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COMMUNICATION

THE EPIDEMIOLOGY OF TRACHOMA*

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Introduction

History of our Knowledge.

The importance of trachoma as a cause of human misery, as a cause of blindness, and as a national economic loss is very much greater in some countries than in others. In Egypt, until quite recently, practically the whole indigenous population was infected, while in England the disease is now rare.

Trachoma has a very ancient history. There is evidence that it was present in Egypt in the nineteenth century B.C. from the fact that a forceps for the removal of ingrowing eyelashes has been found in a tomb of about that date. It will be remembered that ingrowing eyelashes are a common sequela of the disease. Hippocrates, who was born at the Island of Cos in the fifth century B.C., was well acquainted with this condition. In the second century B.C., Heliodorus, who practised at Alexandria, wrote a book, fragments of which survive, containing the description of an operation for scalping the eyelids to remove ingrowing lashes resulting from trachoma.

Celsus, about 14 A.D., gives a good description of the roughness (*aspritudo*) of the inner membrane of the lids and recommends rubbing and scarification. Later, in 447 A.D. Cassius Felix describes "Trachomata id est asperitates palpebrarum."

Paul of Aegina, who lived at Alexandria in the seventh century, compiled from earlier sources three ophthalmological chapters for his book on medicine. He mentions trichiasis, for the cure of

which he describes the operation in common use, until recently, by barbers among the fellahin of Egypt.

It is said that important books by the surgeons of the Ptolemaic and Roman periods were destroyed in the conflagrations which at different epochs destroyed the famous library of Alexandria, but there is little evidence that additional progress was made in the six centuries after the time of Celsus.

The most important of the mediaeval manuals of ophthalmology written in Egypt was that of Omar el-Mausili, about 1000 A.D. It should be particularly noted that both Greek and Arab surgeons distinguished exactly between chronic trachoma and acute ophthalmia.

The first European medical traveller in Egypt, Prosper Alpinus, in 1580 to 1584 A.D., describes the frequency of bleary eyes during the summer.

Talbot (*Revue Internat. du Trachome*, Avril, 1930) believes that trachoma was introduced into Italy early in the thirteenth century as the result of the return of the Crusaders from Palestine, with sojournings in Egypt, as for instance at the siege of Damietta.

The prevalence of acute ophthalmias in Egypt was particularly brought to the notice of Europeans during Napoleon's campaign in that country. Both French and British troops fell victims. Even as early as 1798 the French were obliged to send home a large number of blind, among whom were several army surgeons. An account of the ophthalmic results was written by the great French surgeon, Larrey, which exactly describes the course of acute gonococcal conjunctivitis. We can also deduce the occurrence of an outbreak of what was probably Koch-Weeks conjunctivitis in the Spring of 1801, which attacked more than 3,000 French soldiers without one of them losing his sight. This accords with what we know of the occurrence and course of Koch-Weeks conjunctivitis.

The British troops suffered seriously from gonococcal conjunctivitis, but the disease was recognized by the British surgeons to be contagious, and some precautions were taken. This was not the case in the French army.

A certain proportion of those who had suffered from acute conjunctivitis had at the same time become infected with trachoma and brought the disease back to England.

The French army in the war years which followed appears to have suffered less from trachoma than the British, Italian and Prussian armies.

Trachoma a Chronic Disease.

I may be allowed to reiterate the great difference between trachoma and the other eye diseases which have been

mentioned as affecting armies in Egypt. Trachoma is a chronic disease and never leads to the sudden onset of blindness. The most serious defects of vision which it causes occur at a comparatively late stage of the disease, mainly as the result of cicatricial changes in the eyelids leading to the eyelashes turning inward and injuring the cornea, with its partial or complete destruction.

Acute conjunctivitis on the other hand when due to invasion of the conjunctiva with gonococci may cause ulceration of the cornea and loss of sight in a few days. When due to the Koch-Weeks bacillus the results are not so serious, though they depend on the virulence of the infecting organism. Both these varieties of acute conjunctivitis as well as several others, may become grafted on to a trachoma with serious consequences.

Also there may be a simultaneous infection with acute conjunctivitis and trachoma. The quickest and most obvious effects are produced by the acute conjunctivitis, and the trachoma may not be, and generally is not, discovered until the former condition has subsided.

It is probable that Egypt and Palestine have been the foci from which trachoma has spread to Europe. Nothing definite is known about the foci from which the disease spread to India, China and Japan.

At the present time trachoma is a very serious problem in such countries of Europe as France, Holland among the Israelite population of Amsterdam, Italy, Poland and Czecho-Slovakia.

Definition and Stages of Trachoma.

This communication is not concerned primarily with the clinical aspects of trachoma, nevertheless as the disease is now a comparatively rare one in this country I am required to define the disease and to explain shortly its polymorphism.

Trachoma is a chronic, contagious disease of the conjunctiva characterized by the new formation of lymphoid tissue. The disease usually spreads to the cornea resulting in diminution of visual acuity. It is accompanied by cicatrization of the affected tissues.

The clinical appearances of trachoma are manifested in widely differing forms, and it is impossible to form a lucid idea of the disease until these forms have been classified and arranged in the order of their development.

The classification of these clinical appearances has been in use in Egypt for 25 years.

TABLE I

MACCALLAN'S STAGES OF TRACHOMA

Stage I or Tr. I	Early stage of "pin's head" follicles.
Stage II or Tr. II	Subdivided into:—
Tr. IIa	where follicles are large and gelatinous.
Tr. IIb'	papillary enlargement as well as follicles.
Tr. IIb"	follicles with the added complication of spring catarrh.
Tr. IIc	trachoma complicated by gonococcal conjunctivitis.
Stage III or Tr. III	Where cicatrization has commenced; often non-contagious.
Stage IV or Tr. IV	Where cicatrization of the conjunctiva is complete. This stage is non-contagious.

The disease is divided into four stages according to the comparative prominence of lymphoid follicles or granulations, papillary hypertrophy, and connective tissue formation. The first stage is Tr. I, the second is Tr. II, the third Tr. III, and the fourth Tr. IV.

The first stage, Tr. I, is the earliest sign of uncomplicated trachoma. The pathological appearances are slight and are easily missed by one who has not a large experience of the disease, though any careful observer may detect them. One finds scattered on the conjunctiva of the upper tarsus a few slight roughnesses, forming tiny greyish islets, which are semi-transparent and almost avascular. The rest of the conjunctiva may show no sign of inflammation, and there may be no conjunctival discharge or other inconvenience.

Tr. I may disappear leaving no trace of its former existence. This may be the case although the trachomatous process may have spread to the cornea, and the formation of corneal follicles and of the accompanying vascularization may have been observed (trachomatous pannus.)

However, Tr. I is usually accompanied by a discharge from the mucous membrane, even in cases in which there is no super-added bacterial infection. The discharge has highly contagious properties. There is an incubation period of four to ten days after infection before the disease becomes manifest. Experimentally in monkeys it is about ten days.

The second stage, Tr. II, has two main groups of cases. Tr. IIa is the stage in which the tiny follicles of Tr. I become much larger. They are of a gelatinous consistency and rupture on pressure. During this stage corneal follicles and pannus are always marked.

Tr. IIb shows the formation of red raspberry-like papillae or

elevations which mask the typical gelatinous follicles. The papillae of the upper lid may grow to be long and shaggy.

Two varieties of Tr. II*b* are recognized, Tr. II*b'* which is uncomplicated trachoma, and Tr. II*b''* which is trachoma complicated by spring catarrh. The conjunctival discharge in Tr. II*b''* contains a large number of eosinophile cells.

Tr. II*c* is the reaction of the trachomatous conjunctiva to a superadded gonococcal, Koch-Weeks or Morax-Axenfeld infection. These are very common in Egypt. The gonococcal infection is transferred from eye to eye, and is not venereal in origin.

Tr. III is the stage in which cicatrization has commenced, either as the result of treatment or as a process of natural cure. The laying down of cicatricial tissue affects both the conjunctiva and the underlying tarsus. Cicatricial changes in the tarsus result, in a large number of cases, in the inversion of the eyelids, or entropion. The increased blood supply as the result of the inflammation frequently leads to a proliferation of the hair follicles, or trichiasis. The friction of the eyelashes on the cornea is the cause of most of the ulcers which lead to blindness.

Relapses from Tr. III to Tr. II*a* are liable to occur. Complete immunity to further relapses is only conferred by complete cicatrization of the conjunctiva, which is present in the final stage, Tr. IV.

Sobhy and I have shown that trachomatous infiltration of the mucous membrane of the lacrymal sac is common. Trachomatous infiltration of the lacrymal gland has been described, but I have no experience of this.

I am aware that there are many cases which cannot be stated to belong to one definite stage; for instance, a case may exhibit the evolution of the disease between Tr. II and Tr. III or between Tr. III and Tr. IV. But the division of the disease into these stages is of the greatest value to the clinician who wishes to note the progress of the disease under treatment, and for the teacher who desires to impress on his pupils the different aspects of the disease.

These stages are generally known as MacCallan's stages of trachoma. They are a development of the classification proposed by Raehlmann. After visits paid to Egypt before the war by the late Prof. Fuchs, of Vienna, and by the late Dr. Edmond Landolt, of Paris, MacCallan's stages were adopted in their clinics by these well-known masters of ophthalmology. My book on trachoma is now out of print, but the stages are well described in the recent volume by Cuénod and Nataf, published by Masson, of Paris, in 1930.

The disabilities resulting from trachoma are the subjective symptoms and the physical changes which the disease produces in the eye.

In the early stages there is increased lacrymation, a feeling as of grit beneath the eyelids, and the lids are stuck together in the morning. Later, there is profuse discharge, photophobia and pain. It may be hardly possible to open the eyelids.

The physical changes in the eye itself which result in depreciation of vision are due to the changes in the cornea, the danger of acquiring a superadded infection with bacteria which produce acute conjunctivitis, the occurrence of ulceration of the cornea, opacities of the cornea resulting from the cicatrization of corneal follicles, friction of misplaced eyelashes causing corneal opacity, adherent leucomata after the cornea has perforated as the result of ulceration, secondary glaucoma when the iris becomes adherent to the cornea, and general infection of the globe of the eye with pyogenic organisms, or panophthalmitis.

The increased vascularity of the cornea, or pannus, results from the irritation caused by the corneal trachoma follicles. It may sometimes attain formidable dimensions in old cases of Tr. III and Tr. IV. It is a response to inflammation, is necessary for the continued nutrition of the corneal tissue, and should not be interfered with even though the visual acuity is depreciated.

Epidemiology of Trachoma

According to the *Encyclopaedia Britannica* the following subjects are included in the study of the epidemiology of a disease:—aetiology, incidence or geographical distribution, infectivity and virulence, racial predisposition or immunity, climate, which includes the questions of altitude, temperature, humidity and special physical features of the country, periodicity, carriers, social conditions and prophylaxis.

Two important reports on certain features of the epidemiology of trachoma have been published during the last two years; one by the League of Nations, Geneva, May, 1930 (C.H. 822,/1), written by Jitta and Lutrario, and the other by Wibaut in the Report of the XIII International Congress of Ophthalmology, Amsterdam, 1929. In the latter report there are numerous important papers by oculists from all parts of the world on various aspects of trachoma.

Other essential information is contained in the following publications:

Boldt's Trachoma. Translated by Parsons and Snowball. London, Hodder and Stoughton. 1904.

Department of Public Health, Cairo. Reports of Ophthalmic Section, 1912 to 1923. Government Press, Cairo.

Trachoma and its Complications in Egypt. MacCallan. Cambridge University Press, 1913. (Out of print.)

- Bulletins of the Ophthalmological Society of Egypt, 1904 to 1929. Department of Public Health, Cairo.
- Reports of Memorial Ophthalmic Laboratory, Giza, 1927 to 1929. Department of Public Health, Cairo.
- La Revue Internationale du Trachome. 1924 to 1930. Terroux & Cie, 8 Rue Ulm, Paris.
- Le Trachome. Morax et Petit. Morax et Cie, 63 Rue Nollet, Paris. 1929.
- Le Trachome. Cuénod et Nataf. Masson et Cie, 120 Boul. St. Germain, Paris. 1930.
- Axenfeld. Das Trachom, Freiburg i. Br. 1902.
- Lindner. Genitales Trachom. *Wiener Med. Woch.*, Nr. 45. 1925.
- Noguchi. *Journ. of Experimental Med.*, Vol. XLVIII, No. 2. Rockefeller Institute. New York. 1928.
- Meyerhof. Incubation period. *Centralbl. für prak. Augenheilk.* May, 1913.

Aetiology.

The clinical evidence of contagion in trachoma is undoubted. Experimentally the disease has been transferred from infected persons to the entirely healthy conjunctiva of others on many occasions.

Trachoma is a disease localized to the conjunctiva and is not definitely known to affect any other area of mucous membrane, though a similarly diseased condition of the mucous membrane of the female genital passages has been described.

Monocular trachoma is not uncommon, and it has been suggested that this was due to the imbibition into the blood stream from the affected conjunctiva of a substance which increased the protective mechanism of the conjunctival cells of the hitherto unaffected eye.

However, as a matter of clinical observation any monocular case of trachoma may at any time become binocular, and is merely a clinical rarity.

No form of immunity to the disease is known, either as the result of having already had the disease, or as the result of vaccination or serotherapy. References to researches on these lines will be found in Le Trachome, Morax & Petit, page 122 *et seq.*

Many years ago Nicolle and Cuénod showed that a disease of the mucous membrane of the eyelids, apparently identical with trachoma, could be produced in certain species of monkey by the inoculation of the monkey's palpebral mucous membrane with the material obtained from active human trachoma. This experimental disease was confined to the mucous membrane and never spread to the cornea.

Nicolle and Cuénod also showed that a follicular or granular condition of the conjunctiva, occurring either naturally or as the result of simple traumatism, affected the same species of monkey. It is therefore always necessary to use no monkeys for experimental trachoma inoculations until an expert and detailed examination has been made of the conjunctiva over some period of time.

Cuénod, who is an expert trachomatologist, has no doubt that Nicolle's inoculations produced a real trachoma in monkeys after an incubation period of about ten days. This began as stage Tr. I, went on to stage Tr. IIa, and was followed by the cicatricial development of stage Tr. III.

Microscopical examination of sections of mucous membrane showing follicles proved that the structure and cells were identical with similar sections of human trachoma.

Nicolle, Cuénod and Blaizot have also established the filtrability of the trachoma virus, though this has been contested by Trapefontzewa.

Many different bacteria are found in cases of human trachoma which, however, have not been found to be experimentally specific for the disease. Cuénod suggests that some of these bacteria may be the carriers of an ultra-microscopic organism.

In 1927, the Japanese bacteriologist Noguchi described an organism, which he called the *Bacterium granulosus*, as the causative agent of trachoma. This was isolated from cases of trachoma among the North American Indians. After the lamented death of Noguchi, which it will be remembered occurred as the result of his studies of yellow fever, his work has been confirmed and continued by his pupil Olitsky. It was found possible to inoculate monkeys with human trachomatous tissue as well as with cultures of the *Bacterium granulosus*. The lesions produced resembled those of the Indian trachoma, except that the cornea never showed pannus, or corneal trachoma. From the infected animals the organism was again isolated, which again was capable of producing trachoma. "The histological changes of the experimentally induced conjunctival lesions correspond closely with those of human trachoma and include the characteristic follicle and scar-tissue formation.

The histological appearances, which are observed in the excised tarsal tissues from cases of trachoma occurring among the American Indians, agree with those described as present in similar materials from recognized cases of trachoma elsewhere."

I have quoted the last two sentences from Noguchi's words. They have, however, been questioned by Mayou and Rowland Wilson.

The *Bacterium granulosus* has a superficial resemblance to the *Bacillus xerosis* and other diphtheroids and requires special media

for its cultivation. Under certain conditions it is motile. Noguchi described it as being Gram-negative; however, Morax maintains that if the classical method of staining is carried out it is Gram-positive.

In some cases of trachoma, histological examination of the follicles has shown certain corpuscles or inclusion bodies, which were first described by Prowaczek and by Halberstaedter. However, these are not invariably present, and are found in conditions other than trachoma.

Serious efforts have been made in Egypt, at the Giza Memorial Ophthalmic Laboratory to isolate the Bacterium granulosus from the ample clinical material which is available. These have been entirely unsuccessful.

Olitsky, of the Rockefeller Institute, is the selected bacteriologist who supports the specificity as regards human trachoma of the Bacterium granulosus. He sent three different strains of the Bacterium granulosus to the Giza Laboratory. These were found by Wilson to be Gram-negative as claimed by Noguchi and Olitsky. However, it was not found possible to cause any condition resembling trachoma in animals, although the same variety of monkey, as employed by Noguchi and Olitsky, *macacus rhesus*, was used for several of the inoculations; (seven different monkeys were used.)

Until the alleged specific organism has been isolated in Egypt, the home of trachoma, judgment must be suspended.

If trachoma can be produced in certain varieties of monkey it would be interesting to know the anatomical reason for the non-development of pannus, for in all cases of trachoma in human beings pannus manifests itself at some time during the disease, generally very early. In many cases pannus can be observed only by using a corneal loupe or the slit-lamp.

Geographical Distribution and Incidence.

No race of men is immune from trachoma and all races suffer equally from the disease when exposed to conditions which favour its spread. These conditions will be discussed later.

It is common knowledge that trachoma is very unequally distributed. In some countries it is a rare disease; these are England, Scotland, Norway, Sweden, Denmark, Iceland, Switzerland and New Zealand. In others it is practically universal, such as Egypt, Iraq and Palestine.

In the other countries the incidence varies in each according to the locality. In all cases the actual incidence is often very difficult to determine. First, unless the examination of each person is made by an oculist, and indeed by an oculist with a special knowledge of

trachoma, the computation is merely approximate. It is in every examination necessary to evert the upper eyelids of each person examined, for it is not possible to state by merely looking at an eye whether or not it is trichomatous. Such an examination, unless carried out under conditions of first-class surgical asepsis is an admirable means of cultivating the disease in the hitherto unaffected population.

Indeed for purposes of accuracy it is necessary to examine the cornea of every apparently healthy eye with the slit-lamp, or at any rate with a loupe magnifying by ten, in order to see if pannus is present which may be invisible to unaided vision. I am speaking of examinations carried out in countries where trachoma is endemic. By such means only can it be determined what proportion of the population has either active or cured trachoma. It is often difficult to decide whether an apparently cured trachoma has really reached the stage of finality, Tr. IV, or whether the conjunctiva is incompletely cicatrized, Tr. III, when a recrudescence of the disease, and its reversion to stage Tr. IIa is possible. Hence the importance of enumerating all cases of trachoma, whether apparently cured or not, as trachoma, at any rate for those who have not very special experience of the disease.

Rowland Wilson states that he has seen cases of Tr. IV develop the "pin's head" follicles of Tr. I. I have not had this experience.

The most reliable method of arriving at the incidence of trachoma in a more or less heavily trichomatized country is by the systematic examination of the children in all the primary schools. There are, however, fallacies in this method. First, the primary schools do not contain invariably a true picture of the majority of the population. For instance, in Egypt the primary schools are the strongholds of the middle classes and in them by actual expert ophthalmic examination it was found, in 1928, that 91 per cent. of the pupils were infected. But the vast majority of the children of school age never go to the primary schools. Some of them go to the infant vernacular schools (*kuttab*s), where an examination which I carried out in 1914 on 3,000 odd children in two different towns, and in 39 different schools, showed an incidence of 94 per cent. In the same year the incidence in primary schools was 92 per cent.

However, it would be a great mistake to suppose that the conditions in schools actually represents the state of the country or of the town in which the examinations are made. The majority of cases of trachoma do not go on to blindness but tend to cicatrize, and as has been said before, after some years it may become difficult to assert on careful examination that they have ever been infected.

TABLE II

Egyptian Primary Schools. Percentage of the more serious stages of trachoma, Tr. I and Tr. II among the pupils belonging to each of the four school years from 1916 to 1929.

PERIOD	SCHOOL YEARS			
	First	Second	Third	Fourth
1916-17 ...	45'5	28'1	12'1	6'7
1917-18 ...	41'7	15'3	9'8	2'3
1919-20 ...	31'2	14'8	8'5	7'6
1920-21 ...	33'3	15'7	10'9	7'8
1921-22 ...	42'6	26'1	16'9	16'5
1922-23 ...	47'6	31'8	24'1	19'3
1923-24 ...	43'7	27'9	19'4	14'0
1924-25 ...	49'4	29'8	22'5	15'5
1925-26 ...	42'7	27'5	15'2	9'8
1926-27 ...	40'7	24'4	16'3	11'4
1927-28 ...	42'1	22'9	16'0	12'6
1928-29 ...	43'1	24'7	14'7	9'9

These are well shown in the statistics which have been kept during a period of 12 years at 30 primary schools in Egypt containing a total of 12,346 pupils. They were taken at the beginning of the school year after the long summer vacation. They show that the more serious and more highly contagious stages Tr. I and Tr. II diminish regularly from the first to the fourth year, that is according to the length of time the boys have been at the school, or according to their ages.

Comparison of incidence of more serious stages Tr. I and Tr. II according to school years in 1928-29.

Year	Percentage					
First	...	...	...	...	...	43'13
Second	...	...	...	...	...	24'68
Third	...	...	...	...	...	14'78
Fourth	...	...	...	...	...	9'95

So it is seen that the stages Tr. I and Tr. II which are the most contagious stages, as well as those in which complications endangering the sight are most likely to occur diminish during the four years of school life from about 43 per cent. to about 10 per cent.

It is obvious that the first year pupils are all new to the school and besides being younger have not had ophthalmic treatment at the school during one, two or three years, as is the case with the other pupils.

The good effects of treatment in causing cicatrization of the trachomatous conjunctiva, that is the change to Tr. III and Tr. IV is assisted by the natural evolution of the disease.

TABLE III

Another way of exhibiting the evolution of the disease is to compare the percentage of cases of the cured stage of trachoma, Tr. IV in the four school years of the Egyptian Primary Schools.

PERIOD	SCHOOL YEARS			
	First	Second	Third	Fourth
1916-17 ...	9	22	32	37
1917-18 ...	18	27	36	37
1919-20 ...	19	30	39	44
1921-22 ...	17	28	34	37
1922-23 ...	20	31	38	48
1923-24 ...	16	28	39	41
1925-26 ...	19	28	40	50
1926-27 ...	24	34	41·5	45
1927-28 ...	25	36	41	45
1928-29 ...	23	35·5	40·5	46·7

From this table of statistics it is seen that in every period there has been an increase in the percentage of cured cases of trachoma as the age of the pupils advances from the first year at the primary school until the last or fourth year.

While in the case of the primary school pupils there has been regular treatment applied and the results of treatment are shown to have been satisfactory, it must be remembered that the statistics show in an exaggerated manner what the normal evolution of the disease brings about in persons who exist in fairly favourable social conditions. A large number of people in trachomatous countries become infected with trachoma, which pursuing a benign course changes direct from the first stage of infection, Tr. I, to the last stage, Tr. IV, without the intervention of any complications.

It is the natural evolution of the disease which I wish to insist upon. This is a phenomenon which has been discovered in Egypt, and has never been alluded to elsewhere than in my reports and statistics.

This evolution, while assisted to a very remarkable degree by the effect of regular skilled treatment, in many cases occurs spontaneously.

We must suppose that in these cases of spontaneous evolution from the stage Tr. I to Tr. IV the defensive mechanism of the blood, body cells and fluids is adequate to deal with the results of the trachoma virus. It must be confessed that our present knowledge does not assist us to give help to the natural body processes. It has been suggested that the injection into the blood stream of various chemical substances can induce a leucocytosis which is of help in replacing trachomatous follicles by cicatricial tissue. I have not been able to verify this suggestion. At present the only known methods of causing this change are by the

application of caustics directly to the conjunctiva thereby effecting a local necrosis and resulting leucocytosis.

I have shown that a calculated census of trachoma cannot be based with any accuracy on an examination of pupils in infant schools nor in the first year of primary schools, since the gravity of the incidence of the more severe stages would be exaggerated, and many of the pupils in adult life will exhibit such slight traces of the disease as to be recognizable only by an expert using ophthalmic instruments.

Also it should be recognized that the stage Tr. IV of complete cicatrization is no more trachoma than the cicatrization of the skin from a former severe attack of small-pox is the contagious disease itself. In this stage the vascularization of the cornea, with the resulting opacity and consequent depreciation of vision is one of the unfortunate sequelae of the untreated disease, but it is not the disease itself. For this sequela there is no surgical remedy, as the cornea, which has been partially replaced by fibrous tissue needs the increased blood-supply for its nutrition.

The fallacies of a trachoma census based on school examinations having been exposed, it must be granted that this is nevertheless the soundest basis to work on.

In Egypt the incidence varies considerably according to the locality; at one school in Alexandria 24 per cent. of the boys showed no sign of active or cured trachoma, while at another only 11 per cent. were free from the disease. At a Suez school only 1 per cent. were free.

In Italy a similar variation has been shown by Maggiore to obtain; a school near Palermo had an incidence in 1922 of 60 per cent., while at Girgenti, also in Sicily, the incidence was only 1.6 per cent. At Florence the incidence in 1924 was less than 1 per cent.

Another fairly satisfactory method of arriving at the trachoma incidence in a country where there is general military conscription is to obtain the results of the preliminary physical examination which takes place before a man is recruited. But this is only the case when the examination is carried out by an oculist. Such statistics are available for Italy in 1926 according to Maggiore. Here again the incidence varied enormously according to locality. In Sardinia 56 per cent. were affected, in Apulia 37 per cent., while in Venice less than 1 per cent. were trachomatous.

In Japan in 1928 the trachoma percentage among recruits was 12 per cent.

A less satisfactory method, though often the only method of any value available is the approximations of trachoma incidence by oculists who know the country. For instance, in French Indo-China the incidence of trachoma varies in different districts between

30 per cent. and 97 per cent. according to Bargy of Tonkin, who states that it would give an entirely wrong idea to take the mean between these two percentages as the average of incidence throughout the country.

Another method is to examine samples of the population. This is being carried out in the case of agricultural labourers in Czecho-Slovakia, and also in Japan where the incidence is 10 per cent., though much higher in dependencies such as Formosa (37 per cent.)

Among worthless methods of estimating the percentage of trachoma are the following :—

- (1) Official statistics based on compulsory notification. This has been found to be the case in France where trachoma is a notifiable disease, as this legal duty is ignored by private practitioners.
- (2) The number of trachoma patients in proportion to other ocular diseases at ophthalmic clinics. This for Beirut in Syria is given by de Peyrelongue as 58·9 per cent., but such a figure is perhaps too high.
- (3) The absolute number of trachoma patients known to oculists or general practitioners in a town. This figure is much too small, as the majority of infected persons never seek treatment.
- (4) The trachoma percentage in the causes of blindness. This is devoid of all accuracy.

Having explained the fallacies which underlie all estimates of the percentage of the population of a country infected with trachoma it is of great interest to read the paper by Dr. Josephus Jitta on the subject which I have previously referred to, and to study Dr. Wibaut's "Mappa Mundi Trachomae." Instead of reproducing their percentages I propose to divide up the countries of the world into four categories according to the degree of trachomatous infection. These are :—

- (1) Practically universal.
 - (2) Very common.
 - (3) Occasional with local heavy infections.
 - (4) Rare.
- (1) *Practically Universal*.—Egypt; the Levant; Morocco, Algeria and Tunisia; Palestine, Arabia, Persia and Iraq.
 - (2) *Very Common*.—Italy; Greece; Corsica; Sardinia; Poland; Lithuania; Latvia; Estonia; Finland; Czecho-Slovakia; Russia; China; Indo-China; Japan; Argentina; Mexico; Turkey.

- (3) *Occasional with Local Heavy Infections*.—Ireland; Holland; Belgium; France; Spain; Portugal; Hungary; Austria; Germany (very local: East Prussia); Albania; Yugo-Slavia; Bulgaria; Rumania; Australia (very local); United States of America (very localized, especially among the Indians.)
- (4) *Rare*.—England; Scotland; Wales; Norway; Sweden; Denmark; New Zealand; Canada.

It is to be noted that all countries which border on the Mediterranean are heavily infected with trachoma.

Infectivity and Virulence.

As has already been said it is not known that any race of mankind is immune from trachoma. The infectivity seems to vary first with the source of contagion and secondly with the condition of the conjunctiva of the recipient.

As regards the source of contagion stress must be laid on the difference in infectivity of the various stages of the disease. The stages Tr. I and Tr. II are those in which trachoma is most contagious. The stage Tr. III may be a contagious condition, but owing to the partial cicatrization which has occurred is much less likely to be dangerous. When the conjunctiva has a superadded infection with any organism which leads to a profuse discharge there is obviously much more liability to cause infection. The stage Tr. IV is non-contagious.

In my experience a trachomatous child is more dangerous than a trachomatous adult.

As regards the conjunctiva of the recipient the liability to infection depends on the activity of the defensive cells which are able to respond to the attack of the trachoma virus. Certainly the presence of a bacterial infection of the conjunctiva is not necessary, as an entirely healthy membrane may become infected. On the other hand it is a common experience that a child may be brought for treatment with an acute conjunctivitis, and after careful treatment and improvement of the acute condition, may exhibit undoubted signs of trachoma.

The meaning of such a case is that the infection by trachoma was co-incident with the attack of acute conjunctivitis, or occurred during the manifestation of the acute conjunctivitis, or that the patient became infected with trachoma during the treatment for the acute conjunctivitis by the carelessness of the person who carried out the treatment. It must be remembered that in a trachoma clinic non-trachomatous patients are among the clientèle, and every care must be taken by sterilization of the gloved hands to prevent the transfer of trachoma to them.

During the process of treatment the operator must take the greatest care to prevent any secretion from the eyes of his patients from entering his own eyes, and this applies also to the assistants, by wearing protective goggles. Many surgeons have been known to have become infected while treating their patients. In one case I know of, a doctor of British birth had been working in the East doing general practice with some honorary work at a children's dispensary. He was serving for a pension due after 30 years' service. In the 28th year of his service while carrying out mechanical treatment for trachoma, Tr. IIa, at the dispensary a drop of secretion from the patient flew into his eye. He at once got the European nurse to wash out the eyes with 1 in 10,000 sublimate lotion, and thought no more about it. He did not recognize that he had contracted trachoma for two months. The disease in his case was very severe and resulted in his complete incapacitation, as he continued his work until his time was up, without having efficient treatment.

Another case of infection occurring suddenly after many years of propinquity to trachoma was described in the *Ophthalmic Year Book*. A physician in the United States of America married a young lady who had trachoma. He lived with her for 15 years without contracting the disease, although from time to time she had exacerbations or superadded infections. At the end of this period he became infected.

On more than one occasion in past years I have received into one or both eyes a drop of fluid carrying trachoma virus in all probability. The means used to prevent the occurrence of infection was to wash out the conjunctival sac with a stream of normal saline solution or of weak antiseptic, and then after drying the everted lids to paint them carefully with a 2 per cent. solution of silver nitrate. This treatment is efficacious but very painful. The effect of the silver solution is to kill the superficial epithelial cells of the conjunctiva together with any living organism lying on them; these are washed away by the lacrymation caused by the irritant. This characteristic action of silver nitrate is not imitated by any of the organic compounds of silver, which in my experience are devoid of any value in a trachomatous country.

Infection with trachoma may occur at any age.

When a child is born into a family in which the mother is suffering from an infective stage of trachoma, Tr. I or Tr. II, the period which elapses before the child becomes infected varies with two factors. The first is the social condition of the family, by which is meant the presence of a decent dwellinghouse, the presence of a water supply, drainage and the provision of linen and garments. When these are entirely absent, as is frequently the case, or highly defective, infection occurs more quickly. The

second is the presence in any of the household of an acute or sub-acute inflammation caused by the Koch-Weeks bacillus or gonococcus grafted on the already trachomatous conjunctiva, the discharge caused by which leads to a double infection of the infant.

Contagious discharges from the eyes of the mother are conveyed by her fingers to the eyes of her infant, as must necessarily be the case when facilities for ablutions are defective or entirely absent.

The transmission of trachoma virus by flies has not been proved scientifically, but it is an undoubted fact that in a village where trachoma is endemic the season of the year when flies abound is the season when there is the most trachoma requiring treatment. In Egypt during the hotter weather the rapidity with which flies breed and the scourge which they constitute to both men and animals is very severe. Then relief is only obtained by the presence of a strong breeze out-of-doors, or indoors by screening doors and windows by netting, or living in a darkened room.

A number of cases have been reported in the Bulletins of the Ophthalmological Society of Egypt in which a larval infection of the orbit has occurred due to the deposition by the fly "*Cordylobia Anthropophaga*" and by the fly "*Wohlfartia Magnifica Schinner*" of living larvae in the conjunctival sac. In one case, that of a well-born Egyptian lady, larvae were removed from the conjunctival sac within one hour after their deposition.

Conjunctivitis of various microbic origins is frequently attributed to the entrance of flies into the eyes of non-trachomatous persons.

It would not be surprising to learn that the trachoma virus can be transmitted along with other infections by flies of different species.

During the time I was in Egypt I made an attempt to obtain a daily fly count at several places throughout the year, but although I was ably assisted by the surgeons at the various hospitals, the fly-traps used were not sufficiently reliable to base any statistics on.

However, even if flies do play a part in the propagation of trachoma it is only a minor part, the usual method being digital, with assistance from infected towels, handkerchiefs and beds.

I think there is no doubt that children are much more susceptible to infection by trachoma than adults.

The influence of school life on the propagation of trachoma, is only important in boarding schools; our experience in Egypt, and that of Dr. Talbot in Tunisia, being that few children are infected while attending day schools. It is, of course, understood that no towels of any kind are allowed in the lavatories.

In boarding schools there is grave danger of a large percentage of the pupils becoming infected if there is one child in the school with an infective stage of trachoma. This is a matter of experience

in England in the past, and is still a problem in Ireland (Lavery).

I have already stated that the infectivity of trachoma varies both with the stage of the disease and also with the age of the carrier. There are other factors which will be discussed later, such as climate, temperature, presence of superadded infections, etc. which increase or diminish the infectivity of the disease.

It is not within my knowledge that the state of health of an individual who is exposed to trachoma virus has any important relation to liability to infection. I have seen thousands of children and adults who have become infected though apparently in perfect health.

The virulence with which individuals are attacked or the severity of the disease produced by the trachoma virus varies greatly. This is increased by co-incident or superadded infections with various micro-organisms, such as the Koch-Weeks bacillus, by a temperature and climate which favour the growth of these organisms, and by dirt and bad hygienic conditions. Of variations in virulence due to the strength or weakness of the infecting virus we know nothing, but we do know that a minimal dose of the virus may result in a severe form of the disease. Of personal differences in reaction to the same degree of infection we are ignorant except that some persons live for years in a trachomatous country without getting the disease, while their husbands or wives fall victims.

The virulent effects of trachoma in a heavily trachomatized country are exhibited with great clarity in a report by Rowland Wilson on the ophthalmic condition of a village not very far from Cairo which has been published in the 1929 Annual Report of the Giza Memorial Ophthalmic Laboratory.

The village was Bahtim, which had 3,549 inhabitants. Of these 491 were absent and not examined, leaving 3,058 persons all of whom were examined after eversion of the eyelids. One hundred and forty babies under one year old formed the subject of a separate study. So the number of villagers is left at 2,918. The following results were obtained :—

Condition of conjunctiva found in village of 3,540 inhabitants in Egypt, deducting 491 absent and 140 babies under one year.

	Per cent.
Acute conjunctivitis	2'4
Tr. I	20'6
Tr. II	1
Tr. III	72'4
Tr. IV	3'6

Of those in stage Tr. III, 21 per cent. had trichiasis or entropion, and 4 per cent. had already had an operation performed for one of these two conditions.

Examination of conjunctiva of 140 babies under one year omitted from statistics of last paragraph.

	Per cent.
Normal	24·5
Acute conjunctivitis	38·5
Chronic conjunctivitis	12
Tr. I	25

It is seen from the above that 25 per cent. of the children are infected with trachoma before the end of the first year of life.

It is to be noted that 38 per cent. of these babies had acute conjunctivitis.

In this village of Bahtim the visual acuity was measured of 1,301 persons out of the total number of 3,540 inhabitants, all over ten years old. It was found that 16 per cent. had good vision (6/6 or 6/9), 36 per cent. had fair vision (6/12 or 6/18), and 48 per cent had bad vision (less than the former standards).

The standard of blindness adopted in Egypt is that of Trousseau, inability to count fingers at a distance of one metre. It was found that 5·5 per cent. were blind in one eye, and 1 per cent. blind in both eyes.

The causes of blindness in the great majority of cases were the results of acute conjunctivitis and ulceration of the cornea. There were many cases of primary glaucoma causing blindness, and a comparatively small number of cases in which trachoma was the only cause, without the help of acute conjunctivitis.

This investigation is of great importance as showing the condition of the eyes and the results on the visual acuity of trachoma and acute ophthalmias in a sub-tropical country such as Egypt. As far as I am aware it is the first investigation of this kind which has been published.

There is no reason to suppose that ocular conditions in this village of Bahtim differ considerably from those in thousands of other villages in Egypt.

Climate.

The influence of climate on the spread of trachoma includes the consideration of questions of altitude, temperature, humidity and any special physical conditions of the country.

Heavily trachomatized countries may be found at any altitude, from the low lying Egyptian Delta, through the plateaus of Asia Minor and Algeria, and in the mountains of Alleghany and Carniola. Given the same social conditions there is not much difference between countries on the score of altitude.

The influence of temperature on the trachomatization of a country is a complicated one. The disease is practically universal in some

TABLE V

EGYPTIAN OPHTHALMIC HOSPITALS.

1928.

Average monthly temperature compared with number of new
patients treated per month.

Black line = Average monthly temperature.
Dotted line = Total number of new patients
per month.

Average temperature is calculated by the
Survey Department of the Egyptian Government
from the official reports from three different
meteorological stations.

parts of Poland, a country which may be classed as cold, and also in Egypt, which may be called a hot climate, where the shade temperature on last Christmas day at Asswan was 93° F. Therefore, it seems as if temperature has nothing to do with the spread of trachoma. On the other hand it is a matter of clinical experience in Egypt that the annual summer rise of temperature is closely followed by an increase in the number of patients attending the ophthalmic hospitals.

For many years the Survey Department of the Egyptian Government provided me with an average mean monthly temperature, which was obtained from daily thermometer readings at one place in Lower Egypt, one place in Upper Egypt, and one place between the two, at Cairo.

If the average monthly temperature is charted with the monthly totals of new patients applying for and receiving treatment at the 41 hospitals a remarkable correspondence is seen between the two.

During the comparatively cold weather of January and February less than 20,000 new patients apply for treatment at the hospitals, or about 20 new patients per day at each hospital.

When the temperature rises to about 15° C. (60° F.) in March the patients rapidly increase until in August, with a temperature of about 28° C. or 80° F., 50,000 new patients are applying for treatment per month, or at each unit between 40 and 50 new patients are being received daily.

The increase of patients is due to the ravages of acute ophthalmias, which are mainly gonococcal. The gonococci usually have a non-venereal origin. They have been found by Meyerhof to persist on the conjunctiva of many Egyptians during the winter, lying dormant, but waking to activity as soon as the weather gets warmer and reaching a maximum in July.

The fall of temperature which begins in August is accompanied by a diminution in the number of new patients. This diminution continues until December.

All these patients have trachoma. The constant irritation of the superadded conjunctival infection is one of the causes of the development of the papillary condition so frequently found in the East. This is the stage of trachoma, Tr. IIb.

It may be noted that in the hottest weather at the southernmost town of Egypt, Asswan, the temperature rises above 40° C. and very little acute ophthalmia is then seen.

In Egypt generally the commencement of the warmer weather co-incides with a vast increase in the number of flies, and this persists until the weather becomes definitely cooler, say about 20° C., about the middle or end of October.

So accompanying the rise of atmospheric temperature we have a

noteworthy increase of acute ophthalmia and of flies. It is impossible at this epoch to say anything about increase in the number of patients with trachoma, because the condition of the conjunctiva in patients with acute ophthalmias does not always allow a diagnosis of trachoma to be made.

However, after the phase of hospital treatment of large numbers of patients with acute ophthalmias during June, July and August there comes a phase of increased demand for treatment of trachoma.

In the larger proportion of cases there is no doubt that these are cases of trachoma on which an acute conjunctivitis has been grafted, perhaps due to the gonococcus, perhaps to the Koch-Weeks bacillus (though this latter is not so common in hot weather). But some of them are cases which have not been previously infected with trachoma, but may have been infected through the agency of the feet of flies carrying pus and trachoma virus from an already infected patient suffering from gonococcal conjunctivitis.

I must insist that this is merely a personal opinion, the truth of which has not been proved, and to which I adhere pending further experience and experiment.

I have not been able to trace any definite relation between the spread of trachoma and humidity of the atmosphere.* My impression gleaned from clinical experience is that at a damp place such as Damietta, which is close to the Mediterranean, and surrounded by lakes and swamps, there is a greater amount of the more serious stages of trachoma, Tr. I and Tr. II, than 10° of latitude further south at Asswan, through which the Nile passes, but which is entirely surrounded by arid desert.

There are some physical features of a country which have a great influence on the severity of trachoma in a heavily trachomatized land. The same features in a lightly trachomatized country would be likely to facilitate the spread of the disease. This is the neighbourhood of a dusty area such as the ancient site of an uninhabited town, which was built of bricks, now crumbling away. An instance, of which there are many in Egypt, is the town of Benha situated in proximity to the ancient Athribis. Brick-dust appears to be extremely irritating to the eyes. The sand of the desert is not nearly so harmful: its particles are much larger than those of brick-dust, and are soon removed by the tears from the conjunctival sac, while the dust often remains in the fornices of the conjunctiva.

The questions of racial predisposition or immunity, of periodicity and of carriers have been already dealt with in previous paragraphs.

* For graph, see Report of Ophth. Section, Dep. of Public Health, Cairo, 1914.

Social Conditions.

The upper ranks of society of any nation can be kept free from infection by trachoma provided care is taken to eliminate from the household all servants so affected, or at any rate to forbid entirely all contact between the children of the house and native servants. By these means it is possible to prevent children from becoming attacked, as has been shown to be the case during the last 40 years in the families of British officials in Egypt. Also in Egypt at the present time the upper classes of Egyptian society by one of these two means are preventing their children from being exposed to the trachoma virus, and these children are now usually trachoma free, whereas in the past practically every child was infected within the first year or two of life. If the mother is infected her conjunctival membrane can be kept fairly sterile by treatment.

In the middle and lower strata of society the above-mentioned precautions are impossible. Among the predisposing causes to a general mass contagion are:—(1) Bad houses with an unpaved floor, in hot countries kept as dark as possible in all weathers to reduce the plague of flies. (2) Absence of any regular water supply. In many parts of Eastern countries the women have to walk a mile or more to bring all water used from a river, canal, or well. (3) Overcrowding in many parts of the East is almost universal. (4) Dirt is all pervading in most trachomatous countries. (5) Poverty is obviously the origin of the above-mentioned predisposing causes.

There is no difference between the two sexes as regards incidence of trachoma, but it is generally the case that women suffer more severely from the disease than men: I think because they spend more of their time in their dirty and insanitary houses.

Some customs in the East favour the spread of trachoma, one of them being the fashion of blackening the eyelashes with antimony sulphate or kohl: the instrument for the purpose of applying the black pigment being in use by the whole household without any cleansing.

An attempt has been made by Angelucci to explain the spread of trachoma by linking it with a "lymphatic temperament, or adenoidism." This is entirely contrary to my experience.

Immigration of trachomatous persons in large numbers into a country may lead to a formidable trachomatous infection of the indigenous population. According to some authors this is going on at the present time in France, the carriers coming from Morocco, Poland, and Italy. This will be discussed later under prophylaxis.

Claims for compensation under national schemes for compensating workmen who suffer injury or disease while in pursuit of their calling, and resulting directly from it, have been made many times in the Law Courts of France by persons who after some

injury realize that they have trachoma. As far as we know at present there is no reason to suppose that traumatism plays any part in the production of trachoma. Such claimants must already be suffering from trachoma, which perhaps they have not recognized, or, less likely, there has been an infection with trachoma which was in a stage of incubation at the time of the accident.

Prophylaxis.

The subject of prophylaxis will be dealt with under the following headings :—

- (1) Personal prophylaxis.
- (2) Familial prophylaxis.
- (3) School prophylaxis.
- (4) Prophylaxis in army and navy.

(5) National prophylaxis.—This consists of general sanitary measures; legislative or administrative action such as a general examination of the population; provision of treatment in hospitals, dispensaries and schools; and ophthalmological training of qualified doctors, nurses and home visitors.

(6) International prophylaxis.—This includes examination of immigrants at frontiers; a society which has its headquarters at Paris, "La Ligue contre le Trachome"; an organization which has developed since the last International Congress of Ophthalmology, "Organisation Internationale de la Lutte contre le Trachome."

(1) *Personal Prophylaxis.*—In a trachomatous country it is most important to avoid rubbing the eyes with the fingers. The fingers even when recently cleansed remain uncontaminated with septic matter for a very short time and may easily infect the eyes. If there is an itching sensation of the eyes it is because there is some dust or other foreign body in the conjunctival sac, or because there is an early bacterial infection. Under these conditions a solution of sodium chloride, 1 per cent., should be freely instilled. In very dusty countries some people use such a collyrium regularly two or three times a day with advantage. If the itching is severe the sodium chloride should be used in a 2 per cent. solution, or a solution of zinc sulphate, 0.25 per cent., may be used. However, in my experience an isotonic solution of common salt, approximately 1 per cent., made by dissolving in a pint of boiled water (approximately half a litre), as much salt as will lie on a sixpence or on an Egyptian two piastre piece, is sufficiently useful during ocular health. In inflammatory conditions a hypertonic solution should be used and will be found to be more efficacious than antiseptics.

In dusty countries it is of importance to wash the face and eyelashes with soap and water twice a day, and where possible three times a day. The hands, of course, must be kept as clean as possible.

(2) *Prophylaxis in the family*.—A trachomatous mother, who takes no special ocular precautions, is destined inevitably to infect her newly-born child with trachoma during the first year or two of life, that is if her conjunctiva shows an infective stage of trachoma, Tr. I or Tr. II, or even some cases of Tr. III. A late stage of Tr. III or Tr. IV is no more contagious than is a person who is pitted with small-pox from which he recovered several years previously.

If the mother has Tr. I or Tr. II her everted eyelids should be painted once a day with silver nitrate solution, 2 per cent., and in addition she should instill drops of a solution of zinc sulphate, 0.5 per cent., or zinc chloride 0.5 per cent. several times a day. If the baby exhibits any ocular discharge its everted lids should be painted with silver nitrate solution, 1 per cent., or 2 per cent. in bad cases. This should be carried out daily until the discharge ceases.

The use of handkerchiefs, towels or bed-linen which have been used by trachomatous persons is calculated rapidly to infect any healthy conjunctiva if the article comes into contact with the face.

Friends or servants with trachomatous conjunctivae may readily infect a child whom they handle. As it is during infancy that trachoma is usually contracted, it is during this period that efforts should be made to obtain ocular treatment for the mother if she requires it. The extreme poverty of the inhabitants of some countries renders real cleanliness a counsel of perfection.

As we believe that flies, though not the usual vehicles of contagion, can transfer trachoma from an infected to a healthy person, a square of gauze may be placed over the infant's face to prevent access of the flies to the eyes.

The servant problem in a heavily trachomatized country is a serious one, not because there is any shortage of well-trained applicants, but because all of them have trachoma, many in an infective stage. It is not practicable to get an examination made by an ophthalmic surgeon before engaging a servant, though desirable. It is possible to provide one's servants with some anti-septic drops, such as solutions of either zinc chloride or sulphate, 0.5 per cent., which if used two or three times a day will keep the conjunctiva of all cases, except the worst, in a non-contagious condition, and will be thankfully accepted by the servant.

Similar treatment may be carried out for all members of a trachomatous family with advantage.

(3) *School*.—In order to arrive at an understanding of the different phases of trachoma, of which I was able to obtain no coherent explanation either from books or from doctors in Egypt when I was appointed to organize ophthalmic treatment and research in that country in the year 1903, I desired to obtain access to some of the Government Primary schools, where it would be

possible to observe the pupils during their scholastic course of four years.

After overcoming great administrative difficulties, and by representing my proposed arrangements as philanthropic, whereas they were scientific, I was allowed to undertake the ophthalmic treatment of a school of 464 boys at Tanta in 1907. This I carried out through the agency of an Egyptian oculist, who was one of my pupils, and of one of my trained hospital attendants, in a special room at the school.

The experience gained by the intermittent inspections which I made of all pupils was of the greatest possible value to me. I was so much impressed by the importance from the point of view of the oculist of carrying on school treatment and school inspections that I arranged for everyone of the 70 or 80 Egyptian doctors to whom I taught ophthalmology between 1903 and 1923 to be placed in charge of the ophthalmic treatment at one of the primary schools for a period. I found that the utility and importance of the classification of trachoma into the four stages, I, II, III, and IV was quickly appreciated and never forgotten. The treatment of crowds of patients who attend irregularly at a hospital clinic for trachoma does not give nearly so much insight into the development of the disease as does the treatment in a school.

At the first inspection in 1907 at Tanta School I found 16 pupils with healthy conjunctivae, while 464 had some stage of trachoma, 62 per cent. having it in a serious stage. At the inspection 20 years later, with, of course, a different set of boys, but to show the general improvement which has taken place in the inhabitants of Tanta district, only 4.4 per cent. had a serious stage of trachoma, Tr. I or Tr. II. The number of pupils was somewhat higher, 558, and the number of non-trachomatous pupils was 54, a very considerable rise.

At the time of the last published report, 1928, the number of schools undergoing ophthalmic inspection and treatment was 30, involving the examination of 12,345 pupils. Treatment was carried out on five days each week during the school terms by the oculist himself with the assistance of his well-trained hospital attendant.

The result of treatment may be seen from the following table:—

TABLE VI

Stages of trachoma at beginning and ending of school year 1928-29.

Stages of Trachoma	BEGINNING OF YEAR		END OF YEAR	
	No.	Per cent.	No.	Per cent.
Tr. I ...	1,423	12.6	647	6.0
Tr. II ...	1,201	10.6	75	0.7
Tr. III ...	4,034	35.6	4,683	43.0
Tr. IV ...	4,661	41.2	5,477	50.3

From this it is seen how, as the result of treatment the percentage of partially cicatrized Tr. III and of completely cicatrized trachoma, Tr. IV increased at the expense of the active, uncicatrized stages, Tr. I and Tr. II.

A comparison of the incidence of the more serious stages of trachoma, Tr. I and Tr. II among the pupils of the four school years is of considerable interest. The first year contains all the new entrants to the school; the second year contains all pupils of one year's seniority; the third year contains all pupils who have been two years at school; while the fourth year is the final year of primary school life. It should be mentioned that nearly all the schools are day schools.

Comparison of the serious stages of trachoma found on inspection by a senior oculist at the beginning of the school year 1928 in different years.

Class		Total number of pupils	Total number Tr. I and Tr. II	Per cent.
First year	...	2,381	1,027	43'13
Second year	...	2,832	699	24'68
Third year	...	3,887	575	14'78
Fourth year	...	3,245	323	9'95

From the above table is seen the diminution of the more serious stages of trachoma as the boy gets older. This is due partly to the efficient treatment adopted, and partly to the natural efforts at cicatrization which occur in many children who live under fairly good sanitary conditions. It is to be noted that nearly all the boys in primary schools belong to the middle classes and not to the labouring classes.

The thirty schools from which these statistics are derived are situated throughout Egypt from Damietta in the north to Qena in the south, a distance of more than 600 miles.

The incidence of trachoma in different places varies considerably; whereas in the richer district of Alexandria 24 per cent. of the pupils at the Mohammadiya school are healthy, at the Qerabia school in a poor part of Cairo less than 1 per cent. are free from the disease.

I commenced the compilation of these annual school statistics in 1907, since when they have been kept with great fidelity by my able Egyptian colleagues and former pupils under the directorship of Dr. Mazni Bey.

Infection of pupils who have hitherto escaped infection is rare in the schools of Egypt. I am informed by Dr. Talbot that this is his experience in Tunis.

The greatest care must always be taken by oculists who, during a school inspection evert the eyelids of a large number of pupils,

to prevent infecting healthy pupils. Indiarubber gloves must always be worn and cleansed in a strong antiseptic solution before each examination, such as a one in a thousand solution of perchloride of mercury in 70 per cent. alcohol.

In many other countries besides Egypt it is recognized that the examination of pupils in the schools and their treatment is the most important measure which can be taken to reduce the infectivity of trachoma, and to show the youngest part of the population the importance of treatment and prophylaxis.

The provision of separate schools for trachomatous and non-trachomatous pupils has been tried in some countries. It is a very expensive measure, and considering that infection with the disease is mainly familial and not due to school life, at any rate in day schools, it appears to me to be unnecessary. Certain precautions must be taken at the schools, such as the provision of running water to wash in and the abolition of towels which are for the common use.

However, in countries where trachoma is sporadic and practically a rare disease, as in England, the provision of special boarding schools for trachomatous children collected from a wide area of the country, is reasonable. The utility of this scheme is greater, in my opinion, in relation to prophylaxis in the family, than in relation to school life and the protection of the healthy pupils in the school, for as has been said infection in day schools is not common.

While the treatment of trachoma is being carried on in any school the visual acuity of all pupils should be tested, in order to assist with glasses those who have any error of refraction, and in order to determine the amount of damage which has been done to the eye by the disease. At Tanta school in Egypt the percentage of pupils with opacity of one or both corneae, situated at or near the centres, in 1929 was only 11. This shows a very great improvement on the conditions at the same school in 1914 when 33.5 per cent. had some corneal opacity. During the intervening time treatment had been carried on regularly, and much knowledge of ocular hygiene had been disseminated.

If the percentage of corneal opacity among 11,485 pupils examined throughout Egypt be taken for 1928 it is found that only 7 per cent. of the pupils have any corneal opacity, at or about the centre of the cornea, and likely to cause a defect of vision.

It is therefore seen that in the aggregate of pupils only 7 per cent. have suffered permanent damage to the sight as the result of corneal cicatrization. The visual acuity of the pupils has been divided up into three classes, of, good vision, fair vision and bad vision. The classes good and fair vision correspond to the necessary visual standard for entrance into the ordinary ranks of

the civil service, which were adopted at my recommendation many years ago.

TABLE VII

Vision of all pupils without spectacles, 1928.

	Total	Grand total	Per cent.
Good vision			
(a) 6/6 and 6/6	2,145		
(b) 6/6 and 6/9 or 6/9 and 6/9	3,426	5,571	45.12
Fair vision			
(a) 6/6 and 6/12, 6/9 and 6/12, 6/12 and 6/12	2,608		
(b) 6/6 and 6/18	325	2,933	23.76
Bad vision			
Less than above standards ...	3,842	3,842	31.12

The number of pupils who were ordered glasses was 709; of these 55 per cent. attained good or fair vision.

These statistics are included here to show what has been done in the most heavily trachomatized country in the world. The note taking of the cases is carried out by oculists who have had not less than two years entirely specialized work in ophthalmology. The annual inspections are made by ophthalmic surgeons of not less than ten years standing, and all figures are checked and calculations made by a highly skilled clerical staff.

It may be thought that a discussion on the prophylaxis of trachoma in schools should not include the question of treatment. However, I must state my opinion that treatment in schools is the most important agent in prophylaxis for two reasons, first because the trachomatous pupil is rendered non-contagious, and secondly because treatment is the best prophylactic against depreciation of vision or possible blindness.

(4) *Army and Navy*.—It is dangerous to incorporate in a healthy regiment or ship's company, units infected with a contagious stage of trachoma under ordinary conditions.

If it were possible to give daily treatment to each of the infected units there would be very little danger. Under war conditions this is impossible for a fighting force, and the only alternative in a trachomatous country, which is lightly infected, that is where only a proportion of the conscripted men are infected, is to segregate in special regiments those who have trachoma.

In a labour battalion it is possible, even under war conditions, to carry out such prophylactic measures as are sufficient to prevent the spread of contagion to the fighting force and to the civilian

population. In the Great War, before the despatch of a labour battalion from Egypt composed of fellahin, practically all of whom were trachomatous, I suggested that the daily instillation of drops of zinc chloride or sulphate, in a 0.5 per cent. solution, would prevent exacerbations of the disease and would to a fair extent prevent infection outside the battalion. Independently of this suggestion similar treatment was adopted for this battalion in France, whither they were sent, with good results.

On demobilization of military or naval forces after a war all trachomatous units in a contagious stage should be retained with their regiments to undergo daily treatment by an ophthalmic surgeon, or under his immediate superintendence. Alternatively, they may be drafted into military hospitals for the purpose of undergoing treatment: under these conditions units should receive full pay without deductions. Under skilled treatment there is no reason why the period of detention should be more than three months.

It has been shown by de Grosz that the demobilization of trachomatous regiments without treatment has led to extensive outbreaks of trachoma in some parts of Hungary.

The subject of incorporation of trachomatous men in armies during both peace and war has been carefully studied by Schousboe and those who are interested in the subject should refer to his article in *La Revue Internationale du Trachome* for January, 1925. Also Maggiore's paper at the International Congress at Amsterdam should be read.

Army medical officers of any nation are competent to note at the medical examination before conscription those whose sight is too poor for incorporation in a fighting force, whether this be a sequela of trachoma or whether it has some other cause, but when it is desired to enroll as many men as possible in a trachomatous country, the services of ophthalmic surgeons must be obtained. Also such ophthalmic surgeons must have special experience in the diagnosis and treatment of trachoma. Many of those men who come up for medical examination may be totally unfit for service as the result of trachoma, which may be in a contagious stage or may be in a cicatricial condition and accompanied by entropion or trichiasis, but if specialist treatment can be applied, either in a military or a civil hospital, these men may be rendered fit for service in a period varying from two weeks to two months.

Subsequently the daily instillation of a few drops of zinc sulphate, 0.5 per cent. or 1 per cent., of zinc chloride, 0.5 per cent. or 1 per cent., or of copper sulphate, 3 per cent., should be carried out particularly in the seasons during which acute conjunctivitis is most prevalent; these are, in Tunisia, June and October, and in Egypt from May until September.

(5) *National Prophylaxis.*

(a) The spread of trachoma is favoured by poverty, dirt, bad housing conditions, a deficient water supply and an excessive number of flies. Therefore, it is desirable to raise the standard of life, if such be possible, to improve the housing conditions, where they are defective as to both sanitation and water supply, and to reduce in towns, by cleansing of the streets, the increase of flies.

It is usually impossible to carry out these important measures except very gradually in backward countries, but a beginning should be made in the towns, however slight this may be at first.

(b1) Legislation to compel prophylaxis has not been very successful up to the present time in the countries in which it has been tried. Several methods have been tried. The compulsory notification of the disease by all medical men whenever they see a case has been in force in France since 1924. This, however, has been almost entirely disregarded by the medical profession, and is a dead letter.

The issue of printed instructions to medical men on the prophylaxis against trachoma has been tried in France and in Egypt. Such leaflets when printed are often not distributed, or if distributed are not read. The instructions issued by the Supreme Council of Public Health in France are excellent and are given here :

Instructions Prophylactiques contre le Trachome élaborées par le Conseil Supérieur d'Hygiène Publique de France.

“ Trachoma is a chronic contagious disease characterized by a lesion visible to the naked eye, the trachoma granulation. This is situated on the conjunctiva of the eyelids, principally on the tarsus. It is of slow development and is often complicated at all its stages, by serious alterations of the organ of vision. This disease may attack people of any age. The children of trachomatous parents are almost always infected during the first years of life. It is due to a specific virus which goes through a porcelain filter: this causes a hypertrophy of the lymphatic follicles of the conjunctiva and causes the formation of little tumours, at first soft, bursting on pressure between the nails, or against a curette, and which when they are of long standing become fibrous and provoke, when they contract, an inward deviation of the eyelashes.

(1) *Contagion of Trachoma.*—Contagion is effected by the tears, by direct contact with the fingers, or perhaps by kissing, and often by the intermediate agency of flies, which can transport the virus some distance. It is provoked or facilitated by irritating dust or sand which leads to rubbing of the eyes with the hand or with a soiled handkerchief.

The incubation period is no more than a few days. The disease lasts for several months, often for several years, without ceasing to be transmissible in all its stages.

Trachoma is especially common in Northern Africa, in the Levant and in Indo-China. It is to-day very wide-spread in all the tropical and sub-tropical zones where flies abound, and no race is immune to the disease.

Commercial relations, navigation, railroads and the interpenetration of the inhabitants of different countries or districts, especially since the World War, have facilitated its diffusion in Europe. It can be seen almost everywhere in France and constitutes a danger against which it is an urgent matter to take precautions.

(II) *Prevention of Trachoma.*—The only known means of preventing the propagation of the disease consist:—

- (a) In looking for and treating those who have trachoma as soon as possible.
- (b) In instructing those who live in contact with the disease what they should do to keep themselves and their children free from contagion.

As soon as a person with trachoma is discovered he is to be reported to the Medical Officer of Health, who in conjunction with the patient's medical attendant will see that treatment by an ophthalmic surgeon is carried out until a complete cure is effected, and if possible will send him to a special hospital, or if there are grounds for it will get the patient repatriated.

Those who have been in contact with the patient will be examined and all those who have been exposed to contagion will be supplied with eye-droppers and solutions of glycerinated copper sulphate, 2.5 per cent., and careful instructions how to use them.

(III) *Protection against Flies.*—Very special attention is to be paid to driving away or destroying flies. In hospital and at home patients with trachoma should be prevented from coming in contact with flies by mosquito curtains over the bed, or by protecting the windows and doors with wire netting, the apertures of which are 2 mm. square.

(IV) *Disinfection.*—Instruments, linen or dressings which have been soiled with trachoma virus should be at once placed in a solution of sodium cresyl, 4 per cent., or sterilized by boiling in a solution of sodium carbonate, 2 per cent.

The patient should be recommended never to rub the eyes with the fingers, but with a clean handkerchief, and after washing the hands with soap to steep them in a 2 per cent. solution of copper sulphate."

However, as has been said, obligatory notification is a dead letter in France, even in the towns where the ophthalmic surgeons who recommended its adoption practise.

(b2) *Industrial Measures.*—In trachomatous countries where there are large manufactories an ophthalmic inspection by a specialist appointed by the management would do much for prophylaxis, by giving advice as to treatment, by issuing eye-drops, and by publishing some simple information about the hygiene of the eyes.

It has already been indicated that accidents to the eye while at work have given rise to many claims for indemnities by workers in whom an undiagnosed or an incubating trachoma is present. There is no reason to suppose that an accident, *per se*, can cause trachoma, but the efflorescence of an already existing trachoma may result from an accident to the eyes.

It is of great importance in trachomatous countries for the surgeon who first examines the case to state in his certificate whether or not there are signs of trachoma present in either eye.

The question has been dealt with in the books by Morax et Petit and by Cuénod et Nataf (*vide supra*).

(b3) *Regulation of Industrial Immigrants.*—At certain times of the year numerous manual labourers enter France from Algeria, Tunisia and Morocco to carry out work for which labour is required. Most of these are trachomatous and many are in an actively contagious condition. According to a decree of the Maritime Sanitary police these persons are to be dealt with as follows:—

“Persons affected with granular conjunctivitis (trachoma) will not be allowed to embark. If a ship brings persons so affected their disembarkation will be forbidden and the cost of their repatriation will be at the expense of the ship-owners.”

If this decree were faithfully carried out the sanitary purist would be entirely satisfied. But there would be a labour shortage in the South of France, and a stout resistance would be put up by the Maritime Transport Companies.

The organization of a scheme for the ophthalmic examination of all labour immigrants before embarkation, and for the treatment of those with a contagious stage of the disease before they are allowed to embark, has been suggested by some of the distinguished French oculists who take an interest in the disease.

(c) A general examination of large sections of the population has been carried out in Japan as a preliminary to the establishment of a large number of centres for the treatment of trachoma. Many of these are already actively functioning. The incidence varies greatly, in some places being as high as 50 per cent. For the purpose of interesting Government authorities and charitable

persons in the economic loss and personal misery caused by the disease, it is important in any trachomatous country for the oculists to be able to state with some degree of accuracy what the approximate incidence is in various places, and not to have to rely on their personal impressions, or on the fallacious computation of the percentage of patients with trachoma who attend the public hospitals and dispensaries.

Experience has shown that, like the occurrence of gold in mines, trachoma often occurs in pockets, being very unevenly distributed. Therefore, to make a careful ophthalmic examination of a number of men, women and children in a few towns and to state that the incidence of trachoma is the same for the whole country as it is in the towns investigated is likely to be erroneous.

Galal and Hindawy, who are Egyptian oculists of experience, spent a month at Mecca in 1926. They found that the indigenous inhabitants of this Holy City were free from trachoma, almost without exception. Those who were trachomatous had sojourned in other countries, such as Egypt, Palestine, Syria or Mesopotamia where trachoma is rife. But among the personnel of the Army of Nejd, which is now occupying the City, trachoma is almost universal. Nejd is an emirate of Central Arabia, extending eastwards from Mecca towards the Persian Gulf. It consists mainly of a plateau, where rain is prevalent, and consequently where there is cultivation. There are frequent high winds and sand-storms. Mecca, however, lies in a valley which is very warm in winter and unbearably hot in summer. There is practically no rain, and absolutely no cultivation. The extremely limited water supply is brought in pipes for more than twenty miles.

There is no racial distinction between the inhabitants of Mecca and their neighbours of Nejd. The authors are unable to offer an entirely satisfactory explanation of the apparent immunity of the inhabitants of Mecca though the town has been visited annually for centuries by thousands of pilgrims from trachoma-stricken countries.

I record this interesting observation as an instance of the pocket-like incidence of trachoma in a country.

(d) Provision of Treatment in Hospitals and other Clinics.—The organization of any form of prophylaxis within the limits of a country where trachoma is prevalent must begin with the provision of treatment by ophthalmic surgeons who have experience of the disease, and of the operative treatment of certain stages of the disease and of its sequelae.

It is my experience that a period of two years special ophthalmic work under the continuous supervision of a highly qualified surgeon is necessary before a graduate in medicine is made fit to be placed in charge of a clinic which may be mainly for trachomatous

persons but will certainly be utilized by patients with every kind of eye disease. This applies to medical graduates of any nationality.

These men should be young and, if possible natives of the country in which the work is being carried out. A part of the training should be carried out in a permanent or temporary hospital in the midst of the trachomatous area.

Ophthalmic annexes to general hospitals are of value. However, owing to the fact that the oculist is working in a milieu which is not his own, and that his numerous patients cause inconvenience to the general hospital work, and also because he has to work much harder than the usual provincial hospital medical staff, which may give him a distaste for his own work, a special hospital is to be preferred.

Tent hospitals, fully equipped with the best possible Indian tents and surgical necessities, can be provided for £500 or £1,000, but few climates are suitable for their use throughout the year. Their advent to a district is in itself an advertisement of the need for ocular treatment. They should stay six months in each camping ground, for in a shorter period it is not possible to make much impression on the conjunctival condition of the population.

When a full surgical equipment has been got together it is possible to carry on an ambulatory hospital in a large hired house, provided there is a suitable operation room.

In Egypt ambulatory or travelling hospitals have been used largely as advertisements of the need for permanent hospitals, and to attract the attention of local or central government authorities to their duty to provide money for building, equipment and annual maintenance. In many cases the distances between populous places are so great that a central built hospital would be of less practical value to the more distant places than a travelling hospital which could come to them.

The number of permanent hospitals in Egypt is now 27, while there are 14 travelling hospitals. When plans for building an ophthalmic hospital are to be made it is of the first importance that full details of the accommodation required should be supplied to the architect. In hot countries the orientation of the building on the selected site is of importance, while the site itself should be carefully chosen.

The extremely hard work required of an ophthalmic hospital surgeon in a trachomatous country demands that an adequate salary shall be paid, and that the clinical work shall be carried on for not more than five hours a day, as the hospital employees require the rest of the day to clear up, sterilize dressings, etc. It is very desirable that the surgeon shall have some time available for private practice in order that he may add to his emoluments by

treating the well-to-do people of the neighbourhood who usually do not wish to come to a hospital, and who destroy the routine of treatment for the poorer patients if they do come.

In Egypt it has been from the people who have received treatment from the hospital oculist privately at his residence (which should never be the hospital itself), that upwards of £100,000 sterling for the building of ophthalmic hospitals has been subscribed.

(d2) Provision of Treatment in Schools.—This matter has been already dealt with. It may be stated that as the result of the continuous treatment of trachoma, which is itself a lesson in prophylaxis, and of the teaching of ocular hygiene, and of the generally improved social conditions of the country the proportion of pupils showing any sort of evidence of trachoma, active or cured, has been reduced from 97 per cent. in 1907 to 94·6 per cent. in 1927.

It may seem rather a long time, 20 years to get an improvement of only 2·4 per cent., but I consider this not unsatisfactory.

I should regard with some suspicion figures from a highly trachomatous country which exhibited that rapid and gratifying improvement which we should all like to be able to record.

There remains to be considered what is to be done in day schools in a country such as England, where trachoma is merely sporadic, and also in boarding schools, when the presence of trachoma is discovered.

In London County Council primary schools all children are examined by the School Medical Officer and if their vision is not of full acuity or if they have any conjunctivitis they are sent for examination to the ophthalmic department of one of the general hospitals or to one of the five ophthalmic hospitals (in some of which there are special clinics for school children). If trachoma is diagnosed by the ophthalmic surgeon the School Medical Officer is notified, who sends the child for examination to the Ophthalmic Medical Officer of the London County Council. If he confirms the diagnosis the child is, with the consent of the parents, sent to a boarding school near London, at Swanley, where treatment for the disease is carried out by experts, under admirable conditions for the child. The child is kept at Swanley until a cure is effected.

The average number of days' stay for trachomatous children at Swanley during the last eight years has been 150, 164, 145, 596, 888, 486, 473, 676. These periods seem to be rather prolonged, and are not encouraging for the establishment of similar institutions. It is possible that owing to the shortage of trachoma cases children were detained beyond the period for actual cure of the disease in order to keep the institution open. Occasional outbreaks of trachoma still occur in London, the 201 cases notified in the district of Poplar in 1924-25 being an instance.

The number of admissions to Swanley was 24 in 1928-29, 31 in 1929-30, and 42 in 1930-31.

There is little doubt among most ophthalmic surgeons in London that the gradual elimination of trachoma from the London County Council schools has been due to the careful segregation of all cases of trachoma when found. (Reports of the Metropolitan Asylums Board).

On the other hand I have already stated my opinion that trachomatization occurs but rarely in modern well-ventilated and scrupulously clean day schools, in which ordinary hygienic precautions are observed. Such contagion as is incurred is effected outside the school, generally in the family.

The question of boarding schools is entirely different. In the old Poor Law schools in London, in 1874, Nettleship found 42 per cent. of trachoma. A re-examination by Stephenson in 1896 showed that this had been reduced to 4.91 per cent. This was effected by segregation and treatment of those affected.

At the present time it is believed that there is little or no trachoma among the pupils at boarding schools in England, though it would be possible for an outbreak to occur and to attain considerable dimensions before it was recognized and dealt with. Recently, I detected a single case in a naval college near London. The boy was immediately removed from the college and came under treatment by me in London. He had stage Tr. I accompanied, as is almost invariably the case, with slight pannus, only recognizable with the slit-lamp. He was cured and after treatment exhibited neither cicatricial marking of the conjunctiva nor pannus, as observed with the slit-lamp.

In Ireland the condition is very different. Lavery examined the boys and girls in ten different orphanages where the proportion of trachoma varied from 11.5 per cent. to 20.5 per cent. (*Lancet*, Nov. 22, 1930.) At an institution in County Cork 25 per cent. of the girls had well-marked trachoma.

The fact that most of these institutions are under different management and have different sources of income, makes any comprehensive plan for the betterment of their conditions very difficult.

The fact ought to be recognized by the public health authorities of the Irish Free State that a formidable danger to the Irish Nation is in being. A danger which reduces in many cases the sufferers from a disease to the same condition as that of a backward nation, owing to the effect it has on preventing the proper utilization of the school years and in a fair proportion of cases resulting in permanent depreciation of vision, more than 20 per cent. becoming statutorily blind (less than 6/60.)

I have considered the case of Ireland particularly as the trachoma

conditions there are not unlike those in several nations of Central Europe.

The system of medical inspection of schools should be made compulsory for all boarding schools and for all institutions where young persons under 16 years of age are boarded and an experienced ophthalmic surgeon should examine the eyes of every person by everting the eyelids. The greatest care should be taken to avoid infection of healthy persons by the hands of the oculist who may have just examined a highly contagious case. To avoid this indiarubber gloves must be worn, and after each case the gloved hands should be rinsed in a strong antiseptic solution which is washed away under a stream of water.

However, a mere compilation of statistics is of little value unless it can be found possible to segregate all trachomatous children found in boarding schools, in separate schools or institutions and apply skilled treatment under the direction of an ophthalmic surgeon. I must again note here that *the results of the treatment of trachoma by an ophthalmic surgeon and by a nurse in the absence of the surgeon are two very different things. In the latter case improvement is manifested only very slowly and the development of corneal ulceration as the result of insufficiently careful treatment is not uncommon. In the hands of a skilled surgeon very rapid and gratifying results are obtained by daily treatment in securing cicatrization of the trachomatous conjunctiva.*

In cases where a child is admitted to an institution with an already existing trachoma an attempt should be made to get under hospital treatment the other members of the family who are affected.

Similar proposals have been made by Lavery in the article in the *Lancet* already referred to.

In the schools of all countries where trachoma is rife the measures taken should be augmented by simple lessons on ocular hygiene. These should be taken from a printed leaflet prepared by an ophthalmic surgeon.

(e) The training of qualified medical men as ophthalmic specialists has been considered. It is only by the services of such specialists that many of the sequelae of trachoma can be dealt with. The training of doctors in general practice to enable them to treat the trachomatous conjunctiva with drugs can be carried out under the supervision of an ophthalmic surgeon wherever there are an adequate number of trachoma cases to deal with, either in a hospital clinic or in a school. A month should suffice for this, during which full opportunity should be given for carrying out mechanical treatment or expression of granulations.

The training of nurses to carry out trachoma treatment takes much longer than this, and depends on the facilities for the work,

and on the mental capacity of the individuals. Their interventions should be limited to the application of drugs to the everted conjunctiva.

The training of men such as barbers to do some form of trachoma treatment and to assist in teaching prophylaxis in distant villages by distributing printed pamphlets or by reading or reciting from such has been tried in Russia in pre-war days, it is said with some success. I tried this method in Egypt but found it without value when utilizing individuals who had other duties.

It is important that the personnel at institutions to assist mothers or their children should have some instruction in simple treatment, and that they should give a few words of advice in elementary prophylaxis as regards the eyes. When necessary the mothers should be instructed where they can obtain medical assistance.

The provision of lady visitors to the homes of the poor can be a very useful adjunct to trachoma prophylaxis. These ladies, who may be voluntary workers, or religious sisters, or visiting nurses can give important assistance in any anti-trachoma campaign.

(6) *International Prophylaxis*. — (a) *Frontier examination*. Typically this is carried out in the United States of America for all immigrants who propose to become citizens of that country. A stringent examination is carried out by skilled medical officers, which includes eversion of the eyelids.

All cases are considered to be trachoma in which there are characteristic granulations which do not tend to disappear when the subject is placed for a few days under hygienic conditions, or when ordinary treatment for two weeks does not effect a cure of an abnormal condition of the conjunctiva.

Cases of cured trachoma, Tr. IV, are eligible for admission. Lesions such as marked pannus, corneal cicatrices or entropion definitely exclude.

As it is an obligation for steamship companies to return to the port of embarkation any person excluded as trachomatous, there are at various European ports centres of treatment for prospective immigrants. There is such a centre at Southampton, called Atlantic Park. Here treatment is carried out which in many cases renders a subject of trachoma eligible for admission to the United States.

In practice it is not always easy for an ophthalmic surgeon to state whether a prospective immigrant who has the stages Tr. III or Tr. IV will be allowed admission.

(b) *La Ligue contre le Trachome* was founded at the Pasteur Institute in Paris in 1923 with the following objects:—To bring together everything that has been written about trachoma; to spread abroad sound information as to prophylaxis and hygiene; to create teaching centres; to get research work on the aetiology,

diagnosis and therapeutics of trachoma carried out; to set on foot an organization to deal with anti-trachomatous hygiene and therapeutics; to obtain the help of all those who are interested in trachoma; to look out for financial support, and generally to do everything possible to further the struggle against the disease.

La Ligue contre le Trachome has held each year several scientific meetings at which the members have read papers on trachoma which have been discussed. In spite of very slight financial support the league publishes a quarterly journal, *La Revue Internationale du Trachome*, in which a number of important papers have been published. The review has been the means of bringing into touch with one another those who have to do with trachoma.

The interest which has been aroused in international ophthalmological circles recently is largely due to the review and to the self-sacrificing labours and generosity of a distinguished Parisian oculist, Dr. Victor Morax.

(c) Organisation Internationale de la Lutte contre le Trachome. At the XIIIth International Congress of Ophthalmology held at Amsterdam in 1929, it was proposed to form an organization with the above title. Owing to the labours of Prof. Dr. de Grosz, of Budapest, as President and of Dr. Wibaut, of Amsterdam, as Secretary-General, a meeting of 64 delegates appointed by 32 ophthalmological societies was held in the Council Chamber of the League of Nations, at Geneva, in 1930.

The organization has the following aims:—

(1) To encourage the collaboration of the different organizations which are fighting trachoma.

(2) To work with the international organizations of public health.

(3) To carry out investigations on trachoma with a view to the study of the geographical incidence, the gravity and the sequels of the disease.

(4) To study all measures relative to the fight against trachoma, to assist these measures and to propose their propagation.

(5) To organize meetings to consolidate the scientific bases of the fight against trachoma, to elucidate the problems of its aetiology, of its fundamental causes, of the diagnosis, of the pathology, of the therapeutics, and of the prophylaxis of the disease, as well as of the scientific and social questions which are involved in order that the legislative measures which are indicated may be proposed. An executive committee was elected which is composed as follows:—

President.—de Grosz, Hungary.

Vice-Presidents. — Angelucci, Italy; Birch-Hirschfeld, Germany; MacCallan, Great Britain; Marquez, Spain; Morax, France; Park Lewis, U.S.A.; Szymanski, Poland.

Members.—Brandes, Belgium; Kadlicki, Czecho-Slovakia; de Lapersonne, France; Myashita, Japan; van de Hoeve, Holland. Representatives of the League of Nations.—Jitta, Holland; Lutrario, Italy.

Secretary-General.—Wibaut, Holland.

Hon. Secretary.—Tewfik, Egypt.

The following decisions were arrived at:—

(1) An endeavour is to be made to interest the different governments in the objects of the organization through the different Ministries of Public Health, and if possible to obtain financial support, as the organization has no funds at its disposal even for the most trivial purposes.

Also to offer such advice, as may be asked for, on the national prophylaxis of individual countries.

(2) To form an international library on the subject of trachoma, and to ask authors to send copies of all articles and books on trachoma.

Also to publish quarterly a review of all the articles on trachoma which have appeared in the ophthalmological journals.

(3) For the forthcoming XIVth International Ophthalmological Congress at Madrid it is proposed to have a symposium on the micro-biological aetiology of trachoma; a report on the rôle played by the constitution in trachoma, if any; an enquiry on very early trachoma in the child.

Conclusion

In conclusion, I may quote a paragraph from my book "Trachoma and its Complications in Egypt," which was published in 1913, and is now out of print:—

"The different methods in which ophthalmic relief may be given have been thoroughly studied and no time has been spared in the consideration of the various suggestions which have been made. Realizing the impossibility of effecting an ophthalmic revolution in any finite period it has been considered all important to put those means of relief which future generations will use on a firm and lasting basis."

These means of relief from the pains and discomfort of trachoma and from the loss of earning power which the disease often entails, may differ in various countries. But before any scheme of prophylaxis can be accepted by any community those who are severely affected by the disease must be able to experience the benefits conferred by skilled treatment. Therefore, the establishment of an ophthalmic hospital, where every kind of eye disease can be treated is the first step in prophylaxis, for it is useless to try to teach poorly educated people that they should observe hygienic

rules for their children, when they themselves are incapacitated, partially or completely, by the results of trachoma, such as eye-lashes rubbing on the sensitive cornea, which common talk informs them can be cured by operation.

The establishment of a conveniently situated ophthalmic hospital or of an adequately equipped annexe to a general hospital with a skilled oculist in charge, therefore, is the foundation stone of prophylaxis as well as of treatment.

"From this centre will develop various branches of work, including treatment of the pupils in schools, lectures on ophthalmic hygiene, distribution of pamphlets giving instruction for the prevention of infection, provision of first aid in eye disease in the remoter villages, talks in simple language to collections of women of the necessity of cleanliness for their children and of the way it should be effected."

For different countries different arrangements will be required for dealing with different physical features and with different modes of thought of the inhabitants, but some near or even distant centre where skilled ophthalmic treatment can be obtained is the corner stone in any scheme of prophylaxis.

Whatever success may attend a well-thought-out prophylactic campaign quick results must not be expected, but enthusiasm allied with cool calculation and determination to look far ahead beyond the span of life of the originators will work a vast improvement.

In European countries, where material conditions are not too bad, epochs of improvement may become manifest in decennial periods, while in some Eastern lands the periods must be those dynastic ones of Ancient Egypt.

ANNOTATION

Herbert's Peripheral Pits

MacCallan, writing in the *Archives d'Ophthalmologie* for April, 1931, has drawn attention to the fact that Herbert's work on the corneal manifestations of trachoma has been overlooked by certain Continental writers in recent publications on this subject.

Twenty years ago MacCallan published an article in the *Archives d'Ophthalmologie* (September, 1911) in which he drew attention to the marginal pits of Herbert. He wrote "there are certain cases of healed trachoma where the only signs indicating that this disease ever existed are either the remains of a vascularized pannus or the presence of little depressions at the upper part of the periphery of