prevention of relapses, often following a slight indiscretion on the part of the sufferer whose patience is tested to the limit of human endurance, a prevalence of warmth and moisture in the atmosphere, and frequently from no ascertainable cause. Should complication ensue, the cause is to be found in the upper lid; a persistence in the treatment of suppression with atropine and opium for the relief of pain, counter-irritation, &c., according to the predominating features, give the best results. The application of caustic might at first sight be supposed to be contra-indicated with corneal involvement, yet carefully applied the relief is very great, and strikes at the fountain-head of causation. In reference to the various sequelæ, with their appropriate treatment, the elaborate work of Mr. Spencer Wells on "Diseases of the Eye" fully details; such cases ought to be of very rare occurrence in the Army.

Exercise in the open air, away from the glare of the sun and wind and dust, freedom from all avoidable irritants,† attention to the general health, light nutritious food, and surrounding the patient with careful sanitation, are very necessary. The wear and tear of body is apparent, but the stress upon the mind, and especially the moral faculties, in this disease, few but the sufferers can appreciate, and demand every possible consideration and thoughtful sympathy from the Surgeon and attendants. With the discharge from hospital the treatment does not terminate; the tendency to relapse, from the laxity of the tissues and the follicular elements, on the slightest exposure, and notably in the Army night duty, persists for months and even years, to be opposed by care, sanitation, and nightly application of the tannic acid and glycerine. Separation from the healthy,‡ removal from the foci of production, rebuilding up of stamina of system, are self-evident.

Unquestionably the advantage of early treatment in the prevention of profound organic lesions in the lids and tissues of the eye is very marked; and provided such could be effected, together with good subsequent sanitation, defects of sight and especially disorganization of the eyeball as sequelæ would be seldom seen. It is only by constant supervision that men in the Army can be

* "Diseases of the Eye," p. 59.

† The smoke of tobacco is a common cause of relapse in the Army. The patient no sooner gets away from the supervision of the attendants than he makes up for his long deprivation of the pipe; he seeks a retired corner, and with head bent down on hands, and elbows on knees, he undoes the work of weeks, and pays only too dearly for his temporary gratification.

‡ The experiments of Firing, quoted by Wells ("Diseases of the Eye," p. 28), show "that the discharge of purulent ophthalmia during the early stage, and also "in chronic cases when watery and transparent, is hardly at all contagious." The commingling of relaxed lids, with little secretion, with healthy men, fully attests this; but inasmuch as it is impossible to prevent a semi-purulent product in weak lids from slight exposure, when no doubt exists of its capability of generating an ophthalmia, the precaution of long-continued segregation commends itself.

early brought to hospital, inasmuch as the subjective symptoms are but of the slightest inconvenience, how much more must this deterrent be in operation in civil life, when treatment in hospital means frequently want and privation to the younger members of the family at home!

The eradication of the disease from the community at large must be relegated to that period when the science of hygiene shall rise paramount to pecuniary obstacles, when the soldier on foreign service shall receive that consideration and care due to one who resigns his self-will for the benefit of the State, when advancing civilization shall render apparent to the poorest of the social scale the necessity of sanitation for the preservation of "a sound mind in a sound body," and shall force upon the employers a recognition of their responsibility for the well-being of their *employés*.

