THE

CAUSES & PREVENTION OF

BLINDNESS.

BY DR. FUCHS.

PRIZE ESSAY,

OF THE SOCIETY FOR THE

PREVENTION OF BLINDNESS.


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THE CAUSES

AND THE

PREVENTION OF BLINDNESS.

Charles Goulden

THE

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AND THE

PREVENTION

OF

BLINDNESS.

BY

DR. ERNST FUCHS,

Professor of Ophthalmology in the University of Liege.

VIRIBUS UNITIS.

The Essay which gained the Prize of £80 offered by the Society for the Prevention of Blindness in London.

TRANSLATED BY

DR. R. E. DUDGEON,

Author of "The Human Eye: its Optical Construction."

WITH A FEW NOTES BY

DR. M. ROTH.

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REPORT OF THE HONORARY SECRETARY

OF

The Society for the Prevention of Blindness, and the Improvement of the Physique of the Blind.

48, WIMPOLE STREET,
LONDON, W.
June, 1885.

As the Hon. Secretary (*pro. tem.*) of this Society, I consider it my duty to mention that during the five years and a-half of its existence *over* 100,000 papers, viz., leaflets, prospectus, reports and pamphlets have been gratuitously distributed, and that this Prize Essay (which is the property of the Society) "On the Causes and the Prevention of Blindness," by Dr. Fuchs, Professor at Liege in Belgium, was published this year by J. F. Bergmann, in Wiesbaden in German, the language in which the MS. was written. The German edition consists of 1,000 copies, and is sold at a nominal price to cover the publisher's expenses. A French translation, by Dr. Fieuzal, is in the press. An Italian translation will be published as soon as the funds of the Society will permit. At the third International Congress of Hygiene at Turin, in 1880, I called the attention of the Congress to the subject of the prevention of blindness, and it was resolved that it should again be brought forward at the fourth Congress in Geneva, in 1882. Meanwhile the Society offered a price of £80 for the best essay on the Causes and Prevention of Blindness, written in English, French, German, or Italian. It is due to the generosity of a gentleman (whom I am not permitted to name) appreciating the importance of the aim the Society is pursuing that the prize could be offered, as he contributed five-eighths of the money. The Society has also to thank the same gentleman for his aid in the publication of the English translation by a contribution of almost half of its expense. The programme of the essay, and the *report* of the secretary of the International jury, which was read at the fifth Congress at the Hague, in August, 1884, are here reprinted.

As the Society wishes that this book may be read and understood by the general reader, I have added a diagram of the eye and a glossary of all technical terms, as well as a list of the Society's publications which are distributed amongst the various classes of the population.

The Society's thanks are due to Dr. Dudgeon, who has for a long time paid much attention to eye-diseases, for kindly undertaking the translation of this essay and its careful revision for the press.

The Society hopes that their exertions on behalf of the Prevention of Blindness will contribute to the diminution of the still largely prevailing ignorance of the public who are not generally aware that *two thirds* of the 30,000 blind in England, and of the 320,000 in Europe, owe their misfortune merely to ignorance and neglect. It is desirable that more attention should be paid to the diminution of the immense amount of misery represented by these numbers as well as to the great expense to the country the existence of so many blind persons entails, an expense which is not represented by the mere cost of maintenance, but also by the loss of the productive labour of these blind persons.

DR. ROTH.

Hon. Secretary and Treasurer, pro tem.

Programme.

Offer of a Prize on the Prevention of Blindness.

The Fifth International Congress for Hygiene which meets in 1884 in the Hague (Holland) will award the prize of £80 offered by the London Society for the Prevention of Blindness to the author of the best unpublished essay in English, French, Italian or German, *On the Causes of Blindness and the best Practical Means for Preventing it.* In addition to the chief prize the International Society for the amelioration of the lot of the blind, proposes to award a second prize of £40 (or two prizes of £20), as also a medal and diploma, to the author of any essay or essays considered as specially meritorious by the prize jury. These latter prizes will be given on the occasion of the celebration in Paris of the centenary anniversary of the foundation of the first asylum for the blind by HAÜY.

The Fourth International Congress for Hygiene which met in Geneva in September, 1882, accepted, on the proposal of the prize givers, the following programme for the prize award:—

1. *Causes of Blindness.*—*a.* Influence of heredity, diseases of parents, consanguineous marriages, &c. *b.* Eye diseases of infancy, various inflammations. *c.* School period, progressive myopia, &c. *d.* General diseases, diatheses, various fevers, poisoning, &c. *e.* Influence of occupations, accidents and injuries, sympathetic ophthalmia. *f.* Social and climatic influences; infectious eye diseases; unwholesome, over-crowded, ill-lighted dwelling places, &c. *g.* Defective or total absence of treatment of eye affections.
2. The most appropriate preventive measures are to be stated for each of these groups. *a.* Legislative measures. *b.* Hygienic and professional measures. *c.* Pædagogic measures. *d.* Medical and philanthropic measures.

The Geneva Congress chose an international prize jury consisting of the following gentlemen:—

Germany—Dr. H. COHN, Professor of Ophthalmology in Breslau. Sanitary Councillor Dr. VARRENTRAPP, of Frankfort-on-the-Maine.

England—Dr. M. ROTH, Honorary Secretary and Treasurer of the Society for the Prevention of Blindness. Dr. STREATFIELD, Professor of Ophthalmology in London.

France—Dr. FIEUZAL, Physician to the Blind Asylum of the Quinze-Vingts in Paris. Dr. LAYET, Professor of Hygiene in Bordeaux.

Italy—Dr. REYMOND, Professor of Ophthalmology in Turin. Dr. SORMANI, Professor of Hygiene in Pavia.

Holland—Dr. SNELLEN, Professor of Ophthalmology in Utrecht.

Switzerland—Dr. APPIA, of Geneva. Dr. DUFOUR, Physician to the Eye Hospital in Lausanne. Dr. HALTENHOFF, extra-academical Teacher of Ophthalmology in Geneva (Secretary of the Prize Jury).

As Drs. VARRENTRAPP and APPIA resigned, the prize jury was completed by the nomination of Dr. BERLIN, Professor of Ophthalmology in Stuttgart, and Dr. COURSSERANT, Oculist in Paris.

The Society for the Prevention of Blindness, and the International Society for the Amelioration of the Lot of the Blind, retain the copyright of the essays to which prizes shall be awarded, and the right to publish and distribute them as shall seem fit to them, either completely or in abstract, in various languages.

Manuscripts must be sent to the Secretary before the 31st March, 1884.

Each essay must bear a motto corresponding with one in a sealed envelope, containing the christian and surnames, title and address of the author. The envelopes will not be opened until the award of the prize jury is given.

Dr. G. Haltenhoff,

Geneva, November, 1882. *Secretary*.

Report of the Jury.

(Annales d'oculistique, tome XCII., p. 142.)

Messieurs,

. . . . J'ai, Messieurs, la satisfaction de pouvoir vous annoncer, que le concours que vous avez pris sous votre patronage a pleinement réussi. Le jury a reçu sept travaux, la plupart considérables, à savoir :

Quatre en allemand, Deux en anglais, Un en français.

Après avoir circulé pendant plusieurs mois entre les mains des membres du Jury, habitant les divers pays, ces sept mémoires ont été remis à votre secrétaire général et déposés dans une des salles du Binnenhof, où les membres du Jury, venus au Congrès, ont pu de nouveau les examiner à loisir et échanger leurs idées et leurs impressions sur la valeur comparative des travaux concurrents.

Vous les voyez ici réunis sur la table de la présidence, où ils sont encore en ce moment à votre disposition.

Plusieurs des membres du Jury n'ont pu se rendre à la Haye; la plupart d'entre eux ont envoyé leur appréciation par écrit. Le jury a été à peu près unanime pour conférer le prix de 2000 francs de la "Société pour la prévention de la cécité" au mémoire allemand portant la devise: Viribus unitis.

Le mémoire, de 545 pages manuscrites, en 2 volumes, ayant pour titre: "Die Ursachen und die Verhütung der Blindheit" est une oeuvre originale de grand mérite, répondant, mieux et plus complètement que les autre travaux concurrents, aux diverses questions du programme. Joignant à l'expérience personelle du clinicien la connaissance complète de la littérature spéciale du sujet, l'auteur en a embrassé toutes les faces, avec une compétence, une exactitude, une largeur et une supériorité de vues, qui ont frappé tous les membres du Jury. Ayant toujours présent à l'esprit le but pratique et philanthropique du concours, et prenant comme point de départ une définition de la cécité basée sur l'état de dépendance sociale et économique de l'aveugle, l'auteur a su être complet et scientifique, tout en évitant des détails statistiques superflus, et des considérations de pathologie et de thérapeutique plus ou moins en dehors du sujet. Son travail présente un ensemble bien coordonné, dont chaque chapitre peut aussi être consulté isolément avec fruit. Partout la place la plus large est donnée à l'étude des mesures prophylactiques propres a diminuer le nombre des aveugles incurables. Aussi le jury croit-il devoir exprimer le désir, que ce remarquable mémoire soit bientôt publié et, si possible, traduit en d'autres langues, soit par les soins de la "Société anglaise pour la prévention de la cécité," soit de toute autre manière.

Pour le Jury,

Dr. G. Haltenhoff.

PUBLICATIONS

OF THE

Society for the Prevention of Blindness.

1. Advice to Mothers who do not wish their Children to be Blind.

2. Instructions to Midwives and Monthly Nurses concerning the special care to be bestowed on Newly-born Children in cases of Eye Inflammation. (Published by the Saxon Minister of the Interior, 16th January, 1882).

3. Ocular Hygiene; or Instructions for Preserving a Good Eyesight.

4. Hints for the Prevention of the most common Accidents causing Blindness, and Instruction how to act till Medical aid can be obtained.

5. Prevention of Blindness, By Dr. Roth (re-printed from the Transactions of the Conference on the Blind, held at York in 1883.)

6. The Physical Education of the Blind, by Dr. Roth, (re-printed from the Transactions of the Conference on the Blind, held at York in 1883.)

7. Prospectus of the Society for the Prevention of Blindness.

8. Five Yearly Reports from 1880 to 1884.

PREFACE.

AT the fourth International Congress for Hygiene, which met in September, 1882, at Geneva, the London Society for the Prevention of Blindness offered, through its Hon. Secretary, Dr. M. Roth, a prize for the best Essay on the Causes and Prevention of Blindness. At page vii. will be found the terms of the prize competition, and at page ix. the award of the Jury by which the prize was adjudged to the present work.

By giving the prize the essay became the property of the Society. Entrusted by the Society with the publication of the essay in German, I sent the manuscript to press with a few unimportant alterations.

The extent and arrangement of the matter were laid down for me in the programme. Acting in conformity with the intention shown in the terms of the prize giver's offer, I have dwelt chiefly on the prophylaxis of blindness and therefore have gone into the causes of blindness only as far as a knowledge of them is indispensable for the framing a rational prophylaxis. As regards causes of blindness which are unpreventable I have merely made cursory mention of them. I have refrained from giving full statistics relating to blindness as these would not rightly come within the limits of the terms of the prize offer.

The methods of medical treatment form an important part of the prophylaxis of blindness. If they are not found in this essay the reason is that the subject is treated in full detail in every manual of ophthalmology.

The chief aim of this essay is to rouse the interest of ever increasing circles in the war against blindness. I shall esteem myself fortunate if I shall be able by means of it to do something towards diminishing this frightful calamity.

DR. ERNST FUCHS.

LIEGE, *November*, 1884.

CONTENTS.

Chapter III.—Chronic Poisoning.

Part V.—Infectious Eye-Diseases.

(*a*). *Blennorrhoic conjunctivitis.*

Chapter I.—General Characteristics of Blennorrhoic Conjunctivitis.

Chapter II.—Blennorrhœa Neonatorum.

Chapter III.—Blennorrhœa Acuta Adultorum.

Chapter IV.—Trachoma.

Part IX.—Treatment of Eye Diseases.

INTRODUCTION.

§ 1. This work has an essentially practical aim. The causes of blindness will be investigated in order that they may be combated, and thereby the number of cases of blindness diminished. For our purpose, we shall include in the term blindness more than we would if our investigation were strictly scientific. Extreme degrees of weak sight interfere with the working powers just as much as complete blindness, so that the subjects of them are rendered miserable and become a burden to others.

In a scientific sense the eye, which is incapable of the objective sensation of light is *blind* (amaurosis). This blindness is of one eye or of both; it is (with very rare exceptions) incurable. In a scientific sense an eye which can in no way attain to a normal sharpness of vision, is *weak-sighted*. In conformity with this definition, science calls weak-sighted some persons who do not consider themselves to be so, *e.g.*, persons with defects of refraction that cannot be completely corrected. On the other hand, it calls normal-sighted, for instance, a person affected with an extreme degree of myopia, if he can obtain perfect sharpness of vision by instrumental aid, though he may, perhaps, consider himself to be weak-sighted if his occupation prevent him wearing glasses.

For our practical purpose we shall choose the term for the defect of vision according to the amount of hindrance to working for his livelihood it inflicts upon the subject of it. We call a person *blind* whose visual power is so diminished in an irremediable manner that he is unable to follow any occupation requiring the use of the eyes. It is not of so much consequence what amount of vision still remains; the important point is, that every individual who is blind in this sense, cannot support himself, but needs the aid of his fellow-man.—The above definition requires further elucidation.

1. The definition takes no notice of the fact that really blind persons may, by receiving appropriate instruction, or by their own practice and dexterity, get so far as to be able to exercise a calling, which, under ordinary circumstances, requires the use of the eyes.

2. The definition excludes all cases of blindness of one eye only and all curable cases. A considerable number of curable cases is put down in the official statistics as blind; they are sometimes even met with as pupils in institutions for the blind.*

The best practical test of blindness is given by the capability of finding one's way about. According to this, any one must be

* Some of these cases, indeed, occasionally possess pretty good powers of vision. I once operated on a boy, a pupil of the Vienna Institution for the Education of the Blind, for trichiasis. In consequence of this affection he had such extreme photophobia that he could not go about by himself, and was reckoned as blind. But with the exception of a slight dimness of the cornea, the eyeballs were normal. If for any reason such a case cannot be cured, it must be pronounced practically blind, even though the eyes may be capable of seeing.

denominated blind who is unable in good daylight to guide himself about alone. I say "in good daylight," in order to exclude the subjects of hemeralopia, who see well by day, and are only unable to find their way about by night. The inability to find one's way alone only refers to places with which the patient is unfamiliar. In his own house almost every blind person can find his way about.

Of authors who have concerned themselves with the definition of blindness, some (*e.g.*, EMMERT)* have accepted the impossibility of finding one's way about as constituting blindness. Others have, in opposition to this definition, adduced instances of persons totally blind who yet could find their way about. On the other hand, they allege that it is not blind but only imperfectly seeing persons who are unable to go alone, because at the same time the hearing, the sense of touch, the mobility of the legs, &c., are not perfect. No doubt this is so, but the true state of matters must always be easily ascertained. Moreover, such persons are assuredly unable to follow any occupation, even though they may possess somewhat more power of vision than could be predicated of them from their inability to find their way about.

The inability to find their way about is very suitable as a criterion of blindness, for, as a rule, such persons for that cause alone are incapacitated from exercising an independent calling. Moreover, the fact that a person requires to be led about is known to his neighbours, and hence is easily ascertained. Thereby investigations relative to blind persons, detection of impostors, &c., are facilitated.

* *Correspondenzblatt für Schweizer Aerzte*, 1874, iv., No. 21, et seq.

We may, probably, take for granted that a person who can count fingers held at a distance of 40 inches stands at the limit of being able to find his way about. Any one who cannot do this is, as a rule, unable to go about alone. I do not differ greatly from what SCHMIDT-RIMPLER* and MAGNUS† accept as the limit of blindness. These writers regard an individual as blind, who is only able to count fingers at 12 inches at furthest, but they admit that such a person may eventually count fingers at a greater distance under peculiarly favourable conditions of illumination.

Those who, on account of their defective vision, are incapacitated for certain callings, are *weak-sighted* in a practical sense. Such individuals only exceptionally become dependent on others for their support. If the weak sight was already present when he was quite young, the subject of it would be set to coarser kinds of work, and would earn a smaller income than he could have earned considering the state of his other faculties. When the weak sight only comes on at a later period, it often compels its subject to take up another employment. The older he is when he becomes affected by weak sight, the less fitted is he for a change of occupation, and the more apt is he to become quite incapacitated from working for his bread. Thus weak sight is a relative term dependent on the demands which the special employment makes on the visual faculty.

The *statistics of blindness* which we at present possess are

* *Ueber Blindsein*, *Deutsche Bücherei*, Breslau, 1882.

† MAGNUS, *Die Blindheit, ihre Entstehung und ihre Verhütung*, Breslau, 1883.

compiled on the basis of the census of population. The data of population censuses are naturally not quite accurate. ZEHENDER* has examined these data for the Grand Duchies of Mecklenburg. He found that many blind persons were not counted as such, whilst on the other hand some who could see were put down as blind. In the census returns no accurate distinction, as may well be imagined, was made between blindness and a high degree of weak sight; nor yet between curable and incurable blindness.

For our purpose the statistics of the *causes of blindness* are of more importance than the general statistics of blindness. These are, of course, much more difficult to be obtained. In order to ascertain the causes of blindness the blind person must be examined by an oculist. But in many cases it is difficult, or impossible, for even an oculist to ascertain the cause of a blindness of long standing. Hence, the statistics relating to the causes of blindness hitherto published embrace a proportionately small number of cases. For Germany, we depend chiefly on the statistics of COHN† and MAGNUS;‡ both these authors will be frequently quoted in the course of our work. In France FIEUZAL and DAUMAS, in Spain CARRERAS-ARAGO, in Russia KRUECKOW and SKREBITZKY, have furnished statistics of the causes of blindness.

* ZEHENDER'S *Klin. Monatsblätter*, 1870, p. 277.

† EULENBURG'S *Realenclyclopädie der gesammten Heilkunde.* Artikel *Blindenstatistik.*

‡ Loc. cit. Both these authors base their compilations partly on their own statistics, partly on the investigations of SCHMIDT-RIMPLER, STOLTE, UTHOFF, HIRSCHBERG, LANDESBERG, BREMER, and KATZ.

I subjoin the statistics of COHN and MAGNUS. The former are given by SEIDELMAN.* They refer to 1,000 cases of blindness taken from the case-books of COHN'S eye clinic. The blindness was of both eyes in 224, of one eye in 552 cases.

I. Congenital defects of structure	9
II. Glioma retinæ	6
III. Blennorrhœa neonatorum ...	111
IV. Inflammations incurred later	155
,, of conjunctiva	—
,, of cornea ...	39
,, of iris & choroid	28
Sympathy without injury ...	4
Doubtful origin	—
Scrofula	7
Gonorrhœa	26
Iritis spec.	9
Chorioiditis spec.	11
Trachoma	17
Keratomalacia	8
Diphtheria	3
Puerperium	3
V. Wounds	242
Both eyes	10
Sympathy after wound ...	9
VI. Acute exanthema	54
Small-pox	36
Measles	14
Scarlatina	4
VII. Typhus	9
VIII. Sublatio retinæ	73
Ex myopia	46
Idiopathica	27
IX. Retinitis	84
Centralis e myopia	46
Albuminurica...	2
Neuroretinitis	7
Pigmentosa	9
Chorioretinitis	3
X. Atrophia nervi optici ...	102
Cerebralis	30
Spinalis	19
Ex alia causa...	53
XI. Glaucoma	88
XII. Tumores bulbi	14
XIII. Operationes infaustæ ...	22
XIV. Various causes	31

MAGNUS, in his arrangement of 2,528 cases, admits only cases of blindness of both eyes, because in the practical treatment of the blind question they alone are to be considered. Instead of giving MAGNUS'S tables *in extenso*, I will refer the reader to ROTH'S coloured reproduction of MAGNUS'S graphic representation which will be found at the end of this book.

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* *Zur Aetiologie und Prophylaxis der Erblindungen.* Inaug.-Dissert. Breslau, 1876.

Part I.

Eye Diseases of Hereditary Origin.

§ 2. The eye diseases which are of hereditary origin either exist at the time of birth—congenital eye diseases—or they first make their appearance at a later period of life. Hence, all hereditary eye diseases are not congenital, just as all congenital eye affections are not hereditary.

As regards congenital eye affections, we rarely find at birth the morbid process in its active state. As a rule, we have to do with the effects of fœtal diseases, opacities of the cornea and lens, closure of the pupil, atrophy of the internal membranes or of the optic nerve, distension or diminished size of the whole eyeball. The diminution of the eyeball can amount to its seeming complete absence—anophthalmus. In how far deformities of the eye are the remains of fœtal inflammations, or the consequences of arrest of growth, further investigations must teach us. To the slighter congenital defects of the eye belong certain deformities of the eyeball, such as congenital hypermetropic or myopic shape and astigmatism.

The hereditary eye affections which are not already present at the period of birth have a latent existence, merely giving a tendency to disease. The disease breaks out in consequence of external injury, or even without any such cause. To these hereditary diseases belong many cases of myopia, cataract, glaucoma, &c. The hereditary character of retinitis pigmentosa and certain forms of neuritis is generally acknowledged.

To the class of inherited eye diseases, in the wider sense of the term, belong those cases in which the parents convey to their offspring a general dyscrasia (scrofula, tuberculosis, syphilis, &c.), thereby laying the foundation for various eye affections. Finally, there are cases of inherited eye affections which are owing, not to a disease, but to the blood-relationship of the parents.—We must now consider more in detail these three categories of hereditary eye affections.

1. *Eye diseases of the parents* are transmitted to the offspring. —As already stated, the inherited eye affection in children is either present at birth, or develops itself later.

As a rule, the eye affection of the children is not always quite identical with, but is analagous to, that of the parents. There are, however, exceptions to this. Thus, a man who had lost his sight by blennorrhœa neonatorum had two children affected with microphthalmus (MAGNUS). I am acquainted with a physician who has congenital microphthalmus of the right eye. His father lost his eye when a child by iridocyclitis. The connexion of the eye disease of father and child is indubitable, for DEUTSCHMANN obtained analogous results in his experiments on rabbits.

As regards the inherited eye diseases, there is no question of prophylaxis, properly so called. We possess no means of preventing the transmission of certain eye affections from parents to their offspring. It could only be prevented by those affected with such maladies denying themselves offspring. But that, of course, cannot be expected. But the physician may warn such persons when about to marry that they may possibly have children affected with diseases of the eye, or blindness. What are the cases in which such a result is particularly to be feared? Those cases in which the parents themselves are suffering from an eye disease, either congenital or incurred at an early age. MAGNUS has investigated fourteen instances of married couples, in whom one or both members were either born blind or became blind at an early age. Of the thirty-four children begotten of these marriages, $8=23{\cdot}5\ ^{\circ}/_{\circ}$ were either blind or weak-sighted.

§ 3.—2. *Constitutional diseases of parents* are transmitted to their offspring, and in the latter become the cause of eye diseases. —The constitutional diseases here referred to are chiefly scrofula, tuberculosis, syphilis and leprosy. Among these scrofula holds the first place, as it most frequently gives rise to eye diseases. HORNER* says that the diseases of the cornea, conjunctiva and lids together constitute $59^{\circ}/_{\circ}$ of all the eye diseases of childhood. We know that children's affections of the conjunctiva and cornea mostly belong to the phlyctenular form, and their diseases of the lids to blepharitis. But as a rule, these forms of disease are of scrofulous origin.

The influence of *tuberculosis* cannot be sharply divided from that of scrofula. Tuberculous parents have often scrofulous

* *Handbuch der Kinderkrankheiten*, herausg. von GERHARDT. Bd. V. Abth. ii., p. 203.

children. True tuberculous diseases of the eye do not come within the sphere of our consideration, as they are extremely rare and, as a rule, are quite insignificant in comparison with the general affection of the patients.

Hereditary syphilitic eye affections were, for a long time, confounded with scrofulous. It is only within the last ten years that any considerable progress has been effected in our knowledge of these forms. Besides diseases of the deep seated parts of the eye, we ought particularly to mention here keratitis interstitialis (sive parenchymatosa). According to COHN* this disease constitutes 0.38°/$_0$ of all eye diseases. To the eye diseases of childhood it contributes, according to HORNER, 0.5°/$_0$. The majority of cases belonging to this category are attributable to hereditary syphilis.

What can be done to prevent hereditary syphilis? A person infected by syphilis can never know for certain if he is completely cured of his syphilis, consequently he cannot know if he will beget healthy children. But the probability of his getting healthy children is greater, the longer the time that has elapsed since the last manifestations of syphilis. It is the physician's business to warn his syphilitic patients against marrying too soon. FOURNIER† has admirably stated the conditions under which alone the physician should give his consent to the marriage of a syphilitic: 1. at the time of the marriage there should exist no localizations of syphilis which can be considered contagious, and cause an infection of the other party to be apprehended; 2. at

* SCHUBERT, *Ueber syphilitische Augenleiden*, Berlin, 1880.

† *Syphilis et Mariage*, Paris, 1880.

least three years should have elapsed since the infection, if the syphilis has run a favourable course, otherwise a still longer period ; 3. at least one and a half to two years should have passed without any fresh manifestations of syphilis ; 4. if the syphilis present a malignant character which shows itself in frequent relapses, inefficacy of treatment, early or serious visceral disease, considerable diminution of nutrition, or in any other manner, the marriage should be delayed or broken off altogether ; 5. in every case of marriage a radical antisyphilitic treatment should first be undergone.

Even strict attention to these precautionary rules, gives no guarantee that the children will be healthy. Even when they are quite healthy at birth, they may be affected by syphilitic disease later on. The most frequent form of hereditary syphilitic eye disease, interstitial keratitis belongs to the retarded form of syphilis. It comes on most frequently betwixt the ninth and sixteenth years of life, sometimes still later.

When a woman during her pregnancy presents florid signs of syphilis, an energetic antisyphilitic treatment of her has a favourable effect on the fœtus also.* The offspring of a marriage of syphilitics are often delicate and backward, but do not necessarily show specific symptoms. In such cases a tonic treatment particularly with remedies containing iodine is most fitted to prevent the development of keratitis interstitialis.

* THURMANN relates the following : a syphilitic woman, who was not treated medically, bore successively seven children, who all died of syphilis. During her eighth and ninth pregnancy she was treated medically, and bore two healthy children. During her tenth pregnancy the treatment was neglected, the child died in six months of syphilis. In her eleventh pregnancy, the treatment was resumed and a healthy child was born.

Eye diseases are among the most frequent complications of *leprosy.* According to DANIELSEN* out of 125 leprous patients 87 (= 69°/₀) had eye diseases. Leprous eye diseases often result in blindness from opacity of the cornea or from the formation of leprous tubercles in the cornea and sclera, which terminate in shrivelling up of the eyeball. Hence it comes that a large proportion of leprous subjects go blind before they die. In countries where leprosy prevails, a considerable number of the cases of blindness is due to this disease; thus in Norway the proportion is 2.4°/₀ (HJORT).

In mediæval times, when leprosy was much more extensively prevalent than now, in many places there were strict rules for the isolation of patients, who were relegated to special lazar-houses. These rules were superfluous, for almost all observers are agreed that leprosy is not contagious. On the other hand it appears that it can be transmitted to the offspring. DANIELSEN and BOECK† have been able to trace the influence of heredity 185 times in 215 cases of leprosy, whereas HEBRA denies the hereditary character of the disease. In Iceland, a law of the year 1776 forbids the leprous to marry; no such law exists in Norway. As the hereditary character of the disease is not generally acknowledged, such a law can hardly be justified, irrespective of the circumstance that it cannot be reconciled with our modern notions respecting personal liberty.

§ 4.—3. *Consanguinity of parents* is a frequent cause of diseases,

* *Beretning om Lungegaardshospitalets Virksomhed*, 1877-79.

† *Traité de la Spedalsked*, translated into French by COSSON, Paris, 1848.

among which I may mention especially, mental diseases, deaf-mutism and blindness. The latter is in most cases the result of retinitis pigmentosa.—The opinions regarding the influence of consanguinity on the offspring are by no means agreed. Not only have different explanations of this been offered, but there is as yet no agreement about the fact itself. The so-called consanguinists deny that blood-relationship has an unfavourable influence on the children. G. DARWIN* sought to prove that in England the number of imperfect (particularly deaf-mute) children is not greater in marriages of consanguinity than in other marriages.—Hence we must in the first place endeavour to get at the facts, and especially as regards retinitis pigmentosa. The data obtainable on this point are very scanty, for most of the statistics relative to the question of consanguinity refer to deaf-mutism and not to blindness. The data regarding retinitis pigmentosa were collected in two different ways. Some authors (LIEBREICH, HOCQUARD) examined the pupils of deaf and dumb institutions, bearing in mind that retinitis pigmentosa is frequently met with among deaf-mutes. It was shown that many of the subjects of retinitis were the offspring of consanguineous marriages. But the results thus obtained are not convincing, if it be true that deaf-mutism is a frequent consequence of the consanguinity of the parents. We should then naturally find frequently among deaf-mutes affected with retinitis blood-relationship of the parents.—Other data are the cases of retinitis pigmentosa which presented themselves in a certain eye-

* *Journal of the Statistical Society*, June, 1875.

clinic in the course of a considerable period. I give here some of the records on this subject:

Authors.	Cases of retinitis pigm.	From consanguineous marriages.	Per cent.
FIEUZAL*	... 21	8	38
MOOREN†	... —	—	33
LEBER ‡	... 66	18	27
SAEMISCH §	... 60	15	25

These statistics are corroborated by numerous single observations. Thus, for example, FIEUZAL has the following: In Paris there is a married couple who are cousins. They have had fourteen children; of these eight died in earliest infancy, so that nothing is known respecting the condition of their eyes. All the other six were either blind or very weak-sighted. In some of them FIEUZAL was able to ascertain the existence of retinitis pigmentosa.

In order to make these statistics available as evidence, they must be compared with the proportion of consanguineous marriages to other marriages. I shall take the data for this point from the French statistics, which for many years have specially recorded the marriages of blood-relations. I shall only consider here marriages between nephew and aunt, uncle and niece, and between the children of brothers or

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* *Dictionnaire encyclop. des sciences méd. de* DECHAMBRE. T. XIX. Art. *Consanguinité.*

† *Fünf Lustren ophthalmologischer Wirksamkeit*, Wiesbaden, 1882, p. 219.

‡ *Handbuch der Augenheilk. von Gräfe-Sämisch.* Vol. V., p. 654.

§ DERIGS, *Ueber Retinitis pigmentosa*, Bonn, 1882, p. 21.

sisters, but not marriages between more distant blood-relations. In France the number of consanguineous marriages was

in 1853 .... 59 = 0.9% of all marriages

in 1861 .... 74 = 1.2% „ *

Now if retinitis pigm. had nothing to do with consanguinity then not 25 to 38°/₀ but only about 1°/₀ of the cases in question would be derived from consanguineous marriages, fewer indeed, for such marriages are usually unfruitful. Retinitis pigm., therefore, is about thirty times more frequent in the children of consanguineous marriages than in other children.†

The laws which for ages have imposed limits on the matrimonial alliances of blood relations, were doubtless suggested by the experience that such alliances were unfavourable for the offspring. I subjoin the laws adopted by the more important states of Europe relating to consanguineous marriages :

1. In Russia the secular is framed in accordance with the canon law, and marriages up to the seventh degree of consanguinity are forbidden.‡

2. Marriage is forbidden betwixt relations of the third degree

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* BOUDIN, Ann. d'hygiène publ. 2 serie, T. XVIII.

† I do not conceal from myself the inadequacy of the above statistics. The proportion of consanguineous marriages to other marriages is only that obtaining in France, whereas the cases of retinitis pigm. are taken partly from French, partly from German records. As a rule consanguineous marriages are rarer in Germany than in France. Moreover the statistics of retinitis pigm. deal with too few numbers—on account of the rarity of this disease. I am therefore very far from regarding the figures given as conclusive, still they certainly show the influence of consanguinity.

‡ RITTER, *Oesterreich. Eherecht.* Leipzig, 1876.

(uncle and niece, aunt and nephew) and of the fourth degree (children of brothers and sisters) in Austria* and in Switzerland.†

3. Marriage is forbidden (or only permitted by dispensation) between relations of the third degree, but permitted between relations of the fourth degree in England,‡ France,§ Italy,‖ Holland,¶ and Roumania.

4. In Germany marriage is only forbidden between relations in ascending and descending line, and between brothers and sisters, but allowed between relations of the third and fourth degrees.**

Thus we perceive that the laws vary much in different countries; those of Russia and of Germany are the two extremes.—In the above I have omitted the regulations concerning marriage between brothers and sisters-in-law as they possess no medical interest. I will only observe that many of the laws on this subject contain unjustifiable contradictions, as for instance, the English laws, which on the one hand allow marriages between first cousins, but forbid marriages between brother-in-law and sister-in-law.

Cases of retinitis pigm. are so rare that it would not be proper to forbid marriage between blood-relations on this account alone, that is to say 1°/₀ of all marriages. It is different with

* Par. 65 of the *Bürgerl. Gesetzbuch.* For Jewish subjects the marriage of the children of brothers or sisters is allowed.

† *Loi fédérale.* Par. 28.

‡ STEPHEN, *New Commentaries on the Laws of England*, London, 1844. Vol., II. p. 284.

§ *Code civil*, § 163. ‖ *Code civil*, § 58. ¶ *Code civil*, § 88.

** *Deutsches Reichsgesetzbuch*, § 33.

respect to the so much more frequent deaf-mutism, some mental diseases, &c., in so far as they may be dependent on the consanguinity of parents. But the determination of this question is out of place here.

Part II.

Eye Diseases of Childhood.

§ 5. These consist partly of local affections of the eye, partly of the sequelæ of general diseases. Of the former, some are referable to infection, others are of spontaneous origin. Of infectious eye diseases, I may mention the blennorrhœa of new-born infants and diphtheria. Both of these will come under consideration when treating of the analogous diseases of adults. I will also consider, later on, trachoma, &c.

The purely local eye diseases, not dependent on infection, to which children are liable, are seldom so dangerous as to lead to blindness. It is otherwise with injuries, which will be treated of hereafter.

The most frequent eye diseases of children are those which are the consequence of a general dyscrasia. Among these the most important is scrofula.

Scrofula localises itself in the eye as conjunctivitis and keratitis phlyctænularis (pustulosa). In the great majority of cases these maladies occur along with other symptoms of scrofula, so that VON ARLT rightly denominates them conjunctivitis scrofulosa. (Under this name, he comprehends the affection of the conjunctiva and cornea, for he regards the latter as a mere propagation of the disease from the conjunctiva of the sclera to the conjunctival layer of the cornea.) The consequences of scrofulous keratitis are opacities of the cornea, in the worst cases of such an extensive character that thereby almost complete blindness is produced.—Scrofula, moreover, causes diseases of the deeper seated structures of the eye, such as iritis, iridocyclitis and chorioiditis, as also a peculiar kind of keratitis parenchymatosa. Indirectly, scrofula endangers the eye by setting up disease of neighbouring structures. Obstinate blepharitis leads to inflammation of the conjunctiva and cornea. Caries of the orbital bones is a frequent cause of ectropium of the lids with its injurious effects on the cornea.

Scrofulous eye affections very rarely lead to total blindness: COHN asserts that scrofula furnishes 7 per thousand, MAGNUS 0·4 per thousand of all blind persons. BIRCH-HIRSCHFELD found in the Saxon blind asylums only 6°/ₒ of cases of blindness from scrofula, though only young blind subjects are admitted into these asylums. If complete blindness from scrofula is rare, it is a frequent cause of weak sight. Almost all opacities of the cornea met with in young subjects are the result of scrofulous ophthalmia. COHN found among 10,060 school-children whom he examined, 2 °/ₒ affected with corneal opacities.

Scrofulous ophthalmias do much harm in consequence of their liability to frequent relapses, sometimes lasting through the whole period of childhood, whereby their victims must suffer seriously in their education and training for trades.

Apart from its effect on the eyes, scrofula causes so many other ailments, and is, moreover, so extensively prevalent that it must be looked upon as one of the worst scourges of humanity. The eradication of this plague is one of the noblest tasks of the philanthropist.

The only effectual prophylaxis against scrofula is the improvement of the circumstances of the lower classes. With an increase of the welfare of the people, their food becomes improved, and especially do they more frequently partake of butcher's meat. Their habitations become more roomy and less crowded. The erection of well-built, dry, well-ventilated labourers' houses contribute much to this end. Cleanliness becomes more general. The children are more carefully looked after; instead of being set too early to household or factory work, they are sent to receive instruction at school. I can only cursorily allude to those points which belong rather to the province of the social politician than to that of the physician. Later on, I shall return to this subject.

In cases of already existing scrofulous eye diseases, the treatment must be directed not only against the eye disease, but also against the general disease which lies at the root of it. In this way only will the perpetual relapses which tend to deteriorate the visual power be avoided. It is a great help to the medical treatment if we can bring the little patients, occasionally at least, into more favourable conditions of life. A good commencement for this purpose has been made by the establishment of holiday-colonies and sea-side stations.

Holiday colonies do not receive sick, but only delicate children; their object is therefore mainly prophylactic. Pastor BION, of Zurich, organised the first of these colonies (1878), and his example was soon followed by others in Switzerland, Germany, Austria and Italy. The children remain on an average one month in these colonies. The favourable effect of this sojourn in a healthy (often hilly) situation on the children is very evident. This has been proved objectively by weighing the children before and after their holiday outing. A continuance of the weighing during the subsequent school-year showed that the improvement in the state of health of the children was not merely transient.*—A somewhat different plan was first adopted in Denmark. It consisted in sending the children during the holiday months to be boarded two or three together in well-regulated farmhouses. In many respects this plan is not so good as the holiday-colonies; but, on the other hand, it has the inestimable advantage of costing less, for the farmers will take the children and board them for a very small remuneration—often, indeed, gratuitously. Thus it was possible in Denmark for 7,000 children to be sent in summer into the country in this manner during the last few years: whereas in all the holiday-colonies of Germany, Austria and Switzerland, from 1876 to 1881, only 5,984 children could be received. Hamburg and Bremen have therefore begun to follow the example of Denmark.

For really sick children, the sanatoria which have been established on the sea-coast and beside mineral waters of acknowledged efficacy in scrofula, are well adapted.

* VARRENTRAPP, *IVème Congrès international d'Hygiène.* Genève 1882. T. I., p. 160.

The oldest *seaside station* dates from the last century; it is the National Hospital at Margate, on the English coast, which takes in 700 children annually. But the impetus to the foundation of this kind of sanitary institution of later years proceeded from Italy, and her example was soon followed by other European States, as also by North America. Italy now possesses no less than twenty such establishments, which, however, are only open for a part of the year. The sojourn of the children in them is on an average forty-five days. In France, on the other hand, the children remain from nine to twelve months in these stations. The establishments of the former kind are hence more suitable for slighter cases, those open all the year round for more severe cases of illness. Of course, the cases sent to these stations must be carefully chosen. As regards scrofulous inflammations of the eye, further observation is required to show the effect on them of a residence at the seaside and baths. It is indubitable that children who are sent to such stations after the cessation of an attack, return home strengthened, and less liable to relapses.—It is an excellent idea, first expressed by MICHELET, if possible, not to allow the children cured in these sanatoria to return to town and their former surroundings, but to send them to agricultural work, or to sea as sailors.

There are sanatoria for poor children at many of the bathing places recommended for scrofula, particularly the brine baths,*

* UFFELMANN gives (*Deutsche Vierteljahrsschrift f. Gesundheitspflege* Bd. XII., p. 704) a chart showing the sanatoria in Germany for poor children at the sea-coast, in the country, and at the brine baths.

and what I have said respecting sea-side stations applies equally to these places. They are less suitable for florid cases than for completing the cure of cases of scrofulous eye diseases already on the decline.

§ 6. The other general diseases of childhood are of minor importance to scrofula as far as regards their influence on the eye. Rachitis may be the cause of lamellar cataract. Tuberculous eye affections are too rare to merit consideration in this place; the same may be said of those having their origin in acquired syphilis. Hereditary syphilis is frequent among children; these children are as a rule sickly, and their habitus as also the forms of disease they are liable to are so similar to scrofula, that the difference between the two diseases is not always easily made out. Fortunately this is of no great importance in a practical point of view, as a general strengthening treatment is usually more suitable than a strictly anti-syphilitic treatment. A sojourn in the sanatoria above alluded to is as efficacious for such children as for scrofulous children.

Von Graefe* was the first to describe a peculiar kind of suppuration of the cornea as *keratomalacia*, incident to the general marasmus of children, which however he erroneously connected with encephalitis. He observed a simultaneous xerosis of the conjunctiva without attaching any particular importance to it. Cohn† was the first to point out this connexion; in all the severe cases of conjunctival xerosis he observed, there was a

* V. Graefe's *Archiv f. Opthalmologie*, Bd. XII., 2 Abth., p. 250.

† *Ueber xerosis conjunctivæ.* Inaugural thesis, Breslau, 1868.

simultaneous concurrence of general marasmus. Thus we have a well defined morbid picture in the symptom-complex: marasmus, xerosis of the conjunctiva and suppuration of the cornea. If the children do not succumb in consequence of their marasmus, which is most frequently the case, serious impairment of the visual faculty or complete blindness remains. The disease is most frequently met with amongst us in children who are affected with marasmus as a consequence of hereditary syphilis; but on the whole this is a rare occurrence.* It is met with more frequently in Russia and Brazil. In Russia it is especially prevalent after the great fasts, and destroys or makes blind many children.† In Brazil the ill-fed children of the negro slaves are its chief victims.‡—In the treatment the chief thing to attend to is the improvement of the nutriment; the local employment of warm fomentations seems to do most good (GOUVEA).

Many other maladies of childhood, such as the exanthemata, typhus, meningitis, whooping-cough,§ &c., may be accompanied by eye diseases. I shall return to this subject hereafter (in Part IV).

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* Among his 1000 cases of blindness, COHN gives eight cases of keratomalacia.

† THALBERG *Archiv f. Augenheilkunde*, B. XII., p. 320.

‡ GOUVEA, v. GRAEFE'S *Archiv f. Ophth.* Bd. XXIX., Abth. 1, p. 167. GOUVEA and LEBER (v. GRAEFE'S *Archiv*, Bd. XXIX. Abth. 3, p. 225) give the literature of this subject.

§ LANDESBERG (*Med. and Surg. Reporter*, Vol. XLIII., Sep., 1880) reports four cases of eye affections after whooping cough, two of neuritis optica (in one case with $V = \frac{15}{30}$, in the other with $V = \frac{15}{100}$), one of exophthalmus, one of luxatio lentis.

Part III.

Eye Diseases incident to the Educational Period.

The eye diseases which are most frequently acquired in this period of life are myopia and trachoma. The latter, which is endemic in the orphanages and schools of many countries, shall be considered later on; this chapter shall be devoted exclusively to myopia.

Chapter I. Causes of Myopia.

§ 7. Myopia may be congenital or acquired—we not unfrequently find persons coming to the dispensary for myopia, belonging to the country-folk, who may perhaps have never learnt to read, and most assuredly have never strained their eyes by looking closely. They have generally a high degree of myopia, and allege that they have been short-sighted as long as they can remember. These are cases of *congenital myopia;* they have nothing to do with the kind of occupation of their subjects, and occur in pretty much the same proportion in all classes of society. This is well shown in TSCHERNING'S essay.* He examined men belonging to all classes of society as they presented themselves for the military conscription. He divided

* V. GRAEFE'S *Archiv*, Bd. XXIX., Abth. 1, p. 201.

them into six classes, according as their occupation demanded a greater or less exertion of the eyes. He found that the higher degrees of myopia, above 9 D., were pretty equally distributed through all six classes. When he placed together the three higher classes on one side, and the three lower classes on the other, he found that the former had only 0.56°/₀, while the latter had 0.73°/₀ of this congenital higher degree of myopia.*

§ 8. Whilst congenital myopia is rather rare, *acquired myopia* is much more frequent. Consequently it merits our special attention, and all the more because we can to a certain extent prevent it, which naturally we cannot do in the case of congenital myopia.

Acquired myopia is the result of several factors, among which *prolonged work requiring close vision* takes the first place. The influence it has on the development of myopia is shown by the following circumstances:—1. That myopia is seldom found among new-born infants; 2. nor among uncivilized people; 3. that among civilised people myopia is found in exact proportion to the calls on the eyes for exertion.

The first investigations instituted with respect to the refraction of new-born infants were made by JAEGER.† He found that

* SORMANI (Dati statistici relativi alla distribuzione della miopia e della cecità in Italia. *Ann. di Ottalm.*, Vol. X., p. 546, 1881) found the greatest number of myopes in Italy among the inhabitants of the southern provinces and the sea-coast. Among more than 2,000,000 recruits from these regions, 2.8°/₀ were short-sighted, with a myopia above 6.5 D; and yet the occupations of this population were not of a character to make a great demand on the eyes; 70°/₀ of the recruits could not even read; therefore these statistics had to do with myopia independent of the occupation, and most probably congenital.

† *Einstellungen des dioptrischen Apparates*, p. 20.

among 100 children of from 9 to 16 days old 78 had My., 17 H., and 5 E. These investigations, which for a long time were considered conclusive, have lately been repeated and refuted. HORSTMANN* found among 79 new-born children 9 myopes; ELY† among 100 only 11; KOENIGSTEIN‡ found among 600, SCHLEICH§ among 300 new-born children not one myopic.‖ With respect to the observations of HORSTMANN and ELY on the short-sight of children, their myopia is probably owing to the too great refractive power of the lens, and most of their eyes probably became emmetropic as they grew older. This seems to be proved by the circumstance that COHN found only 1.4°/₀ My. among the children of village schools.¶—Children are not, as a rule, born with myopic eyes, nor do they become myopic later on if they do not need to strain their eyes by looking closely. Among uncivilised people, therefore, myopia is as rare as among new-born children.—Among civilized people the number of myopes is in direct proportion to the amount of work requiring close vision, demanded by the occupation of each individual. It

* *Bericht über die Heidelberger Ophthalmologen-Versammlung*, 1879, p. 241.

† KNAPP'S *Archiv f. Augenheilkunde*, Bd. IX., p. 431.

‡ *Wiener medicinische Jahrbücher*, 1881, p. 47.

§ *Mittheilungen aus der ophth. Klinik in Tübingen*, Bd. II., p. 44.

‖ Since then (at the International Medical Congress at Copenhagen, 1884) further investigations have been recorded upon the eyes of new-born children by BJERRUM and LÖWEGREN, which confirm the above results.

¶ *Die Hygiene des Auges in den Schulen*, 1883, p. 47. Most of the following data are taken from this admirable work. As it contains a full *resumé* of the literature of the subject, I have given but few references to other works in what follows.

has long been noticed that there are many short-sighted persons in the learned professions. This observation gave the impulse to the works of COHN and his followers.

The best opportunity for observing the influence of occupation is afforded by investigations which have to do with a large number of persons irrespective of their position in life, as, for example, those made on persons who present themselves for military service. SEGGEL* and TSCHERNING† have recorded investigations of this kind.

SEGGEL examined 1,600 soldiers of the Munich garrison. According as their occupation required less or more close work, he divided them into 5 classes: The first included country folks; the second those employed in open-air avocations in towns, such as day-labourers, &c.; the third, handicraftsmen and artisans; the fourth, tradesmen, merchants, writers, printers, &c.; the fifth, those who offered themselves as one-year volunteers, these were chiefly students. Myopia in these classes rising from the lowest to the highest was: 2°/₀, 4°/₀, 9°/₀, 44°/₀, and 58°/₀.

TSCHERNING'S investigations included 7,523 persons liable to military service, who were similarly arranged in 6 classes. In those classes myopia was found to increase in the following ratio: 2°/₀, 5°/₀, 12°/₀, 13°/₀, 16°/₀, and 32°/₀.

It is evident from these figures that the chief cause of acquired myopia lies in the requirements of the occupation. Myopia is thus seen to be the melancholy privilege of the learned

* *Bayer. ärztl. Intellegenzblatt*, 1878, p. 33.

† V. GRAEFE'S *Archiv*, Bd. XXIX., Abth. 1, p. 201.

professions. Next in order are those occupations which make especial demands on the eyes. The latter will be considered later on; at present, we shall occupy ourselves exclusively with the influence of study on the eyes.

§ 9. *Short-sightedness in Schools.*

To COHN belongs the great merit of having first instituted extensive investigations relative to the eyes in schools in a strictly scientific manner. His example has given rise to a great number of works bearing on this subject. From all these investigations it appears that, 1, the number of myopes is greater the higher the school is; 2, that in each school the number of myopes increases from the lower school classes to the higher; and 3, that with the number of myopes the average degree of myopia increases.

1. The number of myopes is greater the *higher the school is.*

This is best illustrated by the table which COHN gives relating to more than 1,060 children he examined. In order to include the schools of highest education (universities) in this table, I add 108 medical students also examined by COHN.*

	Percentage of Myopes.	Average degree of Myopia.
Village Schools ...	1.4	$^1/_{24.4}$
Elementary Schools	6.7	$^1/_{22.7}$
Higher Girls' Schools	7.7	—
Middle Schools ...	10.3	$^1/_{21.9}$
Technical Schools ...	19.7	$^1/_{19.6}$
Gymnasia ...	26.2	$^1/_{18.7}$
University ...	59	$^1/_{12.2}$

* The eyes of medical students, *Wiener medic. Jahrbücher*, 1881.

This table does not deal with such large numbers as I might have obtained, had I taken the average of all the data given in COHN'S work. But it has the advantage of being more uniform, the observations were made by the same observer in the same manner, and relate to one country. The picture they present to us of the progressive increase of myopia is sufficiently striking. And yet the numbers of the table are not equal to those given by many other authors. Thus COHN has in his own investigations left out all myopias under 1/36 (1 D).* In the collection given by COHN, we find no fewer than 5 gymnasia in which the myopes were more than 50°/₀. Among the divinity students of Tübingen GAERTNER† found 78°/₀ of myopes.

2. In each school *the number of myopes increases from class to class upwards.*

In illustration of this assertion, I may adduce the figures ascertained by COHN in the gymnasia. The number of the short-sighted in the several classes rising from the lowest to the highest was: 15.5%, 18.2%, 23.7%, 31°/₀, 41.3°/₀, 55.8°/₀. The diagram on next page is also taken from COHN. It represents the increase of myopia from the lowest to the highest class in 24 gymnasia and technical schools investigated by him. The curve shows higher values than the figures just cited, because in it the lowest degrees of myopia are admitted.

3. Not only the number of myopes, but *the average degree of*

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* The investigations relating to medical students are an exception to this.

† BERLIN *and* REMBOLD, *Untersuchungen über den Einfluss des Schreibens.* Stuttgart, 1883, p. 46.

myopia also increases. This is seen by the figures given in the table at p. 19.

PERCENTAGE OF MYOPES IN

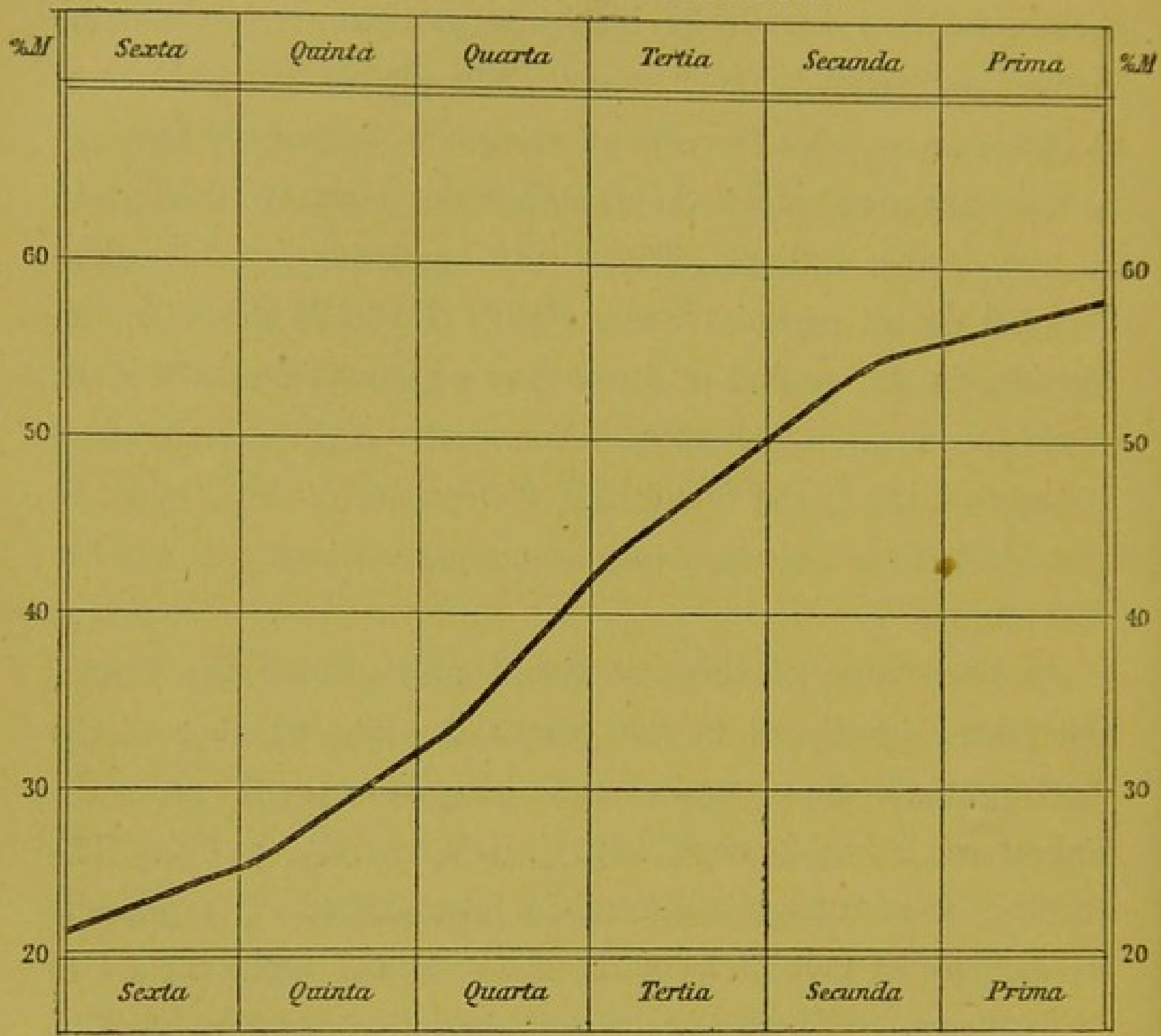

FIG. 1.

From the facts adduced the following conclusions may be drawn: 1. That during the period of study a large number of emmetropic and hypermetropic children become myopic; 2, that in myopes the degree of myopia constantly increases. These two facts are moreover directly proved by investigations made on the same school children at various times.

Investigations of this sort were also first undertaken by COHN.* He found that more than one half of myopes underwent an increase of their myopia ; in the 18 months that elapsed between the two investigations the myopia had increased from an average of $^1/_{20.6}$ to an average of $^1/_{14.6}$. That implies an increase of refraction of $^1/_{50}$ (0.75 D) in $1\frac{1}{2}$ year, or of $^1/_{75}$ (0.5 D) in one year.—Among medical students COHN found not fewer than $37^\circ/_\circ$ whose myopia exceeded $^1/_9$ (4 D.). We must take for granted that in many of these cases the myopia continues to increase after the studies are over. If this take place only to the extent of $^1/_{75}$ per annum, that will in the end cause very high degrees of myopia. We may imagine what kind of future awaits many of these young people as regards their eyes.

Of all the occupations requiring close vision, study is the most dangerous for the production of short-sight. This is not the place to describe the mode in which straining the eyes tends to produce myopia, that is to say, elongation of the eye ball. Thus much only we may say here, that in general the extreme and long continued accommodation and convergency are the hurtful factors. They exert their baneful influence all the more certainly seeing that the majority of students practise them in a perniciously high degree. The excellent investigations made by BERLIN in conjunction with REMBOLD, show that almost all school children hold their books, &c., much closer to their eyes

* In his *Hygiene des Auges*, at pp. 65-67, COHN gives the literature dealing with this subject ; since then REICH (v. GRAEFE'S *Archiv*, XXIX. 2, 203) must be added to the list.

than is necessary: in one class of six year old girls the average distance of the eyes from the pen's point was only 4½ inches.*

§ 10. The question arises, how does it happen that all individuals who have to strain their eyes to a certain degree do not become short-sighted, but only a certain number of them? We need not at present consider those cases where single individuals work under specially unfavourable conditions (bad illumination of their homes, straining of the eyes in order to earn their bread, &c.). As regards the rest, the reason must be that these are circumstances purely personal to themselves which favour the development of myopia. These circumstances can be none other than certain anatomical peculiarities of the eyes and their appendages, of which, however, we yet know extremely little. Those factors that predispose to myopia are:

1. *Defective acuteness of vision*, which compels its subject to bring objects closer to his eye. To this belong congenital defects of the eye, such as albinism, astigmatism, congenital amblyopia, &c.; also acquired defects, such as opaque spots on the cornea.

2. *Disturbances* of the equilibrium among the muscles of the eye.

3. *Heridity*. The influence of heridity is shown in this, that the children of short-sighted parents though they may not be born short-sighted, nevertheless possess a peculiar tendency to become short-sighted under certain conditions.

I may take this opportunity to say something about short-

* L. C., p. 32.

sightedness in the *female sex*. It might be supposed that women have the advantage over men in this respect. This advantage is partly only apparent, for many short-sighted women object to wear spectacles. Partly, however,—in former times at least—their education made slighter demands on their eyes and hence rendered them less liable to become myopic. Nowadays this appears to be no longer the case.

Recent investigations have shown that as regards short sight, there is no great difference between the two sexes. In the following table I have put together the investigations which have been collected by one and the same observer in the same place relating to a boy's school and a girl's school of the same rank. Such investigations best permit a comparison. No doubt there may be differences in the illumination of the schools or in the programme of instruction of schools otherwise similarly conducted, for which it is difficult to make allowance.

			Percentage of Myopia in	
			Boys.	Girls.
NETOLICZKA	Graz, 1881	Village School	4	8
"	"	Town School	10	13
PFLUEGER	Lucern, 1876	Lower School	5	8
NICATI	Marseilles, 1879	Primary School	8	7
"	"	Jewish School	15	10
FLORSCHUETZ	Coburg, 1880	Town School	12	14
"	"	"	4	7
JUST	Zittau, 1879	"	15	14
REICH	Tiflis, 1878	Gymnasium	37	25

4. *Race.* It is a fact that the frequency of myopia is often different among different nations. But the difference depends in great measure on the different degree of culture. As has already been remarked, myopia is almost unknown among uncivilized people. In order to ascertain if a given race possess a special disposition to short-sight, a comparison must be made among civilised nations, and this must be done with the greatest care. We have seen how greatly short-sight varies according to the occupation, and even according to the particular years of study. But should we even compare schools of similar character, *e.g.*, a Russian or French with a German gymnasium, we should not be able to draw any satisfactory conclusions therefrom. There always remain differences in the illumination of the school-rooms, in the construction of the school-forms, in the programme of instruction, in the mode of living of the scholars, &c., which have the greatest influence on the number of the myopes. ERISMANN has shown how much boarding in the school is to blame for the occurrence of short-sight. The day-scholars have 35.4°/₀, the boarders 42.1°/₀ of myopes. DOR found in the Lyons Lyceum among the day-scholars 18°/₀, and among the boarders 33°/₀ of myopes. Thus we can only make use, for the purposes of comparison, of the few investigations referring to mixed schools, in which scholars of different nations are educated under identical external conditions. These investigations are subjoined :—

			Per cent. of Myopia.		
LORING & DERBY	New York, 1876	?	Germans, 24	Americans, 20	Irish, 14
COLLARD	Utrecht, 1881	University	Germans, 40	Dutch, 27	
PFLUEGER	Switzerland, 1875	Teachers	Germans, 24	French, 14	
NICATI	Marseilles, 1879	Boys' School	Jews, 15	Christians (French) 8	
,,	,,	Girls' School	Jews, 10	Christians, 7	
REICH	Tiflis, 1878	Boys' Gymnasium	Russians, 30	Armenians 38	Georgians 45
,,	,,	Girls' Gymnasium	,, 30	,, 24	,, 21
,,	,,	Town School	,, 2	,, 14	,, 14
,,	,,	Teachers' Institution	,, 8	,, 25	,, 10

According to this table, the greatest proportion of short-sighted were found among the Germans and Jews, but the observations are altogether too few to admit of definite con-conclusions being arrived at.

§ 11. Having shown the frequency of myopia in certain classes of the community, we must enquire if it is an affection which seriously threatens the faculty of vision? Are we justified in regarding short-sight as a public danger, which must be guarded against by all the means in our power?

In the majority of myopes, the myopia remains stationary at a low degree. It is not attended with any danger to the sight, and as a rule does not prevent the following of any occupation. On the other hand, in a certain minority the short sight attains such a height that, in the first place, it makes its subject incapable of following certain occupations, and, in the second place, it seriously threatens to destroy the sight in the course of time. The cases of absolute blindness as a consequence of short-sight are no doubt rare in comparison with the large number of myopes. According to MAGNUS chorioiditis e myopia furnishes 0.94% of the blind. To these may be added a portion of the cases of detachment of the retina, which altogether constitute 5.68% of blind persons. On the other hand, much more numerous are the cases in which myopes, as they grow older become not indeed totally blind, but so weak-sighted as to be incapable of earning their subsistence. COHN in his statistics of blindness, includes all eyes which cannot be employed in work. In these statistics, detachment of the retina as a consequence of myopia is given at 4.6%, retinitis centralis e myopia 6.3%, so that myopia is the cause of 10% of all cases of blindness of one eye.

It may also be asserted that very short-sighted persons are proportionally subject to a greater number of injuries than others.

Chapter II. Prophylaxis of Myopia.

How then can we guard against this public calamity, myopia?

The general extension of public education, its increase in profundity and extent is one of the most excellent gains of modern times. We must not diminish this gain; we must not oppose any of the essential requirements of education. But we must seek to watch over it, so that its injurious effects on the health of the scholars must be reduced to a minimum. For this end a number of measures are necessary, some of a general sort applicable to all schools and scholars, some of a special sort for the several stages of education.

I. GENERAL MEASURES.

(a) Measures Relating to the School-room.

§ 12. 1. *Illumination.* In his first investigations in 1865 COHN paid particular attention to this factor. Twenty elementary schools examined by him, in which the requirements of the education were pretty much alike and therefore admitting of a comparison, shewed a variation in the number of myopes of from 1.8°/₀ to 15°/₀ dependent on the illumination of the school-rooms. The new schools situated in broad streets, had from 1.8 to 6.6°/₀ of myopes. FLORSCHUETZ in 1874, found 21°/₀ of myopes in the Coburg schools. In 1877 after a number of new schools had been built, the number of myopes had diminished to 1.5°/₀, so that the importance of good illumination is indubitable.

What is the quantity of light needed for a school-room? Bad illumination is hurtful, because it compels the writing or book to be held too close and thus necessitates excessive accommodation and convergence of the eyes. The illumination is sufficient when it allows even smaller print, *e.g.* Snellen 0.5 to be read at a convenient distance, as for instance 12 inches.—There are various ways of judging of the illumination of a school-room.

The *first* method is to ascertain how large a portion of the sky can be seen from every place in the school-room. As regards the school-room, it is not merely the general illumination, but the illumination of every single place in it that has to be examined; the worst place must receive a sufficiency of light. This method was proposed by JAVAL, and also by a commission appointed by the French government in 1881. This Commission laid down as the minimum of illumination, that an eye at the height of the school desk should be able to see the sky in a vertical extent of at least 12 inches, reckoned from the upper border of the window. Against this I may allege that the illumination of a place in the school-room does not depend only on the portion of visible sky, but also on the reflection of the walls, &c. It is difficult to estimate these factors for every special case, so that it is better to measure directly the quantity of light secured by each place.

A *second* method takes the acuteness of vision as the measure of the illumination. Various propositions have been made in this sense, HOFFMANN requires that Snellen 6 should be read at 20 feet. By this method we certainly ascertain something as regards the illumination of the Snellen table hung up on the wall, but nothing respecting the place from which it is read. LAQUEUR'S plan is better, which requires that diamond type should be easily legible at a distance of 20 inches. LANDOLT'S photometer goes on the same principle. A small card has a group of black spots on a white ground, the distance between the spots is $^1/_8$th of an inch. In order to be able to employ the card for any particular school-desk, it is connected with a mirror in such a manner that the mirror throws the rays proceeding from the points farther in a horizontal direction. With the best illumination, LANDOLT distinguishes the points at 16 feet, in a well-lighted room at 10 feet. Hence he denominates the illumination of this room as $^3/_5$ths of the maximum-illumination, for he reckons from the (disputable) proposition that the acuteness of vision is in direct proportion to the illumination.

These methods have this fault, that their standard of measurement, to wit, the acuteness of human vision is not a fixed standard. There are persons who have a double acuteness of vision and more; they will be capable of reading Sn. 6 at 20 feet in bad illumination. To others who have exactly V. $^6/_6$ Sn. 6 may easily become illegible. Others, on account of short-sight, astigmatism, &c., cannot have such a test applied to them. When an oculist investigates the lighting of a room, he may make allowances for these circumstances in the use of his own eyes. But it were desirable to have a method which should give reliable results also in the hands of others, *e.g.*, teachers, architects, &c. For this reason the attempt has been made to make use of the methods of photometry.

All *photometric methods* give, not an absolute, but a relative measurement of the intensity of light, by the comparison with one another of two sources of light. On this principle BERTIN-SANS has constructed a photometer intended for school-rooms.* With this apparatus I have instituted a series of experiments, which, however, have not yielded very satisfactory results. Quite recently COHN† made use of a photometer constructed by L. WEBER, which fulfils all requirements. Unfortunately, the high price of the apparatus (£15) militates against its general use; therefore it would be very desirable to have a simple cheap photometer which could be easily used by everyone, and yet give sufficiently accurate results.

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* *Annales d'Hygiène*, Tome VII., pp. 46 and 127.

† *Deutsche med. Wochenschrift*, No. 38, 1884.

In order to fulfil the necessary requirements relative to illumination, the following points should be attended to in the construction of a school.

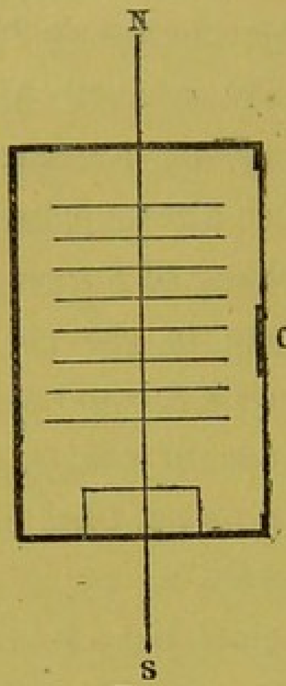

Fig. 2.

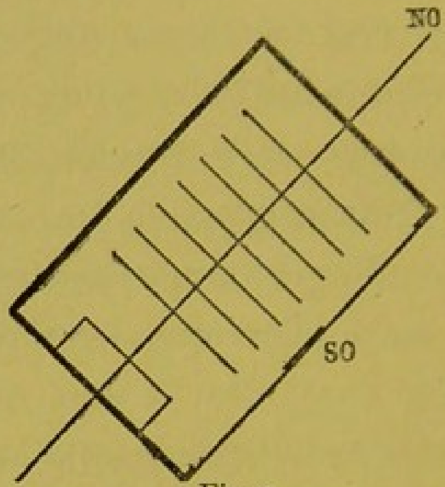

Fig. 3.

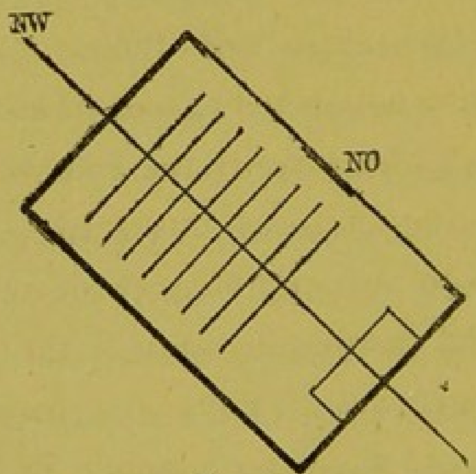

Fig. 4.

§ 13. I. *Position of the school house.* Before all things it is desirable to ascertain from what point of the compass we can obtain the illumination.*

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* In the cuts, O stands for *East.*

Almost all are agreed that the windows should look towards the east and south east. A few (LANG and RECLAM) prefer the aspect towards the north in order to avoid the direct incidence of the sunlight; but the direct sunlight can be warded off by various contrivances. Rooms on the sunny side are more easily warmed in winter, they are much the most cheerful and wholesome.

Hence the best aspect of the windows will be that towards the east and the approximate north-east and south-east. A westerly aspect is only suitable for school-rooms in which no afternoon instruction is given. A due north aspect is to be avoided, because it is so dark and sunless in winter. Nor does a due south aspect seem to me advisable, because in summer it gets too much heat and direct sunlight.—Hence a school-room is well placed if its axis runs nearly north and south. The teacher is placed on the south side, the windows on the west side (fig. 2). The direction of the axis towards north-east (fig. 3), or south-west (fig. 4), also permits the windows to have a good aspect, namely, towards south-east or north-west.

It is impossible to say anything about the position of the whole school building, because the form of the ground plan and therewith the arrangement of the space, may vary extremely. In general we can get a greater number of favourably constructed rooms, if the school building have its corners rather than its façades directed towards the principal points of the compass (Hesse commission, JAVAL); by adopting this plan, we shall avoid the very objectionable due north façade.

It is evident that climate constitutes an important factor in determining the site of a school. The principles just laid down are applicable to a temperate climate like that of Germany or of the middle and north of France. We should have to act in southern countries, where a pure north aspect may be the best for the school-room, otherwise than in northern countries, as for example England, where the prevalence of a cloudy sky and the moisture of the atmosphere would call for a due south aspect. Sometimes also local conditions, as for instance, a high mountain range, some special prevalent direction of the wind, &c., require special consideration.

The circumstances above mentioned to be attended to in regard to the position of the school-room are mostly inapplicable when the illumination is affected by means of a skylight. In that case it is of no importance, so far at least as the lighting is concerned, how near the *surrounding buildings* are. But in the case of lighting from the side, this point requires particular attention, which seems not always to be bestowed on it. COHN very properly disapproves of the situation of the Magdalen Gymnasium of Breslau, which has been built quite close to a high church that takes away the light from many of the school-rooms.—In order to ascertain at what distance the neighbouring houses ought to be, we must look to the school-rooms on the ground floor. We ought to be able to see a bit of sky through the window from the school seats farthest from the window. As a simple calculation shows, this will only be the case when the opposite houses are distant from the school house at least twice as far as their height (JAVAL). Only very low buildings, under 33 feet in height, may stand somewhat nearer than twice their distance. ZWERZ says that the height of the houses opposite measured from the window-sill of the school-room ought not to exceed from 20 to 25.° This corresponds pretty nearly with what is stated above as to the desirable relative height and distance of buildings opposite the school.

In the building of a new school-house a sufficient plot of land should be purchased or kept unbuilt on by agreement, so that the distance between the school and surrounding houses should be at least double the height of the latter. A part of this land may be appropriately laid out as a garden. If, for any reason, it should be impossible to keep such an amount of land unoccupied, then the ground floor on the sides of the building where the light is obstructed by houses opposite should not be used as schoolrooms.

In such cases, the precedent of the school of St. Denis might be followed by constructing a large courtyard on which the windows of the school-rooms look. The dimensions of the courtyard in relation to the height of the building, should of course, be the same as those above enumerated.

§ 14.—2. *Position of the windows.*—It is important to attend to the position and dimensions of the windows. As regards the position of the windows, there is no doubt that a *skylight* affords, relatively, the greatest quantity of light. It is only necessary to visit artists' studios, factories and the like, illuminated in this way, to convince ourselves of the truth of this. The disadvantages alleged against lighting by means of glass roofs are snow in winter and the sun in summer. The first is easily removed. As regards the last, I admit that in warmer countries, such as

Italy, schoolrooms with glass roofs are intolerably hot in summer, and therefore not advisable. But in cooler countries this will not be the case. The direct sun's rays must, of course, be warded off (by means of blinds). If this is attended to, then illumination by means of light from above is no doubt the best and I cannot understand why the French regulation of 1880 should say :—" *L'éclairage par un plafond vitré est interdit.*" Unfortunately, illumination by light from above can only be carried out to a limited extent, owing to architectural difficulties.

When the light comes *from the side* it must be exclusively or chiefly from the left side. The former, to wit, illumination from one side, suffices for small and medium-sized school-rooms, and in such it ought unhesitatingly to be preferred. Larger school-rooms can only be exclusively lighted from the left when they are sufficiently lofty, so that the daylight falls upon the seats at the extreme right in a not too sloping angle.* It is not, therefore, enough that there should merely be a certain relation between window surface and floor surface, but there must also be a proper relation of the height of the upper border of the window to the depth of the room.

JAVAL insists that in illumination from one side the distance of the upper border of the window from the floor should be equal to the depth of the room. TRELAT is satisfied if the height of the upper border of the window is 0.6 the breadth of the room, *plus* the thickness of the wall. On the other hand, the French

* In a sloping incidence of light the illumination of a surface stands in direct relation to the cosine of the angle of incidence.

law of 1880 requires that the windows should be two thirds of the depth of the room. This should be the minimum, below which we ought on no account to go.—It is sometimes necessary to provide school-rooms for a large number of scholars, therefore the rooms must be larger. The length of the room should not overstep a certain limit, in order, on the one hand, that the scholars should still be able to see the boards, and on the other hand, that the voice of the teacher should be audible on the farthest forms. Hence, the rooms should be of considerable breadth. But here the limit of the exclusively left-sided illumination is soon reached, because, on account of architectural considerations, the height of the rooms cannot be increased as much as might be desired.

Great as are the advantages of lighting from one side, still, it is not right to proscribe absolutely lighting *from two sides*, as has occasionally been done. Illumination from two sides is certainly better than insufficient illumination; it is, moreover, a good illumination, if reasonably carried out.* The second row of windows may be set at the back or right side of the scholars (never in front of them). In every case the windows must be so arranged that the light from the left greatly preponderates. The superficies of the left-side windows should constitute at least two-thirds of the whole window superficies, as was the case, for instance, in FERRAND'S school-house in the Paris International Exhibition of 1878.

* I may mention that windows opposite one another facilitate adequate ventilation.

If the number of windows on both the long sides of the room be equal we shall best fulfil the above requirement, by constructing the windows on the right side so that they do not come down so low. In this way we shall most certainly prevent the scholars who sit farthest right from having the shadow of their pen on their left side.

Attention should be given to the position of the room in relation to the points of the compass, for it will aid us in securing a good distribution of the light. Let us suppose the room to be so placed that its two long sides look south-east and south-west. The teacher should be placed at the narrow south side of the room, and twice as many windows should be made on the south-west side as on the north-west side. As—in the forenoon hours at least—the light coming from the south-east is much greater than what comes from the north-west, we shall at all events be able to secure a good distribution of the light.

How far should the windows extend up and down? The higher the upper boundary of the window is, the better; hence, if possible it should reach up to the ceiling. On the other hand the *lower boundary of the window* requires a certain limitation. If the latter comes down too far, part of the light from below falls in the scholar's eyes and dazzles him. Hence the window sill should be at about the level of the heads of the school children when they are seated. Forty inches high appears to me to be quite sufficient (Strasburg Report). A higher elevation of window sill needlessly diminishes the superficies of the window. The French regulation orders 4 feet.† TRELAT advises 4 feet,

† *Réglement pour la construction, &c. Arreté ministeriel du 17 Juin,* 1880.

4 inches, the Brussels commission 5 feet, 2 inches. In this last case the school-room has a prison-like appearance.—Should it be feared that the attention of the scholars would be distracted the lowest panes of the window may be made of ground glass.—I have mentioned above that other considerations come into operation with regard to windows on the right of the scholars, which render it desirable that those windows should not come so far down.

Irrespective of their lower boundary, the dimensions of the windows may be too small, but cannot be too large. The only thing to be done is to fix the lowest limit *for the dimensions of the windows in proportion to the size of the room.* In calculating the superficial dimensions of windows, the window curtains and the cross bar must be deducted. COHN in his work describes a number of model schools exhibited at the Paris and Vienna International Exhibitions. In them the proportion of window superficies to floor superficies, varies from 1 to 8.6 (Prussian school-room at the Vienna Exhibition) to 1 to 1 (FERRAND'S school-house at the Paris Exhibition of 1878).

The actual illumination proportions in existing schools fall very short of those of these model schools. BLASIUS examined all the schools of the Duchy of Brunswick, which possess in all 807 classes. Of these 3.1 °/₀ had the proportion of window to floor superficies of 1 to 4 or an even more favourable proportion; 22.7 °/₀ had the proportion of from 1 to 4 to 1 to 7. The former of these classes were excellently, the latter sufficiently lighted. In the remaining 74 °/₀ there was 1 square yard of glass to more than 7 square yards of floor surface, so that $\frac{3}{4}$ths of all the school-rooms were insufficiently lighted.

What should be considered the minimum of good illumination? COHN requires a proportion of 1 to 5 as the minimum; ERISMANN 1 to 4.5; the Brussels Commission *1* to *6*. Many of the established commissions, as also many government ordinances on the subject lay down no fixed proportion between window and floor superficies, but content themselves with prescribing the height and width of the windows. I have examined the newly built grand middle and technical school of Liege, in which, following the Belgian regulations, in most of the rooms the proportion of 1 to 6 is maintained. In these rooms the lighting of the seats farthest from the windows is very good on bright days, but on dull days insufficient. Therefore I feel compelled to agree with COHN in adopting a minimum of 1 to 5.—With an equal window superficies, many windows are preferable to few, for in the former case there is no obscuration of some seats by broad wall spaces between the windows.

The colour and form of the walls affect the illumination. The walls must be bright in order to reflect the light properly, but not so bright as to dazzle the scholars. Hence COHN'S suggestion to employ a bright gray colour should command general assent.

Direct sunlight should be kept from falling on the school forms. This object may be obtained by the use of ground glass window panes, curtains of various stuffs and blinds of different kinds. Ground glass window panes are sometimes very dazzling. I consider simple gray linen blinds the best. As regards the fixing of these, COHN prefers the mode adopted in the American model school-house of the Vienna Exhibition; in this the blinds were placed in half the height of the window, so that the upper half of the window or the lower half or both together can be shaded.

§ 15. *Artificial illumination* is required for evening instruction, as also in winter for the first hour or even the first two hours. In primary schools in which the hours of instruction are few, the bright time of the day may be chosen for lessons. Artificial illumination is chiefly applicable to middle and upper schools. As these are almost exclusively found in towns provided with gas, the lighting of schools is, as a rule, effected by gas. According to COHN and VARRENTRAPP, there should be one burner for every four scholars (with two-seated desks). All burners should be provided with glass chimneys and shades. In front of the school-desk there should also be one, and still better, two lamps (one on each side). A tin reflector throws the light of the lamp on the desk, and at the same time shades it from the scholars' eyes. When gas cannot be had, petroleum is preferable to oil.

For larger schools with evening instruction, especially for drawing lessons, electric lighting is advisable. The first employment of this, as far as I am aware, was made in the middle and technical schools of Liege, which were opened in October, 1883. Three rooms for drawing classes are lighted by electricity, each room 13 $^{1}/_{3}$ yards wide and twice that length was lighted by two electric sunlights. These were fixed to the lower end of iron rods which hung half way down into the room. Underneath each sunlight there is a concave mirror, one side of which shades the light from view, while the other throws the light on to the white-washed ceiling. From this it is reflected throughout the room. Thus the light comes from above and falls in pretty equal degree upon all the desks, whilst the sources of the light themselves are invisible. The light is quite sufficient, but not at all dazzling.*

§ 16.—2. *The seats and desks.*—One of the chief causes of school-myopia is, that by having the objects too close to them, the scholars strain their eyes more than is required by the work they are engaged on.

The *working distance* has a fixed relation to the size of the body (BERLIN); children, on account of the shortness of their arms must have their writing nearer to them than youths or adults. These differences incident to age, correspond to the greater power of accommodation in childhood, which diminishes as age increases. But within these limits attaching to the size of the body the working distance varies greatly. It is the product of a number of factors, to wit: 1. Acuteness of vision and refraction. 2. Illumination. 3. Size of the object. 4. Method of writing. 5. Construction of the school-seats and school-desks. 6. Customary position. With the exception of the first (acuteness of vision and refraction) all these factors are under our control. If they are regulated in accordance with the requirements of hygiene, there will be few children who—on account of faulty refraction or defective acuteness of vision—will be obliged to have the objects close to their eye. We have first to consider the subject of seats and desks.

The scholar sits in a proper manner if the upper part of his

* See also § 63, Artificial illumination.

body is straight, so that pelvis and shoulders are parallel to the border of the desk, and the head is upright or slightly bent forwards. The feet should rest upon the floor, the back supported by a sacral rest. When writing, the forearms, but not the elbows also, should rest on the desk. This posture is not less important for diminishing curvatures of the spine than for preventing myopia. An indispensable requisite for this is a properly constructed seat. There is at present a great number of models of good school-seats, which I cannot here pause to describe; complete details of their various forms will be found in the works of COHN, RIANT,* BAGINSKI,† and others. I shall only in this place mention the principles on which school-seats should be constructed.

1. *Dimensions of the seats.*—In every class there should be school-seats of different sizes. In schools where there are several classes it will suffice to have in each class school-seats of two or three different sizes. In village schools of only one class, where children of the most different ages (from 6 to 14 years) are seated together, a greater variety of sizes (4 to 6) is required.

2. *The vertical distance* between desk and seat should be only slightly greater than the distance between elbows and seat-bones (= ⅛th of the length of the body). Otherwise the child is compelled, when resting the arms on the desk, to raise the elbows too much, whereby the upper part of the body is suspended between the shoulders.

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* *Hygiène scolaire*, Paris, 1877.

† *Handbuch der Schulhygiene*, Berlin, 1877.

3. *The horizontal distance* betwixt desk and seat should be negative—that is to say, the front border of the seat should extend a little way under the desk. If there is a positive distance between seat and desk (and in a slight degree if there is no distance), the children are obliged when writing to bend the body forwards, and to support it by pressing their elbows against the desk. On the other hand, when the distance is negative (BUCHNER and COHN recommend a projection of the seat under the desk to the extent of 2 inches), the child can write sitting straight upright, and with his back supported. BERLIN has shown that children keep further away from the paper they are writing on when their back is supported.*

The negative distance between seat and desk is good only for writing, otherwise it cramps the scholar, and prevents him rising from his seat. Therefore the desk must be so constructed that it can be pushed back or turned up when not used for writing. The pushing-back arrangement is better than the turning-up, as it can be effected without previously clearing the desk. The school-desks of KUNZE, OLMUETZER, and CARDOT, attain this object in a very simple manner.

4. *The height of the seat* (its distance from the foot-board) must be equal to the length of the scholar's leg, that is, about $\frac{2}{7}$ths the length of the body.

5. *The breadth of the seat* should be about a fifth of the length of the body = 9 to 13 inches. The length of the place for each scholar should be at least 25 inches.†

* L.c., p. 34.

† Most systems allow too small space for little children; some even (in the Paris Schools and GREARD'S system) as little as 18 inches.

6. *The back of the seat should only reach up to the loins** of the scholar. The best form for it is a slight curve fitting to the shape of the body.

7. *The top of the desk* should be sloping, in order that the scholar may hold himself as upright as possible. This slope, moreover, facilitates the movement of the arm when writing. COHN advises a slope of 1 to 6 ($9\frac{1}{2}°$). The slope should be able to be increased, for the purpose of reading, by a mechanical contrivance (turning up of a part of the desk).

8. *The breadth of the desk* must vary according to the size of the scholar's body. According to COHN it should be at least 16 inches.

Of course it is not sufficient that children should have proper seats and desks in the school only; they ought to have the same at home also. This is much more difficult than a suitable arrangement in the schools, particularly with respect to the children of poor people. The evil is minimised if the home work of the scholars is curtailed, but this is a subject to be hereafter considered. Otherwise there is nothing to be done except for the teacher to advise the parents, or printed instructions may be given to them when the child is first admitted to the school. In addition to this the school-doctor should send for the parents of short-sighted children and instruct them with regard to this and other matters.

Even when all the conditions are as favourable as possible there will always be some scholars who will lean forward and bring the eyes too near the object. This is a bad habit which

* See Appendix by Dr. ROTH.

is seen especially in the subjects of developing myopia; although the slight degree of myopia would allow them very well to work at a distance of 12 inches and upwards, they have a great tendency to bring everything as near as possible to their eyes. The impressive warnings of the teacher in the school, may effect much in regard to the posture of the scholars, but he will unfortunately seldom receive much assistance in this direction from the parents at home.

Fig. 5. Kallmann's Upright Holder.

When admonitions are of no avail an *upright holder* should be employed. Among these that of KALLMANN, of Breslau, (fig. 3) seems to me the best. It consists of a metal ring covered with rubber, against which the child's forehead leans whilst he looks through the ring.*

* FÖRSTER has quite recently recorded the excellent results he has obtained by the employment of this upright-holder combined with suitable concave glasses (*Archiv f. Augenheilkunde*, XIV., p. 309.) See Appendix by Dr. ROTH.

(b) Measures Affecting the Scholars.

§ 17.—1. *Writing.*—It has already been mentioned that in addition to other factors, the method of writing has a great influence on the posture of the scholar. A bad posture of the body shows itself in writing on the one hand in an excessive bending forwards, on the other hand in a twisting of the body on its axis. The consequences of these are curvature of the spine and myopia.

What is the connexion between handwriting and posture of the body? I shall pass over the historical development of this question, it may be read at full length in BERLIN'S report. The following are the results of his investigations, which were made on a large number of school-children, and which quite lately have been corroborated by the examination of persons who write with the left hand.

In the vast majority of cases (93°/₀) the eyes, during writing, look at the thick stroke, that is to say during the making of this stroke they constantly follow the point of the pen. On the other hand the hair stroke is made while the writer only fixes his eye on the terminal point to be reached by the pen, and guides his pen to this without following the pen on its way with his eye.

Looking at the thick stroke takes place in this way: the writer places the fundamental line of vision of his eyes (that is the line of combination of the two axes of vision) perpendicularly to the direction of the thick stroke, therefore he guides the thick stroke along the vertical meridian of his binocular field of vision.*

It follows from what has just been said, that the posture of the head (and through that of the whole body) is immediately dependent on the position of the thick line in writing, and if that has a fixed slope to the line, on the position of the copy-book.

I have already said that the scholar should sit so that his head and shoulder are straight upright and parallel to the border of the desk. Such a posture while writing can evidently only be maintained when the scholar writes so that the thick strokes of the writing are perpendicular to the border of the desk. This is effected in two different ways:

1.—*By upright handwriting.*—In this the copy-book lies straight in front of the middle line of the body, the lines are parallel to the border of the table, the thick strokes perpendicular to the lines. COHN, the French official commission, WEBER, ARMAIGNAC, LAYET, SCHUBERT and others prefer this kind of handwriting.

2.—*Sloping handwriting* admits of an upright posture of head and body, when performed under the following conditions: The copy-book lies in front of the middle of the body, so that the lines run up from left to right in a slope of from 30° to 40°. The proper slope is obtained when the thick lines of the writing are perpendicular to the border of the desk. When the sheet to be written on in this manner is laid straight in front of the body, the handwriting

* Writing differs from reading, as in the latter the fundamental line of vision is always *parallel* with the lines.

is sloping, *i.e.*, the thick strokes form with the lines an angle of about 50°. Sloping writing is thus merely upright writing, written on a sheet lying in a sloping position.

Under all other conditions sloping handwriting must necessarily entail a twisted posture of head and body. This is the case in those (numerous) schools, in which the scholar is required, when doing sloping handwriting, to lay the copy-book straight before him. Fortunately, the scholars after a time emancipate themselves from the improper position of the copy-book they have been taught to adopt. But it does not follow that they abandon the bad position of the body they have once adopted.

From what we have said a correct posture of the writer is possible in upright, as well as in (properly performed) sloping handwriting. BERLIN gives the following advantages of sloping over upright handwriting:

The simplest movement, in order to write continuously on one line, consists in a backward bending (extension) of the hand; but as this goes but a little way, it is immediately succeeded by a rotation of the arm at the shoulder joint. The part of the forearm resting on the corner of the desk forms in this manner a fixed point, the centre point of a circular motion of the hand and pen's point. If we attempt in this way to write with upright handwriting lines parallel to the cross axis of the body, we find that we write with an upward slope. In order to remain upon the line, we must draw the elbow backwards and towards the right as we advance along the lines. This takes place by means of a series of small jerking movements of the elbow towards the right.

It is otherwise with sloping handwriting when written under the conditions given above. In that case the direction of the upward sloping lines nearly corresponds with the tangent of the circular arch which the pen's point describes, when the arm is rotated outwards in the shoulder-joint. Here there is no backward-drawing movement of the arm, and rotation in the shoulder-joint alone remains. A very small extent of this suffices, for by means of the long arm of the lever, represented by the forearm, the excursions of the pen are adequately performed. In order that these movements may be well accomplished, the surface of the desk should slope slightly.— For these reasons BERLIN prefers the sloping to the upright handwriting. The latter is more fatiguing, and according to BAEUMLER, more apt to cause writer's cramp.*

In order to decide the question as to which method of writing is preferable, we should be able to compare two schools in which, the hygienic conditions being alike, different methods of writing are practised, in one the upright handwriting, in the other the properly performed sloping handwriting. We should see in which school the average posture of the scholar's body is the best. BERLIN has already instituted investigations on this subject, which prove that those children who employ the upright

* We can convince ourselves of the correctness of what is here said, if we write (with a pencil) a number of lines alternately with upright and sloping handwriting ; it is best always to write the same words. Whenever we are obliged to move the forearm with a jerk, we should mark this interruption with a vertical stroke on the place in the line where it occurs ; we shall then see how many more such strokes there are in the uprightly written lines, especially if the lines are pretty long.

handwriting on an average hold their bodies better than those who use sloping handwriting improperly carried out, but not so well as those who are properly taught sloping handwriting. But BERLIN admits that these trials were made in children unaccustomed to upright handwriting; so that these investigations require corroboration.

Whatever method of writing may be chosen there will always remain, in addition to good illumination, good seats and desks, &c., very much left to the attention of the teacher, who can always do much to ensure a good posture for the children by his admonitions. The teacher should not permit a child (provided always its acuteness of vision is not too bad) to hold itself so that its eyes shall be nearer its book than 10 inches.

A question that is especially interesting to the German nation is in reference to the choice between German and Italian handwriting. Does the German handwriting require of the writer to bring his sheet closer to the eye than the Italian?

SOENNECKEN* contends that Roman letters can be read at a much greater distance than German. But his experiments only refer to print, and they are moreover shown to be inaccurate by the reviewer in ZEHENDER'S *Monatsblättern.*† BERLIN was unable to detect any difference in the distance at which school children held their heads from their copy-books, whether they were writing in the German or the Italian character. There is, therefore, no certain proof that a greater approximation of the writer to

* *Das deutsche Schriftwesen und die Nothwendigkeit seiner Reform*, Bonn, 1881.

† 1883, p. 187.

his work is required when writing German than Italian characters. JAVAL is therefore wrong in ascribing to the use of the German characters such a great part of the blame for the prevalence of myopia in Germany. If in spite of this all German authors desire the general adoption of the Roman character, they do so chiefly for international reasons. These certainly are a complete justification of the proposal to give up the German character, which the Germans alone among nations have retained since the middle ages, and which form an obstacle to international intercourse.

COHN warmly advises the introduction of obligatory instruction in short-hand writing into the higher classes of middle schools, for thereby, the time passed by the scholars at the writing-desk would be materially shortened. From my own experience I must unhesitatingly join in this advice; it would certainly be still better were the amount of writing generally lessened. This applies particularly to middle schools and universities, in many of which latter the writing of college exercises is still in vogue.

§ 18.—2. *Reading.*—JAVAL was the first to subject printed matter to a thorough scientific examination. He makes a distinction between *visibility* and *legibility* of the letters.* He says, a letter is visible when one becomes aware of it as an actual object, even when one cannot recognize and name it; if the latter is the case, then the letter is legible. I would employ the expressions in another sense, as thus: a letter is visible

* *Annales d'Oculistique*, T. LXXXI., pp. 69 and 70.

when we see it under such an angle that we can clearly distinguish all its separate parts, so that, for example, when it is an unknown letter we are able to draw a copy of it. The letter is legible when we can name it. In order to perform this latter act, we do not need to see all its separate parts; our skill in reading often allows us to guess it when we only see certain parts of it. Still more is this the case when we have to do with connected words or sentences. In the sense employed by me a letter or a word is legible at a greater distance than it is visible.—For reading purposes it suffices that we see certain parts of the letter. What are these parts? They are chiefly the thick strokes, the hair strokes belonging to them we guess at. JAVAL has called attention to the fact, that the facility with which thick letters (Norman letters) are read depends on this. I subjoin samples of ordinary type (Roman letters) and thick letters (Norman letters) of equal height.

VIRIBUS UNITIS.

VIRIBUS UNITIS.

The thicker letters are legible at a much greater distance, though their hair strokes are quite as fine as those of the ordinary letters, and cannot be seen farther off; they are just guessed at. Hence we employ by preference the thick letters for headings, sign-boards, &c. So also the cross strokes at the ends of the letters (apices) are not employed merely for the purpose of embellishing the letters, but also in order to assist us in guessing what they are. They serve for the purpose of embellishment when they are put at the ends of the thick stroke; they prevent these appearing rounded from the effects of irradiation (*e.g.* **I**). Apices assist us in guessing when they occur on the hair strokes, the ends of which they indicate to us. Thus they help us to distinguish **E** and **F** from one another, at a distance where the hair strokes of both these letters are quite invisible to us.

The *form of the letters* influences their legibility. The form of every letter should be so characteristic that it should be impossible to confound it with other letters. This is unfortunately not always the case, so that, for instance, the letters c and e, n and u can easily be confounded with one another. JAVAL and COHN propose plans by which this can be remedied. —The difference between visibility and legibility becomes more striking, when we experiment with single letters on the one hand, with whole words and sentences on the other, when we shall find that the latter can be recognised and read at much the greatest distance. Of course much depends on the amount of practice in reading the subject of the experiment has had. Children have as a rule greater acuteness of vision than adults, and hence letters are visible to them at a greater distance. On the other hand lines of printed matter must be brought closer to them than to adults in order to be legible as children have had less practice in guessing. Consequently the print of books ought to be larger for the first years of instruction than for the later ones. This has long been the case in practice, as testified to by the large print of reading primers. The large print of the books intended for country folks (prayer books, &c.) is partly owing to this reason.

For those used to reading the legibility of printed matter depends not only on the size (height and thickness) and form of the letters, but also on the relation of the letters to one another. Legibility increases as a rule with the distance between the several letters and words (approche), as also with the distance between the several lines (interlignage).*

Moreover the print should be clear and uniformly black. The paper should be sufficiently thick so that the print should not penetrate through it, and of pure white colour. This appears to me to be preferable to the gray or yellow colour proposed by many.†

§ 19.—3. *Drawing and manual work.*—If, in drawing or manual work the eye must be brought very near the object, these occupations must, of course, be fraught with the same danger for the eye as reading and writing.

In order to make this branch of education as harmless as possible for the eyes, the following points must be attended to:

* The desiderata laid down by COHN for the print of a school-book are as follows: 1. Height of the n (which COHN takes as the standard of measurement for the height of the whole printed matter) at least 1.5 mill. This is the so-called corpus type, which nearly corresponds to the French "philosophie" (of 10 points); 2. Thickness of the n at least 0.25 mill.; 3. Approche at least 0.75 mill.; 4. Interlignage at least 2.5 mill.; 5. Length of lines at most 100 mill., with not more than 60 letters in a line.

† To the reasons given by COHN for preferring pure white paper, I may add another. The greater the difference of light and shade betwixt print and paper the further can the illumination be diminished before the print becomes illegible. Hence with bad illumination, black letters on a white ground are more easy to read than any other. For this reason pure white paper deserves to be preferred to every other, for if we can provide a good illumination in the school we cannot always secure it for the home studies.

1. As a rule the only manual works to be taught in the school are such as do not require too close looking. COHN and WEBER agree in thinking, that manual work requiring the eye to be brought nearer than 14 inches to the object, should be forbidden. The kinds of work required in ordinary household affairs, and which consequently girls must learn, can all be performed at this distance. As regards those kinds of work which should be prohibited at school as being too fine, they are only such as minister to pure luxury, so they may be set aside without injury.

2. Instruction in these two subjects should not begin too soon, for, as BERLIN has shewn, it is precisely the youngest scholars who are most inclined to hold themselves too close to their work. Hence it is wrong to set children of six to eight years' old, or even while they are yet in the kindergarten to copy patterns drawn before them, especially when the patterns are so small and difficult to see, as for example, the dot-system proposed by STUHLMANN.

3. For drawing, as well as for manual work, the best lighted rooms should be selected. If the work must be done in the evening (as regards drawing that cannot always be avoided, as, for example, in the evening classes in technical schools) the artificial lighting should very good. Electrical illumination, such as has been adopted in Liege, is certainly the best.

§ 20. If we always adopt in our schools the best mode of lighting that can be obtained, we not only spare the children's eyes, but we also gain a further advantage. Children who are accustomed to work in school in a good light, will endeavour to procure the best possible lighting at home. How often do we see children doing their home work at a table that is far away from the window and receives but little light; the boys read and the girls sew as long as they can in the twilight, before the lamp is lighted. When the children see the importance attached to good illumination in school, and when they enjoy this good illumination for a part of the day, they will when at home, select the best lighted part of the room, &c. In this way, perhaps, a stimulus will be gradually given to that incredible indolence of people owing to which they often work in semi-darkness, when they might easily obtain good light.

II. SPECIAL MEASURES FOR THE DIFFERENT STAGES OF EDUCATION.

§ 21. 1. *Primary education.*— As regards *age*, no child under six years of age should be admitted into the school. In many countries indeed the law requires that the sixth year of life should be completed, and fixes the duration of primary instruction from the sixth to the fourteenth year.

As regards the *number of lessons* in primary schools, these should be moderate. For the lower classes the maximum for "sitting lessons" ought to be three, for the upper four hours. No sitting lesson should last longer than three quarters of an hour. As sitting still is more difficult for children the younger they are, it would perhaps suffice to give only half an hour for each lesson in the lower classes. ZEHENDER* and CHALYBAEUS† express their approval of this arrangement, which has, indeed, been adopted in some schools. Between the different lessons there is thus a *pause* of a quarter to half an hour. This, according to some, should be filled up with gymnastic exercises. It is certainly expedient that the children should leave the school-room during the pauses, and the room should then be thoroughly aired. But, in place of employing the children during this short interval in doing gymnastics, it seems to me that it would be better,‡ to set them at liberty in the open air or (in winter) in a covered space where they might amuse themselves as they liked.

In addition to the sedentary lessons, the singing and gymnastic lessons are reckoned as educational lessons. As regards the gymnastic lessons, they ought to begin in the lower classes as free exercises, and as soon as the children's ages allow, gymnastics with apparatus should be employed. Gymnastics should be obligatory for girls as well as for boys.

The *arrangement* of the lessons should be such that the sedentary lessons should be appropriately interrupted by gymnastic and singing lessons. It is a good plan to set the children to work in school-gardens (Austria), to easy military drilling (France), to playing at out-of-door games (ball-play, &c.) to swimming, to excursions in company, &c.

* *Ueber den Einfluss des Schulunterrichts auf die Entstehung der Kurzsichtigkeit.* Stuttgart, 1880.

† *Vierteljahresschrift für Gesundheitspflege*, Bd. II., p. 55.

‡ See ROTH, IV. *International Hygienic Congress*, Geneva, 1883, Vol. II., p. 402.

Home work were better dispensed with among the lower classes of primary schools ; in the upper classes they should not extend beyond one-and-a-half to two hours daily.

As regards the *method of instruction*, mention has already been made of the chief points appertaining to reading and writing. The first instruction should begin with reading ; after six months or one year a commencement of learning to write should be made.

In order to learn sloping writing it is not necessary to have sloping ruled lines in the copy books and slates. If the copy book be placed properly before the child, the writing necessarily gets the proper slope. Deviations from a given degree of slope are of no consequence, and BERLIN is right in proposing to dispense with sloping ruled lines, because they compel the children to look more closely. The same may be said of ADLERS' model writing copy books, which COHN objects to. All copies which are chiefly or quite made up of fine lines or points difficult to see, should be rejected.

As regards the *material for writing on*, hitherto the slate has been usually employed for the commencement of writing lessons. HORNER* showed that, as regards visibility, writing on the slates is to writing with ink on paper as 3 to 4. This together with the shiny surface of the slate causes the writing scholar to assume a bad posture. Hence white slates are preferable to black ones, as suggested by COHN. Such are the artificial white slates for writing on with a peculiar lead pencil, which are made

* *Deutsche Vierteljahresschrift für öffentliche Gesundheitspflege*, X., p. 742

by THIEBEN, in Pilsen. The trials of this, made by COHN, showed that as regards the visibility of the writing, the black are to the white as 5 to 6 (later trials give as 7 to 8).

§ 22.—2. *Middle school education.*—The middle school is that stage of education which is attended by the greatest dangers for the eye. The primary school makes very few short-sighted. Hence the number of myopes who enter the lower classes of the middle school is small. During the period of the middle school the number of myopes gradually increases up to an average of 57 °/ₒ (see the curve copied from COHN on p. 30). I have pointed out above what influence the defective lighting, the seats and desks, the type of the books, &c., have in the production of this terrible increase of short-sightedness. The injurious influence of these factors is particularly increased by the excessive amount of work which is imposed on the scholars of the middle school. It is particularly in Germany that the scholars are *overworked* to a very great degree. DUERR* gives some interesting calculations on this point. In Germany during his middle school years, the scholar has to devote 25,000 hours to his school and home lessons, 650 only of which are spent in gymnastic lessons. He compares the number of hours which the scholar has to give to his lessons between his 10th and 19th year in Germany, France, and England. They are as follows:—

Hours from 10th to 19th year.	Working hours.	Gymnastic hours.
in England	16,500 ...	4,500
„ France	19,000 ...	1,300
„ Germany	20,000 ...	650

* V. GRAEFE'S *Archiv*, Vol. XXIX., part I., p. 143.

Nothing could more strikingly demonstrate the absurd method of instruction in the German schools. Here we see at the same time the true cause of the frequency of myopia in Germany. It is not the German writing or print, not the too long lines or the influence of nationality, but the excessive work imposed on the scholars. This overwork has a twofold reason: too many subjects and a faulty mode of teaching.—The increase in the number of subjects taught is owing to the unexpected pre-eminence which the natural sciences in particular have obtained in recent times. The recognition of their importance for every one has necessarily led to their introduction into the programme of studies of the middle schools, which have at the same time retained the old subjects of study in their full extent. But these, owing to the retention of old faulty modes of teaching, have become so onerous, that many influential voices have been raised for the omission of a portion of them. This is not the place to discuss this point.

All are agreed that the time devoted daily to work by the middle school scholars ought to be diminished. Some are of opinion that this can be effected whilst retaining all the subjects of study in their present extent, if a better method of instruction were adopted. Others think that this alone would not suffice, but that some of the subjects of study (*e.g.* the dead languages) should be cut down. I must say I agree with the latter opinion. Like many other university teachers, I see every day that the students in the technical branches are very insufficiently prepared for the university, whilst at the same time their knowledge of the dead languages is so defective, that it does not compensate for their deficiencies in the former. How can we remedy this evil?

The authorities should endeavour to control the admissions to the gymnasia and technical schools.

Many of the young people belonged to the middle schools in the narrower sense (upper public schools), which stand between the lower public schools and the gymnasia and retain the scholars till their sixteenth year. These would supply them with a better defined education and one more suitable for their purpose than the gymnasia and technical schools. Still more worthy of recommendation are the commercial and trade schools, where without over-burdening the scholars, in addition to general education they are taught a number of subjects useful for a business life.

But in the other middle schools (gymnasia and technical schools) in order to do away with overwork, the instruction in the school and the work to be done at home must be suitably regulated. This is more especially necessary in Germany where overwork is carried to the greatest lengths.

And first let us consider the *school-lessons.* These are divided into sedentary lessons and lessons of corporeal exercise. To the latter belong singing and gymnastic lessons, to the former, all other lessons which require either exertion of the mind or of the eyes, or of both together.*—As regards overwork it is

* This division is more convenient than that into scientific and technical lessons; the technical lessons include singing, gymnastics, drawing, and writing. It is a mistake to include these four subjects in the same category. Drawing and writing lessons are attended with as much injury to the eye and the body as lessons in science.

only the sedentary lessons that have to be considered. The Strasburg Commission proposed to commence the lower class with 18 sedentary hours per week and to increase them gradually to 30 hours in the upper class. ALEXI is in favour of a still greater reduction. According to his recommendations to the German Society for public Hygiene,* the number of hours for sedentary lessons per week should be 24 in the gymnasium (only in the upper classes 26) and in the technical schools 28.—Everyone can realise for himself the mental exertion required to follow with sufficient attention a lecture lasting a full hour. If the scholar has to do this for four hours daily, that is a great effort and to my thinking the maximum that should be required from him. It must be borne in mind that the less clever scholar will have enough to do to digest mentally what he has heard in these four hours, whilst the more clever scholar gets at home additional instruction in music, languages, &c.; further, that besides his studies at home the scholar ought to have time for walks, bodily exercises, &c.

The *arrangement* of the instruction should be such as to allow an occasional relaxation of the accommodation. Hence it will be necessary to adhere to the principle already laid down for primary schools, that each lesson should only last $\frac{3}{4}$ths of an hour. In the quarter-hour pause between two lessons, the scholars should leave the room in order that it may be aired, and amuse themselves according to their fancy in the open air or in a covered locality. Further, care should be taken that

* *Deutsche Vierteljahresschrift für öffentliche Gesundheitspflege*, Bd. XI., p. 46.

two lessons with writing should not come in immediate succession. Finally it is of the greatest importance so to distribute the lessons, that the series of sedentary lessons should as far as possible be interrupted by lessons involving bodily exercises. A proper arrangement of this sort would necessitate an increase of the gymnastic lessons, which according to most of the suggestions are not more than two per week; such an increase appears to me to be urgently required.

Like the lessons in school, the *work at home* required from the scholars of gymnasia and technical schools has gradually risen to an extravagant height.

The scholars of the Berlin gymnasia, according to ALEXI, have to devote 33 hours, those of the Dresden technical schools* as much as 36 hours per week to home work, so that the students of the upper classes have to work every day from 7 a.m. till 10 p.m. What time have they for recreation? As regards the value of the work performed, we may say of it as we say of manual work, that it is in the inverse ratio of the duration of the daily work.

The Strasburg Commission recommends that the hours of home work should rise from three per week in the lowest class, to 12—18 in the highest class, but should not exceed this maximum. This is quite right. A diminution in the amount of home work is doubly necessary, because it must often be performed in a bad light, on an unsuitable seat, and under many other unfavourable conditions. But it should not only be

* NIEDNER, *Deutsche Vierteljahresschrift für öffentliche Gesundheitspflege*, Bd. X., p. 74.

diminished but arranged in a sensible manner. It has therefore been proposed to ask the parents of the scholars to come at the commencement of the school year, and to ask them what lessons they will get their children to do at home. The opportunity might be seized to give the parents the necessary instructions. Should it turn out that the scholar is not particularly clever, the teacher should earnestly warn the parents not to fatigue him with any out-of-the-way subjects.

Sundays and *holidays*, the real object of which is the recreation of the scholar, should not be interfered with by home lessons. The vacation is best spent, when the circumstances of the scholar will allow it, in expeditions on foot. Quite apart from the great advantages of this kind of travelling on body and mind, it has a specially good influence on the eyes. ARLT made the observation on himself, and it has been repeated by many others, that myopes generally return from such a journey somewhat less short-sighted. The long-continued rest of the eyes probably effects a complete relaxation of the accommodation and therewith a diminution of the myopia to its true degree.*

The education of our youth stands in need of a thorough reformation, the necessity for which is every day more apparent and insisted on. The body can now no longer be neglected for the sake of the mind as has hitherto been the case. The model for all is the education of youth as practised in England, in which what are called "athletics," play a great part. To these belong

* COHN (*Hygiene der Augen*, p. 165) found that complete rest of the eye for three weeks has the same effect as an atropine treatment, that is to say diminution of the degree of myopia.

swimming, rowing, riding, running, archery, and a great number of games which are played in the open air and demand bodily agility.

A disproportion between the knowledge to be acquired and the time allotted to its acquisition is found in the *upper schools* as well as in the middle schools. But the scholar in the upper school is not subject to such strict rules; he can, if he please, prolong the time given to the acquirement of the necessary knowledge. But the other evils I have alluded to as incident to the middle schools, exist in the upper schools in, if possible, a still greater degree. Seats and desks, lighting, type of books, with few exceptions, leave much to be desired. In addition to this, there is the unfortunate habit, practised in Germany, in particular, for ages, of writing down many lectures, and studying these ill-written college scribblings.

III. MEASURES APPLICABLE TO EXISTING MYOPIA.

§ 23. This is not the place to speak of the therapeutics of myopia; that will be found in the manuals of ophthalmic medicine. I may be allowed to make only a few remarks upon it.

In the slighter cases of myopia (up to about $4\ D = {}^{1}/_{9}$), the teacher, or still better the school-doctor, should send for the parents and instruct them in the essential rules for the guidance of myopes.

Many short-sighted scholars wear spectacles, mostly such as they have bought for themselves without medical advice. The consequence of this is that many use unsuitable glasses.

COHN found that about 37% of the spectacle-wearing scholars wore too strong glasses, ERISMANN found this the case with 19%. Medical supervision is therefore urgently necessary, and no scholar should be permitted to wear spectacles until he is able to show a medical prescription for them.

Should short-sighted scholars wear spectacles? Myopes of the lowest degree do not require them, if these are able to see the school board when sitting on one of the front forms. Myopes of the middle kind must for that purpose evidently wear glasses. Extremely short-sighted persons must be regarded as unwell. Every such case should be carefully examined by the school doctor, in order that he may be able to point out the proper means to be employed. The physician should particularly call the parents' attention to the fact that their child is not suitable for every calling.

IV. MEDICAL SUPERVISION OF SCHOOLS.

§ 24. It is but a few years since medical men have been allowed to say a word about schools. Surgeons and oculists were the first to direct attention to the dangers to which school exposes many children. Then learned medical societies began to busy themselves with this question, and some municipal bodies went so far as to organise a medical supervision of the schools under their control. Lastly came the Governments which appointed Commissions which were to occupy themselves with this question. In France, on the 17th of June, 1880, the Ministry promulgated regulations regarding the building and arrangement of schools, in which modern hygienic requirements are attended to. In 1881 the Government nominated a Commission, partly composed of medical men. This Commission visited some schools, and in the following year issued a report through Dr. GARIEL.* About the same time a Commission composed entirely of medical men appointed by the Governor of Alsace-Lorraine made their report. Further, a Commission composed of medical men and schoolmasters was appointed by the Hessian Government. Besides these a Commission was appointed by the Wirtemberg Government to which BERLIN and REMBOLD presented a report in 1882. All these Commissions recommended the appointment of school-physicians who should undertake a regular inspection of schools. Finally the precise recommendations of COHN were communicated to the International Hygienic Congress at Geneva in 1882, which adopted the proposals of COHN.

Although the Governments have not yet pronounced any generally applicable judgment relative to medical supervision, some towns and departments have already spontaneously instituted a regular medical school service. Brussels was the first to do this. The medical school inspection has been in operation since 1874. It includes all the schools of the city, including the kindergartens. The school physicians have to inspect every school three times every month, and to report particularly on the hygienic conditions of the schools and the state of health of the scholars. Especial attention is given to the eyes (on account of the trachoma that prevails in Belgium). In

* *Annales d'hygiène publique*, 1882, Vol. VII., p. 367.

Belgium the example of Brussels was followed some years later by Louvain, Antwerp and a number of other towns.

In the neighbouring country, *Holland*, the law, since 1865, gives the state-appointed physicians the right to visit the schools and to insist upon alterations, but it does not compel these physicians to do this, so that a regular inspection of the schools does not yet exist.

In *England* a medical department in the Local Government Board was established in 1872. To it is confided the medical supervision of the schools.

In *France* the department of the Seine was the first to establish a medical school service in 1879. It has this defect, that it is confined to the communal schools, but does not extend to the *écoles libres* (private schools). The school physicians who are nominated by the Prefect for three years, are required to visit every class twice a month. They have first to inspect all the localities and then to examine the scholars. They enter their observations in a book, which is kept in the school but in addition to this they must within twenty-four hours send a report to the Maire concerning their visit (in the shape of a filled up formulary). The example of the department of the Seine has been followed by a number of provincial towns, such as Havre, Bordeaux, Lille and Lyons, which have also instituted a medical service in the schools.

In *Germany*, Frankfort-on-the-Main appointed a town physician on the 1st of April, 1883, to inspect the schools. In *Switzerland*, Geneva is about to establish a school inspection.

From this it will be seen that the medical inspection of schools is still in an incipient stage, what at present there is of it is due to the initiative of some enlightened municipalities. But the powerful action of the government is required, in order that this inspection may be carried out in the whole country, if possible according to some uniform plan.

§ 25. *School physicians.*—As regards the supervision of a school many points are to be considered. The general hygienic conditions of the building, the state of health of the children in general, the outbreak of infectious diseases among them, the posture of their bodies in reference to spinal curvatures, finally the eyes of the scholars. It is not sufficient that the supervision should embrace all necessary points, it must also be precise and reliable. If we are unable to obtain good supervision of the schools it is better to require none at all; if imperfectly performed it only keeps the parents in a false security without affording any protection to the children.

The necessity of a good intelligent supervision constitutes, perhaps, the main difficulty to be overcome in the introduction of a school supervision. As is evident the supervision of a school demands an amount of knowledge which cannot be expected of every medical practitioner, because it is to a great extent of a quite special nature. I may mention a knowledge of hygiene in reference to school buildings, and especially a knowledge of the way to examine the eye. Austria is the country where clinical instruction in ophthalmic medicine has been longest practised and made compulsory for all medical students. But of my own experience I can testify that in spite of this it is very badly provided with practitioners endowed with a knowledge of ophthalmic subjects. It is only during the last few years that all the universities in Germany have established eye-clinics; in Paris a university eye-clinic has only existed for four years; in England a course of eye diseases is not obligatory, and accordingly few medical students attend it. How then can we expect from ordinary practitioners a special acquaintance with ophthalmic medicine? How long should we have to seek before finding a physician who possessed a case of spectacle lenses? Consequently we cannot expect even from good medical practitioners the ability to determine the refraction of school children; even should the study be compulsory, we could not rely on obtaining satisfactory results. Every oculist knows that it is not always an easy task to determine the refraction. So that although as regards the other points appertaining to the supervision mentioned above, the knowledge of a good medical practitioner may be adequate, it may be very inadequate in respect to the examination of the eyes. Therefore, if the inspection of schools is to be effectually performed, it must be entrusted to specially qualified medical men. For this the medical men appointed by the state (parish doctors, district doctors, or whatever they are called) must be employed. In some countries these men have to undergo an examination (Physicatsexamen) upon subjects specially appertaining to their office, such as hygiene. In future more care must be taken that they are sufficiently versed in the hygiene of the eyes than is the case at present. To medical men with such requirements the supervision of the schools should be entrusted. But doctors with State appointments are in no country numerous enough to make a constant inspection of all the schools in the country. So I think that there should be various degrees of inspection according to the character of the school. In the primary schools, more particularly the village schools, the hours of instruction are so short, that some of the dangers incident to schools, such as spinal curvatures and short-sightedness, are little to be dreaded. As regards the latter danger I may remind the reader that COHN found only 1.4 °/₀ of myopes among the children of village schools. The supervision of the village schools may therefore be entrusted to ordinary medical practitioners, and a determination of the refraction of the children need not be required. On the other hand the middle school should be under the supervision of the district (parish) doctor. In towns where there are oculists they should be employed to assist the district doctor in the examination of the eyes.

I shall now mention those points appertaining to the supervision of schools, which refer to the refraction of the eyes. I shall confine myself to these in this place; hereafter I shall say something about the supervision of schools in reference to trachoma.

1. The government, acting on the advice of a competent commission, should lay down rules in reference to the construction of school buildings, the school furniture, the subjects to be taught, the method of teaching, the school books, &c.* As

* By a ministerial ordinance of the 13th May, 1879, there was established in Paris a pedagogic museum, with library attached, for the reception of all objects bearing on school hygiene. In Brussels, also, a scholastic museum has existed for the last four years.

regards school buildings and furniture, the regulations thereto appertaining must be strictly observed in the erection of all new schools. Hence the plan of the school to be built must be submitted to the authorities for their examination and approval. As regards schools already existing a minimum of requirements should be fixed, which no school should fall short of.

2. All the schools in the country should be examined by competent Commissions, in order to ascertain if they come up to the required minimum. Should this not be case, the Commission must decide whether any alterations should be made in the school, or whether it should be entirely shut up.

3. The school physicians should be nominated by the Government, and they should receive an adequate remuneration for their services. In a locality where there is a district physician, he should be entrusted with the oversight of the schools In places where there is an oculist, to him should be committed the examination of the eyes.

4. In the middle schools (town schools, commercial and trade schools, gymnasia, technical schools, &c.), at the commencement of the school year the refraction of all the scholars should be determined and entered in a book. The doctor has to settle how they are to sit with regard to their visual powers; further, what scholars are to wear spectacles and the kind of spectacles they require; so also, if in consequence of the state of their eyes they have to dispense with some subjects (*e.g.*, drawing). Moreover in cases where it appears necessary he should send for the parents in order to acquaint

them with the hygienic precautions the eyes of the child require.

The school physician ought to report the results of his examinations of the eyes, as well as his other observations, to the proper authorities.

As already observed, these points refer exclusively to the prevention of myopia.—It would be a material assistance to the efforts of the State and of the physicians appointed by it, if those destined for the post of teacher were to receive suitable instruction in hygiene. This wish has been already expressed in many quarters. If this were done, then teacher and school physician would be able to act in conjunction for the advantage the scholars.

Part IV.

Eye-Diseases consequent on General Diseases.

The farther we advance in medical knowledge, the more numerous become the eye diseases which we can refer to general diseases or to affections of certain organs. Certainly we do not take matters so easily as the old humoral pathologists, who simply referred every disease to some deterioriation of the humours.

Not only do we require proof of the connexion, we endeavour also to ascertain how it takes place. With regard to many eye affections, we have already succeeded in ascertaining their dependence on other diseases of the body. This is especially true of affections of the deeper parts of the eye, namely the uveal tract, the retina and the optic nerve. In many cases no special prophylaxis relating to the eye is possible; it can only be directed against the general disease from which it springs.

Chap. I. Acute Febrile Diseases.

The eye is much more frequently affected in these than is generally supposed. Owing to the gravity of the general malady, the affections of the eye, especially those of its deeper parts, are easily overlooked. The patient lying grievously ill, makes no complaint of disorders of vision, and so, as a rule, no minute examination of the eyes is undertaken. Should the patient recover, the slighter affections of the eye generally recover spontaneously, and so remain unnoticed. If the eyes have been more seriously affected, the oculist often does not see until long afterwards the cases of closure of the pupil, atrophy of the optic nerve, &c., which remain after the cessation of the disease.

Most of the diseases coming under consideration in this place are infectious diseases. The eye diseases incident to them have much in common; I shall consider them in the order in which they attack the several parts of the eye.

§26.—1. *Affections of the cornea.*—Persons attacked by a serious disease such as typhus, cholera, pyæmia, meningitis, &c., often lie for several days half or quite unconscious. The eyelids are half open, between them the lower third of the cornea lies exposed. It is generally covered with yellow dried secretion; if we remove this crust we find beneath it the cornea dry, lustreless, dim, or even ulcerated. When such patients do not die, as usually happens, but recover, they may have dense cicatrices in the cornea, or they may lose one or both eyes completely. This keratitis was formerly regarded as the effect of depressed innervation and designated as neuro-paralytic. Now we know, thanks especially to FEUER'S labours* that this keratitis is a consequence of the drying of the exposed cornea. On this account FEUER called it *keratitis xerotica.* This affection may be prevented by the care of the medical attendant. Patients who are not able to close their eyes completely, and in whom the first signs of this drying process show themselves, should have their eyelids immediately closed. This is best done by means of narrow strips of court plaster. Every practitioner should know this.

Another form of keratitis, *abscess of the cornea* (hypopion keratitis) is chiefly met with in small-pox. The cornea is, as a rule, first affected when the pocks have already passed their culmination, consequently in the stage of desiccation, or during convalescence. There are relatively few observations on the frequency of eye affections in small-pox. I subjoin some of these.

* *Wiener med. Presse*, 1877, p. 43.

Observer.		Number of small pox cases.		Of these the eyes were affected in :
HEBRA	... ...	12,000	...	1°/₀
MANZ*	... ...	2,000	...	1.6°/₀
ADLER†	I. Vienna Communespital	—	...	6°/₀
„	II. Vienna Communespital	1,182	...	2.9°/₀
„	Vienna Children's hospital	706	...	9°/₀
MONTAGNE D. MAKUNA‡	...	—	...	9.7°/₀
OPPERT §	... ...	2,755	...	11°/₀

The percentages given in the above table refer to eye diseases in general, not merely to abscess of the cornea. The frequency of these complications varies considerably; it depends to a great degree on the severity of the epidemic. The more severe the small pox is in general, the greater is the danger to the eyes. ADLER observed a series of 100 cases of small pox in which the eyes were affected, a number of whom were blinded. This accident, however, only happened to patients who died of small-pox, consequently to the severest cases. None of those who recovered lost an eye.

The eye affections observed were of very different kinds, but we shall only consider those in which the cornea was affected. ADLER had among 165 variolous opthalmias, 70 cases of corneal affection (42°/₀), LANDSBERG‖ among 270 variolous ophthalmias,

* *Bericht der naturforsch. Gesellschaft in Freiburg*, 1872. MANZ only gives the severe cases of eye affections.

† *Vierteljahresschrift für Dermatologie und Syphilis*, 1874.

‡ *Brit. Med. Journ.*, 3rd June, 1882.

§ *Deutsche Klinik* 1872. OPPERT includes also the slighter cases.

‖ *Beiträge zur variolösen Ophthalmie*, Elberfeld, 1874.

81 cases of corneal affections (30°/₀). These authors enumerate all the cases of variolous ophthalmia, severe and slight, among the latter many were simple conjunctivitis. If we confine ourselves to the severe cases of eye affections only, we find that most of these were affections of the cornea. Thus COCCIUS* found among 58 variolous ophthalmias the cornea implicated 44 times (76°/₀), MANZ in 32 cases, 24 times (75°/₀).

The following data give us information respecting the gravity of the corneal affection: In 81 cases of variolous keratitis, reported by LANDESBERG, the eye was lost 12 times. Of MANZ'S 32 cases, 4 went on to phthisis corneæ, 2 to total staphyloma corneæ, and 11 to the formation of leucoma.—In any case, therefore, variolous keratitis is a very serious disease, which often causes loss of sight.

Before the introduction of vaccination, small-pox was an extremely widespread disease, and consequently furnished a very great contingent of blind people. According to CARRON DE VILLARS, before the discovery of vaccination 35 °/₀ of all blind persons in France lost their sight from small-pox, but after the introduction of vaccination not more than 7 °/₀ (DUMONT). According to STEFFAN,† in Prussia, before the introduction of compulsory vaccination 35 °/₀, after its introduction 2 °/₀ of the blind lost their sight through small-pox. MAGNUS finds the present number for Germany 2 °/₀, whereas COHN in his statistics makes it 3.6 °/₀.

* *Universitätsprogramm*, Leipzig, 1871.

† *Was können wir*, &c., IV. Congress of teachers of the blind at Frankfort, 1882.

In spite of the general introduction of vaccination, small-pox will never entirely disappear, but it is much milder in the vaccinated and hence is much more rarely a cause of blindness. Almost all authors who have observed epidemics of small-pox are of this opinion. DUMONT found that of the 122 cases of blindness caused by small-pox, which came to the Hospice des Quinze-Vingts, only one single one had been vaccinated, and he had been vaccinated unsuccessfully.

From what has been said the supreme necessity for compulsory vaccination is obvious. As regards the eyes specially, the physician who treats the small-pox is in a position to do much by care to ward off danger. HORNER justly observes that in the treatment of small-pox patients as a rule not sufficient attention is paid to the eyes. The eyelids of the patient are covered with pocks or crusts, much swollen, and consequently not opened. The physician in the small-pox hospital only sees the eyes when as the disease declines the patient again opens his eyes. But the affection of the cornea may, by this time, have advanced considerably. In abscess of the cornea much may be done if energetic measures are taken at the beginning of the disease. In some cases of abscess of the cornea in small-pox (in one case both eyes were affected) I have been able to arrest the process by early cauterisation with the actual cautery, and thus to preserve the eyes which otherwise would most likely have become blind.

It is therefore one of the most important duties of the physician in the treatment of small-pox to devote the requisite attention to the eyes. The lids should be covered by a linen rag smeared with ointment (HORNER prefers borax ointment). The lids are thus rendered supple, they do not stick fast and opening them causes the patient less pain. The conjunctiva must be cleared of secretion at least once a day, and disinfected (this is best done by a solution of corrosive sublimate—1 to 5,000). In doing this the cornea should always be inspected. As soon as the physician notices it to be diseased he must resort to energetic measures.

As in variola so also, though much more rarely, abscess of the cornea is found in measles, scarlatina, and typhus. Here the same prophylactic measures are to be employed as in small-pox.

When little children are the subjects of the above-named acute exanthemata, of typhus or other severe diseases, they may, owing to extreme degradation of their nutrition become affected with *malacia of the cornea.* Malacia is certainly more frequently observed in chronic marasmus of children (see page 22.) On the other hand children are proportionately more frequently affected with scrofulous ophthalmia after acute diseases, and this may sometimes continue very obstinately for a long time.

§ 27.—2. *Affections of the uveal tract.*—These occur in the course of all acute infectious diseases. Slight affections of the ciliary body and choroid, which are only manifested by some dimness of the vitreous humour, would probably often be found if looked for. REICH* observed in 767 typhus cases (mostly convalescents) dimness of the vitreous humour 40 times. Fortunately the implication of the eyes in the morbid process is

* *Zehender's klin. Monatsblätter*, 1878, p. 487.

seldom so severe as to seriously injure the sight. Cases of blindness caused by irido-choroiditis after typhus, variola, scarlatina and acute rheumatic arthritis have been observed.

The affection of the eyes in *relapsing fever* deserves particular mention. This form of typhus, which occurs especially in years of scarcity among the poorer classes, is sometimes more, sometimes less frequently complicated with affections of the uveal tract. KNIPPING* observed in an epidemic at Dantzic eye complications in 3.8 °/₀ of the cases, LACHMANN † in 11 °/₀, LUCHHAU ‡ in $3\frac{1}{3}$ °/₀, and TROMPETTER § in 6 °/₀. The frequency of eye affections varies greatly in different epidemics. The more severe these are in general, the more frequent and more severe are the affections of the eye (ESTLANDER). They generally involve the anterior part of the uveal tract, namely the iris and ciliary body. The disease runs a tedious course and traces of it with affection of the power of vision often remain. Complete blindness has been observed by several authors, but on the whole this is rare. Thus LOGETSCHNIKOFF‖ saw in 750 such cases of irido-choroiditis, blindness occur only three times.

The inflammation of the uveal tract in *cerebro-spinal meningitis* runs a much severer course. Both the epidemic and the sporadic forms of this meningitis may be complicated with irido-choroiditis. Usually this is of a purulent character and leads to shrivelling of the eye with complete blindness. A cure

* *Deutsches Archiv für klin. Medicin*, Bd. XXVI., p. 10, 1880.

† *Ibid*, p. 526.

‡ *Virchow's Archiv*, Bd. 82, p. 18.

§ *Klin. Monatsblätter f. Augenheilkunde*, 1880, p. 123.

‖ *V. Graefe's Archiv f. Opthalmologie*, Bd. XIV., Pl. 1, p. 353.

with partial preservation of the sight is rare. This affection is chiefly met with in children under five years old. According to MAGNUS patients who have thus lost their sight constitute 1.4 °/₀ of all blind persons.

A very similar affection is purulent choroiditis which arises from *metastais* from some deposit of pus. From this source infective matter enters the circulation and adheres to the vessels of the choroid (seldom to those of the retina) where it develops purulent inflammation. Hence it is to be regarded as a phenomenon of pyæmia. The most various kinds of primary diseases may give rise to it, provided some focus of pus is present. This does not need to be large; metastatic choroiditis of both eyes has even been observed after the extraction of a tooth. Suppurations in the female sexual organs seem to be especially apt to engender the disease, probably on account of the large number of veins in which purulent thrombosis may occur. This is most frequently the case in lying-in women; most of the cases of metastatic choroiditis are met with in puerperal maladies.

Choroiditis metastatica is much commoner than is generally believed. In the large lying-in hospitals of Vienna I have often had opportunities of observing it. As patients affected with it are very seriously ill, and as a rule die, but little attention is paid to the eye affection; the oculist especially seldom hears anything about it. The affected eye is irretrievably lost. Not uncommonly both eyes are simultaneously or successively attacked. Notwithstanding this the number of those rendered blind from this cause is small, for very few of those who have the serious general disease recover (and the same is the case with cerebro-spinal meningitis).

In all these affections of the uveal tract prophylactic treatment specially directed to the eyes is impossible. When the eye disease has declared itself, it ought to be appropriately treated, but the physician is seldom able to influence its course.

§ 28.—3. *Affections of the optic nerve.*—As a consequence of acute febrile diseases, there occurs sometimes transient, sometimes permanent blindness from affection of the optic nerve and its central termination. We have only to concern ourselves with the permanent blindness. Ophthalmoscopic examination reveals in these cases generally neuritis, which terminates in atrophy of the optic nerve. Sometimes, however, no pathological condition can be discovered, and atrophy comes on later.

Much more frequently such instances of blindness accompany meningitis (also epidemic cerebro-spinal meningitis). Affections of the retina and optic nerve in meningitis were found :

By	ALBUTT	in 38	cases of	meningitis,	29 times
„	HEINZEL	„ 41	„	„	41 „
„	BOUCHUT	„ 59	„	„	57 „

The changes observed in these cases were generally of a slight kind, hyperæmia or slight inflammation of the retina and optic nerve. But in some cases they attained such a degree, that blindness ensued. As in meningitis, so also atrophy of the optic nerve comes on after measles, scarlatina, dysentery and especially typhus. It is probable, however, that in a number of these cases the eye affection is to be ascribed to a complication with meningitis.

Neuritis, with termination in blindness, sometimes occurs in erysipelas of the head. In MAGNUS'S collection of 2,528 cases of blindness, two such cases are recorded. The neuritis was produced either by inflammation of the orbital cellular tissue or by complication of erysipelas with meningitis.

In all these cases the prophylactic treatment must be directed to the fundamental disease, not to the secondary affection of the optic nerve.

Chapter II. Chronic Diseases.

§ 29.—1. *Chronic general diseases.*—Syphilis, in consequence of its being so widely diffused, is the cause of many eye affections which, however, seldom cause complete blindness. COHN* found among 20,000 patients 1.15°/₀ of syphilitic eye diseases, and COCCIUS† among his eye patients 1.16°/₀. The number of those rendered completely blind by lues is small, according to MAGNUS, 0.47°/₀ of all blind persons. But all the greater is the number of those who, through syphilitic eye affections, have their sight materially injured. But this ought not to be the case, for the prognosis of syphilitic eye affections is generally favourable, if they come sufficiently early under treatment. Of this we may best become convinced in private practice, for syphilitic patients among the better classes are usually anxious and seek medical advice early. Opportunities for procuring medical advice ought also to be offered to patients of the lower classes.

* SCHUBERT, *Ueber Syphilitische Augenkrankheiten*, Berlin, 1880.

† NAGEL'S *Jahresbericht für Augenheilkunde*, 1870, p. 206.

This question will be considered later on. There is no prophylaxis against syphilitic eye diseases, as we are not able to prevent the occurrence of iritis, &c., in a syphilitic person. Prophylaxis is only possible against syphilis itself; to eradicate this disease is one of the most important problems of hygiene.

In the first and second parts of this treatise I have already spoken of hereditary syphilis, scrofula, leprosy and rachitis. Other chronic general diseases which cause injury to the sight, and in rare cases blindness, are: Leukæmia, pernicious anæmia, scurvy, albuminuria, diabetes, hysteria, chronic rheumatism and gout. In none of these cases is prophylaxis possible.

I may here allude to some eye affections which are caused by entozoa. In workmen seriously affected with anchylostomosis RAMPOLDI* observed neuro-retinitis, but all the patients died.—Cysticercus in the eye, according to VON GRAEFE, occurs in about one per thousand of eye patients. This is true for North Germany where cysticercus is very prevalent. In other countries it is much rarer; WECKER saw, in Paris, among 60,000 eye patients only one case. Fortunately cases where both eyes are affected rarely if ever occur. A cysticercus can only be developed in the eye when proglottides of tænia solium are introduced into the intestinal canal. SCHUERMANN† calls attention to the fact, that in many places the vegetable gardens are watered with the foul water of ditches, in which house drains often terminate. Hence it is advisable to wash thoroughly all vegetables that are eaten raw (salad).

* *Annali di Ottalmologia*, Vol. IX., p. 121, 1880.

† *Mittheilungen aus der Universitäts-Augenklinik zu München*, 1882, p. 204.

§ 30.—2. *Chronic diseases of organs.*—These diseases of the brain and spinal cord furnish the largest contingent. According to MAGNUS the former contributes nearly 7 °/₀,* the latter 2.3 °/₀ of all cases of blindness. COHN ascribes to spinal atrophy of the optic nerve 1.9 °/₀. According to LEBER one-fourth of all cases of atrophy of the optic nerve depend on tabes, others say still more.

Diseases of the vascular system lead to blindness by embolism or thrombosis of the retinal vessels. Such cases—more particularly in both eyes—are, however, very rare. On the other hand retinal hæmorrhages, with or without retinitis, which injure the sight very much are common, and are also caused by changes in the retinal vessels.—MAGNUS reckons among these, cases of blindness caused by neuro-retinitis after great losses of blood.

Of diseases of the sexual organs I may mention disturbances of the menstrual function, as also various diseases of the uterus as a consequence of which neuritis resulting in partial or total blindness has sometimes been observed.

§ 31.—3. *Derangements of nutrition of unknown kinds.*—Under this head should be first mentioned the cases of blindness which have been observed as consequences of pregnancy, the puerperal state or lactation. Let us first omit those cases where albuminuria, puerperal fever and such like maladies were present, there will still remain a number of cases in which the pregnancy or lying-in apparently ran a normal course. I say "apparently," for we must take for granted some still unknown disturbances

* In this number are included the cases of meningitis alluded to above.

which cause the eye affection. This attacks the optic nerve generally, more rarely the uveal tract. Whilst in some cases the sight is retained, in others permanent blindness occurs. Such cases, according to MAGNUS, constitute 0.4 °/。 of all blind persons.

Senile cataract is not a physiological phenomenon appertaining to old age, like, let me say, turning white of the hair. It is questionable whether it be a disease caused by purely local changes or by some general derangement of the nutrition. Of late years many efforts have been made in order to show that some senile cataracts are owing to the last named cause. MICHEL attributed it to atheroma of the blood-vessels, DEUTSCHMANN to albuminuria.— It is with glaucoma as with cataract, it is undoubtedly owing to some still unknown derangement of the nutrition. Cataract and glaucoma are both curable, provided they are taken early and treated properly.

Unfortunately we cannot say the same of chronic irido-choroiditis (i. serosa), which we often meet with in persons above forty years of age. An insufficient supply of food, and in women premature menopause, have been alleged as its causes. Many of these cases may be arrested by iridectomy; others continue their course in spite of the operation and lead to blindness. According to MAGNUS, of blind persons between forty-five and sixty years of age, 15½ °/。 have lost their sight by diseases of the uveal tract. A considerable proportion of these cases have been contributed by chronic irido-choroiditis.—There is no prophylaxis for it.

Chapter III. Chronic Poisonings.

The chief among these demanding attention are those resulting from tobacco and alcohol. They cause affections of the optic nerve, which very rarely (if ever) lead to total blindness. But all the more frequently are they the cause of weakness of vision, which interferes with the working powers of their victims. In this connexion, tobacco plays a greater part than alcohol; in most cases the two act simultaneously.

§ 32.—*(a.) Tobacco.*—The noxious agent in tobacco is the nicotine. The dry leaves contain from 1.5 to 9°/ₒ of it, according to the kind. In the preparation of the leaves for use, some nicotine is lost, so that the tobacco of commerce contains 1.7°/ₒ of it. The proportion of nicotine is greater in the cheaper, smaller in the dearer sorts. The cheapest tobacco contains from 2.2 to 2.5°/ₒ of nicotine, the middling sorts 1.5 to 1.8°/ₒ, Havana tobacco 1.8 to 2.2°/ₒ.

Heated to 250° the nicotine is volatilized and decomposed. But if watery vapour is present, volatilization takes place without decomposition. When dry tobacco is smoked, the greater part of the nicotine is decomposed by the heat. The moister the tobacco—and the cheap kinds are generally damp—the greater the quantity of nicotine that passes into the smoke with the watery vapour.

Not only smoking, but chewing tobacco also can produce amblyopia (FOERSTER,* AYRES†). Tobacco for chewing is usually

* *Handbuch der Augenheilkunde, herausgegeben von* GRAEFE *and* SAEMISCH, Bd. VII., p. 205.

† *Cincinnati Lancet,* 11th Feb., 1882.

rich in nicotine. In many smokers the habit of chewing the end of the cigar held in the mouth, may have something to do with its bad effects.

As I have just said, only a small portion of the nicotine goes into the smoke, and of this again very little is absorbed. So that in order to cause chronic nicotine poisoning, a very considerable quantity of tobacco must be smoked. This is shown by the circumstance, that of the great number of smokers relatively few are affected with tobacco amblyopia. Those thus affected constitute 0.6°/₀ (HIRSCHBERG) to 1°/₀ (FOERSTER), of all eye patients. SICHEL* says that few can smoke over 12 drachms daily with impunity. It is impossible to fix the quantity precisely; this depends not only on the kind of tobacco and on the mode of smoking, but also on the individuality and the age of the smoker. Among the cases cited by HUTCHINSON,† there are many who did not smoke more than about half an ounce daily. HUTCHINSON is of opinion that persons who take no alcohol, are less able to resist the effects of tobacco. I do not know if this has been proved. It is certain that on the contrary inordinate abuse of alcohol favours the development of tobacco amblyopia. Young persons bear tobacco better in general than older men. FOERSTER rightly observes that many smokers after the age of 40 must diminish their daily ratio of tobacco, if they would avoid sleeplessness, loss of appetite, debility, &c. By far the greater number of cases of tobacco amblyopia are met with in persons beyond 40 years of age.

* *Annales d'Oculistique*, Vol. LIII., p. 122.

† *Ophthalmic Hospital Reports*, Vol. VIII., p. 456.

HIRSCHBERG* asserts that in Germany every year $3\frac{1}{2}$ pounds, in Great Britain $1\frac{1}{4}$ pound, in France and Austria from $1\frac{3}{4}$ to 2 pounds of tobacco are consumed per head of the population. If we reckon that adult men, from 20 years and upwards, constitute one third of the total population, and that all these smoke, then the daily consumption of tobacco of every smoker amounts in Germany to from 150 to 180 grains, in Great Britain to 75 grains, in France and Austria to from 105 to 108 grains. Some of HIRSCHBERG'S patients consumed per annum nearly 100 pounds of tobacco consequently above 4 ounces per diem.

The cheap sorts of tobacco contain more nicotine, and are therefore more injurious than the dearer sorts. Perhaps it is owing to this that tobacco amblyopia is more frequent among the poorer than among the richer classes. This may, perhaps, be also owing to the greater carelessness of the former. They continue to smoke, even when distinct signs of impaired health in consequence of smoking are present. Moreover among these classes the abuse of alcohol is more frequent, and this favours the occurence of tobacco amblyopia.

In most cases the prognosis is favourable; the malady is curable when it has not lasted too long, and the patient abandons the use of tobacco. Very few of the patients who seek medical advice on account of tobacco amblyopia suspect that their impaired vision is caused by smoking. Hence it is evident that it is important to instruct the public on this subject. If

* *Centralblatt für Augenheilkunde*, 1878, p. 244.

smokers knew that smoking can cause weakness of sight, they would when that occurs feel disposed to leave off smoking.

What can be done to check the abuse of tobacco? Should we open a campaign against it, as against the abuse of alcohol? I do not think we should be justified in doing so. An agitation of this sort would find few partisans and effect still smaller results. According to my idea we should content ourselves with the following:—

1. Instruction of the public with respect to the consequences of the abuse of tobacco.

2. Diminution of the quantity of nicotine contained in tobacco, especially the cheaper sorts. There are various processes for extracting the greater part of the nicotine from the leaves without impairing the aroma of the tobacco. It will only be necessary to find out the best and cheapest of these, and to bring them into operation. At present in countries where tobacco is a government monopoly, the government gains from 800 to 900 °/ₒ in the manufacture of the cheap sorts; it might therefore very well spend some of its profits in rendering the tobacco less injurious to health.

§ 33.—(*b.*) *Alcohol.*—The abuse of alcohol sometimes causes amblyopia, the symptoms and course of which greatly resemble those of tobacco amblyopia. In most cases tobacco and alcohol act together.—In order that chronic alcoholic poisoning should occur, two factors are required: 1. The taking of a sufficient quantity of alcohol for a long time; 2. The presence of fusel oil in the drink. Both of these generally come into play in the case of spirit drinkers. Hence an agitation has very properly been directed against drinking spirits.

The drinking of spirits among the people increases, generally speaking, as we go north. In some localities it is enormously great. In the Dutch province of Gröningen the annual consumption of Genièvre (the cheapest kind of spirits) amounts to 62 pints per head of the population, therefore certainly more than 124 pints for every grown up man. For the workmen in the "Poldern" and on the dykes the quantity reckoned is $1\frac{3}{4}$ pints of spirits per diem per head, but many exceed this quantity.*

The proportion of fusel is very great in the commoner sorts of spirits, as potatoes are chiefly used in its manufacture, that being the cheapest material, and they furnish a large quantity of fusel. Moreover as little as possible is done in the way of rectifying the product.

Alcohol does so much harm that governments have felt it their duty to endeavour to mitigate the evil by special enactments. Of all spirit-drinking countries Belgium is the only one which forms a discreditable exception in this respect. All other civilised countries in which spirits are drunk have regulations on the subject.† These represent all degrees of stringency, commencing with the State of Maine in North America, where the sale of spirituous liquors is totally forbidden (except for medical purposes). The requirements with regard to the legislation concerning spirits have often been formulated. The following are the chief points:

* J. Beaujon, *Revue de Belgique*, 1883.

† Metman, *Etude sur les législations Européennes rélatives aux debits de boissons alcooliques*, Paris, 1879.

1. The State should take care that the spirits sold should be good, *i.e.*, free from fusel.

2. It should enhance the price of spirits by suitable excise duties, and on the other hand favour the production and sale of milder alcoholic drinks (beer, cider).

3. The number of drinking shops should be diminished by making the license for them dear and difficult. The number of licenses granted should be regulated in proportion to the number of the population.* The sale of spirits by other than licensed persons should be severely punished.

4. On the other hand the establishment of tea houses and soup kitchens, of warm rooms and such like places, should be encouraged as much as possible.

5. The existing spirit shops should be carefully watched by the police. Severe punishments and withdrawal of the license should be threatened to such as sell bad (adulterated) spirits. No spirit should be sold to minors or intoxicated persons, &c.

6. Any one found in the streets intoxicated should be punished by fine or imprisonment.

7. A notorious drunkard should be treated as a dissipated character and placed under restraint. Habitual drunkenness should form a ground for divorce.

8. The action of temperance societies, or societies for tea houses and soup kitchens, &c., may be of great use.

* In Holland, according to the new law, in communities above 50,000 souls one license is granted for every 2,500 inhabitants; in smaller communities one license for every 250 inhabitants is granted as the maximum. For the purpose of comparison, I may mention that in Belgium one license is granted for every 44 inhabitants.

§ 34.—(*c.*) *Lead.*—Chronic lead poisoning sometimes causes optic neuritis, from which atrophy of the optic nerve may result. If the affection is not too severe and if treatment is resorted to in time the case may be cured. Otherwise weak sight or even total blindness may come on. Other symptoms of chronic saturnine poisoning always precede the eye affection.*

Chronic lead poisoning can be produced in two different ways: 1. The lead is introduced into the body with the food. This happens when food is prepared or kept in vessels containing lead, or when it is adulterated with substances containing lead. 2. When the workman is brought into contact with substances containing lead.

Poisonings by lead in food, are, as a rule, slight in degree and hardly ever lead to injury of the sight. More frequent and more serious are the lead poisonings of workmen who come in contact with substances containing lead.

The measures to be taken in order to protect the workmen are as follows: For substances containing lead should be substituted, where possible, others of an inocuous character, as has been already done in the preparation of many colours. In working up substances containing lead, manual labour should as much as possible be replaced by machinery. It is very important to avoid exposure to the dust. The substances containing lead should, whenever practicable, be worked up in a

* The eyes may suffer from exposure to vapours containing lead, which irritate the cornea and cause depositions of lead upon it. (BELLOUARD, *Kératite professionelle*, *Archives d'Ophth.*, 1882, p. 1.)

moist state (with water or oil). The workmen's room should be very well ventilated. The floor should be frequently watered and a fine artificial rain should be frequently introduced in order to beat down the dust. Particular apparatus is required in order to conduct vapours containing lead to the outer air. A respirator for mouth and nose, and even a complete mask is sometimes needed for the protection of the face and respiratory organs. The hands, if needful, may be covered with gloves. Meals should not be taken in the work-rooms. Before every meal the workman should rinse out his mouth, and thoroughly cleanse hands and face. For this latter purpose LAYET recommends black soap or a weak solution of sulphuric acid. The same cleansing process should be adopted when the workman leaves the manufactory, and he should also change his clothes. Warm baths (especially sulphur baths) should be erected by his employers for the use of the workman. Workmen employed in the most dangerous parts of the work should be frequently changed. Every workman, on the first signs of lead poisoning, should cease from the work and be treated medically. To do this efficaciously the workmen should be subjected to regular medical inspection.

Part V.

Infectious Eye-Diseases.

These are the blennorrhoic and the diphtheric inflammation of the conjunctiva. It is doubtful if simple catarrh is infectious, at all events it has not yet been certainly proved to be so. As it is not as a rule dangerous to vision we need not occupy ourselves with it in this place.

(a) Blennorrhoic Conjunctivitis.

Chapter I. General Characteristics of the Blennorrhoic Inflammations.

§ 35. Blennorrhoic conjunctivitis occurs under various forms, which differ from one another partly by the rapidity of their course, partly by the changes that take place in the conjunctiva. Conformably to this, we may arrange them as follows:

Blennorrhœa	Acute	Ophthalmia gonorrhoica
		Ophthalmia neonatorum
	Chronic	Granular form
		Papillar form

This arrangement, which differs essentially from the ordinary classification of diseases of the conjunctiva requires justification. This is all the more easy for me, because I have for the above arrangement the authority of VON ARLT.

As regards the acute forms, all oculists are agreed that ophthalmia gonorrhoica is essentially the same disease as blennorrhœa neonatorum.

The blennorrhoic inflammations that run a chronic course may be divided into two forms, according to the anatomical alterations they set up in the conjunctiva. The *first* form is characterized by this, that in the conjunctiva gelatinoid, sago-like granules appear (trachoma granulations). Hence this disease has been called conjunctivitis granulosa (synonyms: trachoma, ophthalmia ægyptiaca,* militaris, conj. follicularis, HORNER). This disease sometimes comes on in an acute manner (acute granulations). Much more frequently the attendant inflammatory symptoms are slight or altogether absent for a long time, so that the trachoma granulations lie beneath an almost pale conjunctiva.

The *second* form is distinguished by excessive growth of the papillæ of the tarsal conjunctiva; chronic blennorhœa (synonyms: ophthalmie purulente chronique, conj. granulosa according to some who compare the enlarged papillæ to fleshy granulations, papillary trachoma). This affection is usually accompanied by severe inflammatory symptoms.

Both these forms, are, in my opinion, to be regarded as varieties of one and the same disease, for the following reasons:

a. The greater number of cases observed are compound forms. This is proved by the most recent anatomical investiga-

* Opinions differ as to the form of the ophthalmia which attacked Napoleon's soldiers in Egypt. See RAEHLMANN, *v. Gräfe's Archiv* Bd. XXIX., Pl. 2, p. 144.

tions of MANDELSTAMM and RAEHLMANN (V. STELLWAG'S *trachoma mixtum.*)

b. Both forms are very similar in clinical respects; they are infectious, are distinguished by an uncommonly slow course, and in the end lead to cicatricial contraction of the conjunctiva.

c. Many authors assert that a person affected with one form may infect another, who thereupon gets the other form. GOLDZIEHER observed in the Buda-Pesth Blind Institution an epidemic which was introduced by a newly admitted boy. He had lost his sight from acute blennorrhœa. All the male and most of the female pupils got diseased from him. Among them were observed all possible forms, from true blennorrhœa to true granular trachoma, and all intermediate varieties.* PIRINGER,† in his inoculation experiments obtained from the same infective matter in different individuals both forms, in one case even on the two eyes of one and the same individual. VON ARLT, also, often observed that one form produced the other by infection. This, in conjunction with the above-mentioned reasons, led him to consider both forms as one and the same disease. Formerly he had considered them as quite different, he was indeed the first who gave a clear description of the true granulations, so that this was often called after him trachoma Arlti.‡ Observations extended over many years induced him to abandon this artificial distinction.

Is there an *ætiological connexion* between the acute and

* *Heidelberger Ophthalmologenversammlung*, 1881, p. 37.

† *Die Blennorrhoe im Menschenauge*, Graz, 1841.

‡ ARLT, *Die Krankheiten des Auges*, Prag, 1854, Bd. I., p. 106.

chronic forms of blennorrhœa? It does not admit of a doubt that chronic blennorrhœa often remains after acute blennorrhœa. This is frequently, but not always the case; most cases of chronic blennorrhœa indeed arise without such acute preliminary stage. The typical conj. granulosa does not occur as the final stage of acute blennorrhœa, and yet VON ARLT has observed the occurrence of trachoma granulations also in chronic blennorhœa which had been caused by infection with gonorrhœal matter.* SATTLER† relates the following case: a mother, who was suffering from slight leucorrhœa had a child, which was affected with acute blennorrhœa of a mild character. The child infected the mother, who got true trachoma, although she resided in a locality free from trachoma, and hence could not have been infected in any other way. A similar case was that of GOLDZIEHER above alluded to.

There is therefore no doubt that infection from acute blennorrhœa may cause on the one hand chronic blennorrhœa, and on the other conj. granulosa. This again proves the connexion between both chronic forms and their relation to acute blennorrhœa. It is therefore possible that all blennorrhoic inflammations of the conjunctiva may originally be due to infection from the genitals. In the case of acute blennorrhœa this would generally be direct, of chronic blennorrhœa indirect. For as acute blennorrhœa may pass into chronic, the latter by being

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* ARLT, ibid, p. 113.

† *Heidelberger Ophthalmologenversammlung*, 1881, p. 27.

conveyed to another may produce at once the chronic form which then runs its course as such.*

At all events I firmly believe in the identity of the two chronic forms of blennorrhoic ophthalmia. And this I do all the more, because, as regards the prophylaxis, no difference can be made between the two. I shall employ the term trachoma for both, for the simple reason that it is the shortest.

§ 36. All the blennorrhoic inflammations of the conjunctiva have this in common, that they are not autochthonous, but are always caused by *infection.* The infectious matter is derived from a diseased vagina, from a urethra affected with gonorrhœa, or from a blennorrhoic eye. As regards the infection the following points are to be noted :

1. *The conveyance of the matter* can take place directly, *e.g.*, by the spurting of the matter into the eye of the physician during his examination. Much more frequently, however, the conveyance of the secretion takes place indirectly, by the finger, by towels or other linen, by sponges, &c.

2. *The danger of infection* is greater the more copious and puriform the secretion is. A virulent leucorrhœa of a purulent character in the mother constitutes a much greater danger for

* NEISSER was the first to discover in the discharges of gonorrhœa and of acute blennorrhœa a special micrococcus *(gonococcus)*. SATTLER and LEBER found this micrococcus in the secretion of trachomatous ophthalmia, the former found it also in the interior of the trachoma granulations. Inoculations with pure cultivations of these organisms have produced the characteristic trachomatous conjunctivitis. If these observations are confirmed, they will go far to prove the identity of origin of the acute and chronic forms of blennorrhœa.

the child than a simple vaginal catarrh with mucous discharge. The acute blennorrhœas are, as regards infection, much more dangerous than the chronic, and these latter again more dangerous the greater the inflammation and secretion that accompanies them.

PIRINGER performed experiments by introducing blennorrhoic matter directly into human eyes, which had a healthy conjunctiva (but were otherwise mostly blind).* He made in all 84 inoculations on 49 persons, and these inoculations were made with the gonorrhœal discharge from the genitals as well as with that of blennorrhoic eyes. He found that the secretion of an acute blennorrhœa of a mild character, at the very commencement when it is as clear as water, does not convey infection, and the same is the case with the limpid secretion of many chronic blennorrhœas. On the other hand infection ensues certainly and violently when we employ the purulent secretion of an acute or chronic blennorrhœa for our inoculations.

3. *The severity and rapidity* with which the infected eye becomes affected, depend on two circumstances: the origin of the secretion and the amount and freshness of it. If an eye with acute blennorrhœa infects another eye, the latter develops, as a rule, also acute blennorrhœa, which may even appear in from six to eight hours. If the infecting eye is suffering from

* [This is not quite correct. PIRINGER'S subjects were affected with pannus, which is generally accompanied by a granular condition of the conjunctiva. The numbers he inoculated were 61 eyes in 33 individuals. I believe I was the first to practise this method in this country. I published a successful case in the *Edin. Month. Jour. of Med. Soc.*, May, 1844.—R.E.D.]

trachoma, the infected eye as a rule gets the same disease. The period of inoculation is then longer, from 72 hours (PIRINGER) to 7 days (SATTLER) and perhaps still longer. The disease comes on often so unobservedly that the infected person does not notice it until much later.

Perfectly fresh secretion is the most efficacious. If dried upon linen rags it retains its infective power for about 36 hours; when it is preserved like vaccine matter, for about 60 hours. Within this limit it is still efficacious, but causes a milder inflammation than if it were fresh. Thus the secretion of a very severe blennorrhœa, if it has been dried for some days, only produces a slight blennorrhœa, moreover it takes a longer time to make its appearance (in one case eight days).—Dilution with water also weakens or entirely destroys the efficacy of the secretion. But the secretion of a violent acute blennorrhœa requires to be diluted more than 100 times in order to become inocuous (PIRINGER).

4. The facility and severity with which the infection acts, depends also on the *condition of the infected eye.* A catarrhal condition of the conjunctiva seems to make it more sensitive to the action of the infecting matter. The conjunctiva of healthy eyes does not, as PIRINGER found, always react in the same way to the blennorrhoic poison.

Can the infection also take place through the air? This may occur, as we may imagine, if the dried secretion is distributed in dust-form through the air of the room and thus comes in contact with the healthy eye. Whether this ever actually takes place is not yet satisfactorily determined.

Chapter II. Blennorrhœa Neonatorum.

Infection takes place in the great majority of cases of blennorrhœa neonatorum by the vaginal secretion of the mother, in a few cases also by inoculation from one infant to another.

§ 37. *Infection by the vaginal secretion* of the mother usually occurs during or rather immediately after birth. The child passes through the mother's genital passages with closed eyes. Hence during the passage of the infant's head through the vagina, the vaginal secretion can only penetrate into the conjunctival sack with difficulty and in small quantity. But the secretion remains attached to the eyelashes and edges of the lids. It can enter the conjunctival sack as soon as the infant opens its eyes and winks repeatedly.— Infection incurred during the passage of the head through the vagina might take place if the labour were very protracted so that the head remained a long time in the vagina, or if the forceps were applied to the head. Under these circumstances, as HAUSSMANN* observes, the soft parts of the face may be displaced, and thus a direct opening of the lids affected. Perhaps this is the reason why blennorrhœa more frequently attacks boys than girls (HAUSSMANN), because the bigger heads of the former pass more slowly through the vagina, and are more firmly pressed on by its walls.

Cases have been recorded where the blennorrhœa broke out immediately after birth, or was actually present during the

* HAUSSMANN, *Die Bindehaut-Infection der Neugebornen*, Stuttgart, 1882. Many of the following data are taken from this monograph.

birth. In one case, indeed, the infant when born showed perforation of both corneæ as a consequence of blennorrhœa. In these cases, we must conclude that the infection took place *intra utero*. HAUSSMANN thought that the infection of the child in such cases was caused by the accoucheur during his examination introducing the vaginal secretion on his finger into the membranes or directly on the child's face. This latter is possible in face presentations.

The blennorrhœa of new-born infants is not caused by the secretion of a virulent vaginal catarrh only; it may be produced by *the secretion of a simple catarrh* of the vagina. This is admitted by most authors. It is, of course, not always easy to pronounce with certainty on the true character of a vaginal catarrh in the practice of a lying-in hospital, but this is frequently possible in private practice. Almost every oculist has met with cases in which the infants got blennorrhœa from an undoubtedly mild fluor albus. Opportunities for making such observations are constantly occurring, as leucorrhœa is one of the most ordinary accompaniments of pregnancy.*

When the infection takes place during labour, the disease appears on the second to the fifth day†. The different duration of the period of incubation depends on the character of the secretion, and the quantity introduced into the eye.

* HAUSSMANN met with catarrh with mucous or purulent discharge 249 times among 250 pregnant women of the lower classes, and 30 times among 50 pregnant women in private practice. CHARRIER saw 72 cases of vaginal catarrh among 100 pregnant women.

† CREDÉ (*Archiv f. Gynäkologie*, Bd. XVIII., p. 367) asserts that the children infected during labour, show the disease mostly on the second or third day after birth, never after the fifth day.

§ 38. When the ophthalmia comes on later than the fifth day, we must conclude that the infection occurred *after birth.* In this case it was caused by the lochial secretion, which was introduced into the infant's eye by the mother or nurse by means of a dirty finger, by the linen, sponge, &c. But this seems only to take place from the lochial secretion of women suffering from leucorrhœa. At least the inoculations made by ZWEIFEL* with the lochial discharge of perfectly healthy women had no effect on the eyes of new-born infants.

The infection of an eye by another eye suffering from blennorrhœa often takes place.—In all cases where the two eyes of an infant are not simultaneously attacked, but where one gets the disease two or more days after the other, we may take for granted that the second eye was infected by the first. So also the conveyance of the disease from one infant to another frequently occurs. This happens particularly in the foundling and lying-in institutions, in consequence of the carelessness of the nurses. Many children are infected in this manner. Of 4140 blennorrhoic children (some inmates of a Parisian crêche, some belonging to the Petersburg Foundling Institute) 1622, consequently 39°/₀, first got the disease in an asylum where they were infected by other children.† In the Vienna Foundling hospital there were admitted from 1854 to 1866, 130,104 children of whom 5,616 were affected with blennorrhœa. Of these 1,413=25°/₀ first got the disease in the Foundling Hospital.

* *Archiv f. Gynäkologie*, Bd. XXII., p. 325.

† *Report of* DOLBEAU, FRÖBELIUS, DÖBB, see also HAUSSMANN.

Are there any other causes of blennorrhœa neonatorum?

In former times many attributed the production of blennorrhœa to intense light, to a chill, to mechanical injuries received by the eye during birth, to icterus, &c.; nowadays this view has but few supporters. HAUSSMANN is of opinion that the infection of the infant's eye can take place by secretions that have nothing to do with the mother's genitals; purulent secretion from an excoriated nipple of the mother, or from a suppurating navel of the child, from the contents of a pemphigus blister which may have got into the eye, raw meat applied to the eye, &c. I believe that all these things are capable of causing catarrh of the conjunctiva, but not blennorrhœa. In blennorrhœa of the lachrymal sack, in many cases of caries of the orbit often much pus, and even decomposed pus may enter the eye, the virulent character of which is shown by its attacking the cornea and producing abscess of the cornea. But blennorrhœa as a consequence of this is never observed. Nor is it ever caused by matter from an abscess when opened spurting into the doctor's eye, or when decomposed fluid from a dead body gets into the eye of the anatomist. SATTLER has settled this by experiment; he introduced putrid flesh, putrid blood and pure cultivations of various putrefactive fungi into the human conjunctiva without obtaining any bad effect. We must, therefore, conclude that the conjunctival blennorrhœa owes its origin to a fungus, which finds a suitable soil for its development only on the genital mucous membrane and the conjunctiva of human beings.

The conjunctivitis of new-born infants therefore has its source in the vaginal secretion of the mother. At the same time we cannot doubt that many still unknown circumstances, especially facilitate the infection at certain times; regular epidemics of conjunctival blennorrhœa are sometimes seen in lying-in and foundling hospitals. The season of the year has not as yet been positively ascertained to have any influence on its production.

§ 39. *Frequency of blennorrhœa neonatorum.*—We possess no statistics relative to the occurrence of blennorrhœa in general, only relative to its frequency in certain lying-in and foundling hospitals. The figures given in these reports vary very much, which—besides other causes—depends on different principles of calculation.

The ophthalmias which attack new-born infants may be divided into milder and severer cases; the former are of catarrhal, the latter of blennorrhoic character. There is no doubt that a great number of the catarrhal cases are attributable to infection. This is proved by the observation that under a suitable prophylactic treatment the number of cases, not only of blennorrhœa but also of catarrh is greatly diminished. Hence we must conclude that in the mild cases either the vaginal secretion was less infectious, or that very little of it entered the eye.

The various observers sometimes include these catarrhal cases in their calculations, sometimes they omit them, but without always telling us which plan they adopt in their reports. Hence it comes, for example, that in the University Lying-in Hospital in Berlin the percentage of blennorrhoic children to the total of the infants in a series of years, varies between 1 °/。

and 8 °/₀, whereas on the other hand in the Berlin Charité Hospital the blennorrhœas amount to between 7 and 21 °/₀. In the subjoined table I give a *resumé* of the data of a number of lying-in and foundling hospitals, which will be found *in extenso* in Haussmann :

I. *Lying-in Hospitals.*

Hospital.	Years.	Number of affected children per cent.
Berlin University Lying-in Hospital ...	1829—69	1.07— 8.3
„ Charité Hospital...	1817—79	7.4 —21.3
Breslau	1827—77	7.0 —18.5
Dresden	1826—75	2.2 —25.3
Halle	1840—79	2.8 —21.7
Leipzic	1849—79	7.6 —13.6
Munich*	1860—81	0.8 — 5.2
Stuttgart	1828—79	5.8 —20.9
Vienna I. Klinik...	1857—64	0.84— 2.3
„ II. „	1857—64	0.6 — 1.6
Petersburg	1845—54	1.2 — 1.4
Stockholm	—	2.9 — 7.9

II. *Foundling Hospitals.*

Prague	1865—68	8.6 —13.0
Vienna	1856—66	4.31
Petersburg	1830—78	5.9 —10.0

Of the blennorrhoic children of the foundling hospitals, about one-fourth to one-third were first taken ill by infection from other children.

* V. Hecker, *Archiv f. Gynäkologie*, Bd. XX., p. 387.

The records respecting cases of blennorrhœa occurring in lying-in hospitals do not allow us to come to any precise conclusions as to the frequency of blennorhœa outside these establishments. It is probable that they occur among the better classes seldomer, among the lower classes oftener than in lying-in hospitals. Cleanliness is less attended to among the poor people (and the linen at their disposal scantier) than in a well ordered lying-in hospital.—Nor do the reports of ophthalmic hospitals enable us to form an opinion respecting the frequency of blennorrhœa among the population; not even respecting the proportion of blennorrhœa to other eye diseases. Blennorrhœa is very frequently neglected by parents and midwives, and as a rule it is only the severer cases that are brought to the doctor. HIRSCHBERG met with only 1.46 % of blennorrhœa neonatorum among 21,440 eye patients.

§ 40. *Dangers of blennorrhœa.*—I have stated above that besides the severe cases many slight cases also occur, which bear the character of simple catarrh of the conjunctiva.

KOENIGSTEIN* found that of 1,C92 children in the II. Lying-in Hospital in Vienna, 4.76 % were affected with blennorrhœa, 14.5 % with catarrh. Some of the reports of the Dresden Lying-in Hospital also distinguish between severe and slight cases. Of 690 cases of blennorrhœa 360 were severe, 330 slight. The difference of the data is explained by the different meanings attached to the terms severe and slight. It is impossible to draw a hard and fast line between the two, nor is it needful to

* *Archiv f. Kinderheilkunde*, Bd. III., 1882.

do so. On the other hand it is important to know how often the cornea will be implicated and the sight thereby imperilled. Unfortunately there are but few records which give information on this point. I have subjoined all that I have been able to collect bearing on the subject:

Hospital.	Cases of Blen-norrhœa.	Opacity of Cornea.	Blindness of one eye.	Blindness of both eyes.	Per cent. of injured eyes.
Berlin Charité	213	2	2	?	1.9
Munich Lying-in Hospital*	123	1	2	1	2.4
Dresden " "	1378	38	15	4	3.8
Stuttgart " "	538	13	12	1	4.6
Vienna Foundling Hospital	1347	112	171	42	21.0
Prague " "	300	105	32	?	45.7

To this table I have to make the following remarks: In the reports the words used are often "opacity of the cornea" or "dimness of the cornea"; all these I have placed under the heading: "opacity of the cornea." But as it is not said to what extent this dimness of the cornea went in the several cases, it is quite possible that many of the cases of total blindness should come under this heading. The difference between lying-in hospitals and foundling hospitals is very striking, the latter showing a so much greater number of blind cases. In most lying-in establishments the women, when they are in good health, are dismissed in from eight to ten days after delivery, even though

* V. HECKER, *Archiv f. Gynäkologie*, Bd. XX., p. 388.

their children may have bad eyes. As a rule nothing is known about the future state of the child ; so that it is possible that many children become blind after leaving the hospital. But the high proportion of blindness in the foundling hospitals is owing to this, that most of the blennorrhoic children have the blennorrhœa when admitted, and that not unfrequently in a very neglected state, where the cornea is already implicated. In such cases the treatment often comes too late. Hence the proportion of cases of blindness in foundling hospitals approximates to that in ophthalmic hospitals. In the latter also, besides recent cases many far advanced cases come under treatment. I subjoin a list of these cases from the reports of various observers :

Author.	Number of cases observed.	Affections of cornea.	Blindness of both eyes.	Per cent. of injured eyes.
HORNER*	108	43	0	39.8
HIRSCHBERG†	200	55	6	27.5
SCHÖLER‡	156	43	?	27.5
HEYMANN§	139	25	?	18.0
EMRYS JONES‖ ...	420	72	16	17.1

These figures make blennorrhœa appear to be more dangerous than it is in reality, because oculists see more severe and neglected cases than mild ones. Still these figures accord

* *Handbuch der Kinderkrankheiten*, herausgegeben von GERHARDT, Bd. V., Pt. II., p. 262.

† *Beiträge zur praktischen Augenheilkunde*, 1876, p. 6.

‡ *Jahresbericht*, 1880, p. 7.

§ *Prager Vierteljahresschrift*, 1860, II., p. 70.

‖ *Manchester Medical Society*, February, 1881.

very well with those furnished by the foundling hospitals as regards the number of blindness of both eyes:—

	Number of cases of blennorrhœa.	Blindness of both eyes.	Percentage.
Vienna Foundling Hospital ...	1347	42	3.1
HIRSCHBERG	200	6	3.0
EMRYS JONES	420	16	3.8

HORNER is an exception, for he had not a single case of blindness among 108 cases.

There is no doubt that every year a great many new-born infants become affected with blennorrhœa, and owing to this a certain number of them lose their sight.

It is not possible to determine the exact number of the contingent which those who have lost their sight by blennorrhœa contribute to the total number of the blind. The data on this subject are no doubt numerous, but too divergent to allow us to draw an accurate conclusion. This divergence of the data is caused by two things: The differences of the material investigated and the various frequency of blennorrhœa in different countries.

The material investigated is of three kinds. 1. The pupils of blind asylums; 2. The cases of blindness applying to ophthalmic hospitals; 3. The inhabitants of a whole province. I will give examples from each of these three categories.

I.—*Blind Asylums.*

		Percentage of blenn. blindness.
REINHARD	Germany, Austria, Denmark, Holland	40
CLAISSE	Paris	46

MAGNUS	Breslau	34
KATZ	Berlin	41

II.—*Eye Hospitals and Dispensaries.*

MAGNUS	9 German hospitals ...	10.8
COHN	Breslau	11.1
DAUMAS	Paris	69.3
BOURJOT ST. HILAIRE	Paris	27

III.—*Total Population.*

Brunswick	28
Nassau	13

What is the true proportion of blindness caused by blennorrhœa to blindness in general? The blind asylums make this proportion appear too high, because they admit principally young blind persons, among whom the blennorrhoic are proportionally frequent. In the eye hospitals such blind cases come less frequently than others, because the most of them regard the misfortune they have had from their infancy as irremmediable; hence probably the reason why COHN and MAGNUS have found such a small percentage. Then again, the examinations of the blind of an entire country are as yet too few and too superficially carried out to allow us to come to precise conclusions. Besides, blennorrhœa does not everywhere prevail to the same extent; its occurrence depends on the one hand on the prevalence of vaginal catarrh, on the other hand on the degree of civilization and thence resulting cleanliness of the people.

§ 41. *The prophylaxis of blennorrhœa neonatorum* is one of the most important, and at the same time satisfactory, problems of hygiene. Appropriate treatment may, in the great majority of cases prevent infection. If in spite of all precautions the disease should occur, we possess such reliable modes of treatment that we may with tolerable certainty prevent blindness.

We have now to occupy ourselves with the prophylaxis against infection, and with the treatment of the blennorrhœa itself.

(A.) Prophylaxis of Blennorrhœa.

Protection against infection is a natural consequence of the knowledge that blennorrhœa depends on infection. At the beginning of this century (1807), GIBSON indicated clearly and rightly the fundamental principles of the prophylaxis in the following maxims :

1. The leucorrhœa of the mother ought, if possible, to be cured during the pregnancy.

2. When this has not been done, the noxious secretion ought to be removed from the vagina during delivery.

3. The infant's eyes ought, immediately after the birth, to be cleansed with a fluid which either removes the noxious matter, or is able to prevent its injurious effects.

The requirements of prophylaxis could not be more precisely enunciated at the present day. All the more wonderful is it that these efforts to prevent blennorrhœa were afterwards completely forgotten, although the doctrine of the infectious nature of the disease became more and more established. It is only in quite recent times that they were again adopted. The first serious commencement in this direction was made in Basel. BISCHOFF,*

* HORNER, *Gerhardt's Handbuch der Kinderkrankheiten*, Bd. V., p. 269

in 1875, carried out in a methodical manner the disinfection of the vagina in the Basel Lying-in Hospital, with a solution of carbolic acid, and at the same time washed the eyes with salicylic acid. SCHIESS of Basel, published an essay in 1876, in which he directed the midwife to cleanse the eyes of the infant immediately after birth with a disinfectant. Since then, in many institutions similar trials have been made and reported on.

The prophylaxis must endeavour to prevent infection, both during delivery, and after birth.

I. Infection During Birth.

§ 42. In order to hinder this, two methods have been proposed: The disinfection of the maternal passages and the disinfection of the eyes of the new-born infant.

As regards the mother, it is especially desirable to cure during pregnancy any vaginal catarrh that may be present, particularly if it be attended by a purulent secretion. If this has not been done, the disinfection of the vagina must be performed during delivery. The discharge of the liquor amnii effects a washing out of the vagina. But some secretion may still remain among the folds of the mucous membrane, and also on the external genitals. Should the labour be slow, as is generally the case with *primaparæ*, after the membranes have given way there is plenty of time for the collection of fresh secretion in the vagina.

On this account CREDÉ, in his first publication, lays great stress on the disinfection of the vagina, whilst at the same time he cleanses the eyes of the infant with a solution of borax. HAUSSMANN also is strongly in favour of this method. BISCHOFF, as already mentioned, introduced it into his hospital since 1875. In Austria, the midwives are required to disinfect the vagina before delivery. Whether the disinfection of the maternal passages will alone suffice to prevent blennorrhœa, I am unable to prove by statistics, for disinfection of the eyes is always performed at the same time.

At the present time all are agreed that the chief thing is the disinfection of the infant's eyes. The infecting secretion, as a rule, obtains access to the infant's eyes after birth. It hangs about the borders of the eyelids and eyelashes, and gets into the conjunctival sack when the child opens its eyes and winks repeatedly. Infection of the infant can be prevented by appropriate cleansing of the eyes.—But is a really efficacious disinfection possible if in spite of this some secretion penetrates into the the conjunctival sack? PIRINGER'S experiments answer this question in the affirmative. He found that blennorrhoic matter introduced into the conjunctival sack produces no effect, if very soon afterwards (at latest three minutes) the conjunctiva be carefully rinsed out with water, and then cold compresses applied for some hours.

The different methods proposed for the treatment of the eyes of newborn infants are divisible into the three following groups:—

(*a.*) *Simple cleansing of the eyes.*—ABEGG* recommends careful

* *Archiv f. Gynäkologie*, Bd. XVII., p. 502.

washing out of the eyes with pure water; since doing so he has only 3 °/o of blennorrhœas.

SCHIRMER thinks that the infection of the eyes is generally caused by the bath water, and hence he directs that at first the head should only be wiped with a dry towel; the face should not be washed in a basin till next day. By following this plan he had no case of blennorrhœa in fifty births.

(*b.*) Cleansing the eyes with *disinfecting fluids.* Most of the disinfectants used in surgery have been recommended. FIEUZAL is in favour of weak solutions which shall not irritate the eyes, thus carbolic acid in the proportion of 1 to 250, but he enjoins frequent ablution with it, and if the eyelids are swollen he advises the application of cold compresses.*

CREDÉ in his first trials used a solution of borax (1 to 60), but was not quite satisfied with it. BISCHOFF employs a solution of salicylic acid, whilst SCHMIDT-RIMPLER gives the preference to chlorine water. But far the greater number made their experiments with carbolic acid; this has the advantage of being at hand in all hospitals, and even midwives are bound to carry it about with them. HAUSSMANN recommends a 1 °/o solution of it; OHLSHAUSEN employs it in a 2 °/o solution (not in 1 °/o as erroneously stated in his publication); BUNGE and MACDONALD the same. GRAEFE advises that the eyelids should be everted when the solution is applied.

c. Instillation of *argenti nitras.*—CREDÉ having obtained no satisfactory results from the borax solution proposed the

* *Congrès d'hygiène de Genève*, T. I., p. 233.

following plan. He first cleansed the eyes carefully with salicylic acid (2 to 100) and put into the conjunctival sack one drop of nitrate of silver solution, and then laid compresses with salicylic acid (2 to 100) on the eyes for twenty-four hours. Afterwards he altered this procedure by omitting the compresses of salicylic acid, and merely washed the eyes with water, and then dropped into them the nitrate of silver solution. KOENIGSTEIN, FELSENREICH and BAYER adopted CREDÉ'S last method.

§ 43. The best proof of the value of this procedure is the *result*. Before going into the examination of the advantages and disadvantages of the several methods, I will give a collective view of the results obtained by them. I have endeavoured to present not merely the percentages of blennorrhœa, but also the absolute numbers of the infants observed. The larger these figures are the greater right have we to regard the results as decisive.

A comparison of the data given in the table, in order to form a judgment relative to the value of different modes of precedure gives the following: Simple cleansing of the eyes with water, diminishes to some extent the frequency of the occurrence of blennorrhœa. Thus BISCHOFF, before employing his salicylic ablutions, merely by observing great cleanliness and care in the nursing, brought down the proportion of blennorrhœas from 5.6 °/₀ to 3.5 °/₀. Cleansing the eyes and conjunctival sack with carbolic solution gives still better results; and by this means KOENIGSTEIN reduced the blennorrhœas to 1.4 °/₀. In each of these methods a great deal depends on the period when, and the care with which the cleansing is performed.

Author.	Before using Prophylaxis.			After employing Prophylaxis.			
	Number of Infants.	Cases of blennorrhœa.	Percentage.	Prophylactic Method.	Number of Infants.	Cases of Blennorrhœa.	Percentage.
ABEGG*	—	—	—	Cleansing with water	—	—	3
SCHIRMER† ...	—	—	—	Dry cleansing	50	0	0
BISCHOFF‡ ...	—	—	5.6	Salicylic acid	—	—	2.6
OLSHAUSEN§ ...	550	69	12.5	2°/₀ Carbolic solution after severing navel	137	12	8.8
,, ...	—	—	—	,, ,, before ,, ,,	166	6	3.6
KRUKENBERG‖ ...	1266	92	7.3	,, ,, ,, ,, ,,	82	11	13.4
KÖNIGSTEIN¶ ...	1092	51	4.8	1°/₀ ,, ,, ,, ,,	1541	21	1.4
CREDÉ**	2897	314	10.8	2°/₀ nitrate of silver solution... ...	1160	1 to 2	0.1 to 0.2
KÖNIGSTEIN ...	—	—	—	,, ,, ,, ,, ...	1250	9	0.7
KRUKENBERG ...	—	—	—	,, ,, ,, ,, ...	703	1	0.14
FELSENREICH†† ...	1887	82	4.3	,, ,, ,, first period ...	3000	58	1.9
,, ...	—	—	—	,, ,, ,, second period ...	2100	21	1.0
RUSSELL-SIMPSON‡‡	—	—	11.76	,, ,, ,, ...	—	—	5
BAYER§§	1106	136	12.3	,, ,, ,, ...	361	0	0

* NAGEL'S *Jahresbericht f. Augenheilk.* 1881, p. 337. † Quoted by KÖNIGSTEIN. ‡ HORNER, *Handbuch der Kinderkrankheiten*, herausg. v. GERHARDT, Bd. V. Pt. 2, p. 264. § *Berliner klin. Wochenschrift*, 1881, No. 8. ‖ *Archiv f. Gynäkologie*, Bd. XXII. p. 329. ¶ *Archiv f. Kinderheilkunde*, Bd. III. 1882. ** *Archiv f. Gynäkologie*, Bd. XXI. p. 181. †† *Wiener med. Wochenschrift*, 1883, No. 35. ‡‡ *Annales d Oculistique*, T. XC. p. 145. Catarrhs apparently included among the blennorrhœas. §§ *Archiv f. Gynäkologie*, Bd. XXX.

When OLSHAUSEN performed the disinfection of the eyes with carbolic acid after severing the navel-string of the infant, he had 8.8°/$_o$ of blennorrhœas; afterwards he disinfected the eyes as soon as the head was born, and thereby reduced the blennorrhœas to 3.6°/$_o$. When the disinfection is left to the midwife, experience in this manipulation has much to do with its success. Hence it is that in the different lying-in hospitals the proportions are the more favourable the longer the practice has been employed. FELSENREICH in his first period of observation (of CREDÉ'S method) had 1.93°/$_o$, in the second period only 1.0°/$_o$ of blennorrhœas.

From these data, it is evident that the disinfection of the eyes of new-born infants constitutes a very powerful prophylactic means against blennorrhœa, provided the disinfection is carefully performed and as soon as possible after birth. It ought to be practised on all infants, even on those whose mothers have no vaginal discharge. Which is the disinfectant that most deserves to be recommended?

Hitherto, only carbolic acid and nitrate of silver have been employed on a large scale. The carbolic solution ought not to be too weak. A two per cent. solution can be dropped into the eye without doing harm, though now and then it causes swelling and eczema of the lids (KOENIGSTEIN). As regards nitrate of silver, we might think that it would injure the eyes still more, but, according to CREDÉ'S experience and that of his imitators, in most infants no reaction at all follows its use. In a few hyperæmia and some secretion from the conjunctiva were observed; which, however, went off spontaneously after three days at most. The solution employed was a 2°/₀; a weaker solution seems not to be efficacious. At least VON HECKER* in the Munich Lying-in Hospital, saw no effect from a one per cent. solution. As regards the results obtained from both remedies, the above table shows that OLSHAUSEN with carbolic acid had still 3.6°/₀ of blennorrhœa, whereas CREDÉ with nitrate of silver solution had only 0.1°/₀. Since his adoption of this method, CREDÉ had not more than one or two cases of blennorrhœa among 1,600 infants. But in order to draw an accurate conclusion from these data, we ought to know what each of the observers understands and designates as blennorrhœa. OLSHAUSEN says that under his treatment, the blennorrhœas that occurred were all much milder; another would perhaps have classed them as catarrh. Hence the work of KOENIGSTEIN is of great value. He distinguished between blennorrhœa and catarrh, and classed them separately. He first observed 1,092 children without treating them, in another series of 1,541 children, a 1°/₀ carbolic solution was used; in a third series of 1,250 children, a 2°/₀ solution of nitrate of silver was employed. All this took place in the same hospital with the same attendants, and was recorded by the same observer, so that these observations best fulfil the requirements of a scientific experiment. KOENIGSTEIN came to the following conclusions:

	No. of new-born infants.	Per cent. of blennor.	Per cent. of catarrh.	Total Percentage.
No treatment ...	1092 ...	4.76 ...	14.5 ...	19.26
With 2°/₀ carbolic wash	1541 ...	1.42 ...	6 ...	7.42
With 1°/₀ silver wash	1250 ...	0.72 ...	4.72 ...	5.44

* *Archiv f. Gynäkologie*, Bd. XX., p. 386.

KRUKENBERG also instituted comparative trials first with carbolic lotion, afterwards with nitrate of silver, but in place of employing a solution he used a vaseline ointment containing 2°/$_0$ of nitrate of silver (he afterwards abandoned this ointment for the solution). He himself performed the disinfection, so that we may take for granted that uniform care was bestowed on the manipulation. His results are :

No treatment	7·3°/$_0$
With 2°/$_0$ carbolic wash	13·4°/$_0$
With silver vaseline	0.14°/$_0$*

Thus by disinfecting treatment the number of cases of catarrh, as well as of blennorrhœa, is reduced. The nitrate of silver solution acts more certainly in this respect than the carbolic solution ; as moreover experience has shown that the silver solution is not dangerous to the eyes, it deserves to be preferred to the carbolic solution. In addition to this the method proposed by CREDÉ is exceedingly simple. He first ties and cuts the navel string, then has the infants put into a bath and their eyes cleansed with water. Then the child is laid down and into each eye, slightly opened, a single drop of a two per cent. solution of nitrate of silver is introduced by means of a small glass rod, that is to say it is allowed to fall on the cornea. Nothing else is to be done to the eye.

* KRUKENBERG had 4 blenn. among 703 treated with the above ointment therefore actually 0.56°/$_0$. Three of these infants, however, took the disease from the seventh to the ninth day, consequently they were undoubtedly infected after birth. He therefore quite properly eliminates these cases, so that only the children in whom the disinfection of their eyes was ineffectual, remain.

As regards the mode of action of the silver solution, I look upon it in this case as an antiseptic, the solution causing the albumen to coagulate and entering into combination with it. The silver solution differs from the carbolic solution in this, that it acts not only on the surface but also to some extent on the deeper parts. Thus it cauterises the outer layer of epithelial cells; hence if the micro-organisms have already penetrated into this layer, they will be reached and destroyed by the silver solution. For this reason the action of the silver solution is much more certain than that of the carbolic solution.—But it is desirable that further comparative trials should be instituted, particularly with a solution of corrosive sublimate, which according to the investigations of the German Board of Health displays the surest antiseptic action.

§ 44. The methods described have hitherto been chiefly carried out in lying-in hospitals. But are they adapted for labours occurring outside lying-in hospitals, and can we trust to midwives for their performance? The prophylaxis of blennorrhœa is more important outside lying-in hospitals than in such establishments. In the first place the number of births in lying-in hospitals is but a small fraction of the total number of births. In the second place blennorrhœa is much less dangerous in lying-in hospitals, for in them the children affected with eye diseases are immediately subjected to treatment. Among the people, on the other hand, blennorrhœa is either neglected or aggravated by improper treatment, so that many eyes are thereby destroyed. Therefore the prophylaxis of blennorrhœa outside lying-in hospitals is more urgently required than in these establishments. But in the former case it can only be carried out by midwives. At present the doctor is never called to a normal labour in any well-to-do families,* not to speak of the poor people. Quite irrespective of the expense this is never done, because the number of medical men in many places is insufficient. This is still more the case in those countries where the doctors are much fewer than in ours, *e.g.*, in Sweden, where the midwives are relied upon even for the performance of the application of the forceps.†

If we are to leave the disinfection of the eyes to midwives, we must adopt an extremely simple treatment. Above all we must know if it be necessary in order to apply the disinfectant to evert the lids, as GRAEFE and others direct? This certainly must not be left to the midwives. They might injure the eyes by their rough manipulation, and introduce into the eyes some still more infectious substances, in the majority of cases indeed they are unable to evert the lids. The object of everting the lids is to bring the disinfecting substance in direct contact with the whole surface of the conjunctiva. That cannot be done unless the everting manœuvre exposes the upper fold. This is the main part to be disinfected, because foreign bodies (and consequently the infecting vaginal mucus) are, as is well-known, readily conveyed into the upper fornix. The disinfection of this part of the conjunctiva is effected by simple instillation, for the fluid, by the process of winking, is

* [This of course does not apply to England, where the employment of male accoucheurs is the rule, that of midwives the exception.—R.E.D.]

† In 1878, 381 deliveries with forceps were performed by midwives. IRGENS, *Centralblatt f. Gynäkologie*, 1880, No. 47.

distributed all over the conjunctival sack. Neither CREDÉ nor KOENIGSTEIN nor FELSENREICH directs the lids to be everted, for they allow the midwife to perform the disinfection, and yet they have obtained remarkably good results. Therefore it is not necessary to evert the lids; simple instillation of the disinfecting fluid suffices, and this may without danger be left to the midwife.

I do not doubt that on an average the midwife will not carry out the operation with the same carefulness as a medical man would. Still I am in favour of trusting the midwives to do it, for in most labours there is no physician present. Of course the midwives must be thoroughly instructed in the operation; by-and-bye I will return to this subject.

The due carrying out of these rules will be facilitated if the public are enlightened with regard to the dangers of blennorhœa and the means to be taken in order to ward them off. If that were done the parents of the infant would in many cases insist upon the necessary care being practised. Popular writings on this subject have been published by different authors. BRIÈRE, in Havre, caused a pamphlet of this character to be given to all persons who intimated at the mairie the approaching birth of a child. FIEUZAL proposed to add an *avis aux parents* to the *livret de mariage*. ROTH, in London, published a fly-leaf about blennorrhœa in the name of the Society for the Prevention of Blindness. As a consequence of these numerous efforts some governments have already begun to direct their attention to the matter.

The new Prussian midwife's book published in 1878, says: "The midwife should begin by cleansing the eyes, but not with the bath water"; it would have been as well to add, "nor with the bath sponge." In September, 1880, the French Government caused a note to be inserted in the *Journal des Communes* calling general attention to this subject. In December, 1882, the Austrian Government issued an edict in which CREDÉ'S method was recommended to medical men. The Hungarian Government distributed to all the midwives in the country a popularly written treatise upon the blennorrhœa of new-born infants.

Chapter II. Infection after Birth.

§ 45. At the first bath the dirt adherent to the infant's body gets into the water and may, when the face is being washed, get into the eyes. SCHIRMER regards this "poison water," as he terms it, as the chief danger of infection. I do not think that the danger is so great as that; PIRINGER'S experiments have shown that the blennorrhoic secretion loses all its virulence when diluted to a certain extent. Nevertheless it is very advisable not to use the bath water to wash the face not only on the first day but also on the subsequent days, and to employ pure water and a separate sponge or linen rag.

On the days following the birth infection may be conveyed by the *lochial secretion*. In many lying-in hospitals, as also among the poorer classes, the infant has no crib to itself, but lies in its mother's bed. In consequence of this, and also of want of cleanliness of the linen, fingers, &c., the conveyance of the secretion to the eyes is possible. Greater care and cleanliness of the attendants and of the lying-in woman herself is above all things requisite. HAUSSMANN proposed to remove the lochial secretion as much as possible, syringing the vagina twice a day with a two per cent. solution of carbolic acid. GRAEFE advises the instillation into the infant's eyes of a two per cent. solution of carbolic acid every twelve hours during the first two days after birth.

In lying-in and foundling hospitals blennorrhœa is often communicated from one child to another. Want of cleanliness and carelessness in the nursing, the employment of the same bath water, of the same sponges and linen for healthy and diseased children are to blame for this accident. We must therefore insist that each infant has its own utensils.

In foundling hospitals nurses with blennorrhœa of the vagina or eyes should not be employed to suckle the infants, if this can be avoided.—Many children brought to foundling establishments have the germs of the disease on admission, and it bursts forth in a day or two. On this account HAUSSMANN advises that all the children on admission should have their conjunctival sack disinfected by an instillation of nitrate of silver solution.

Over-crowding is one of the most powerful agents for propagating blennorrhœa. Unfortunately many of the large lying-in and foundling hospitals are almost always over-crowded. When that is the case, all the greater attention to cleanliness and ventilation is necessary. The physician should inspect the children every day, and in the case of infants with diseased eyes should do what is required. This includes, besides the medical treatment of the blennorrhœa, the *isolation* of the affected children. This is the more important the larger the establishment and consequently the greater the difficulty of paying attention to every separate case. In Paris LEFORT carried out this separation with excellent effect. The number of infants with eye diseases declined quickly until the disease was almost extinguished.

(B) Treatment of Blennorrhœa.

§ 46.—By assiduous carrying out of the prophylactic rules we shall succeed in keeping down blennorrhœa to a minimum in lying-in-hospitals, and perhaps also by-and-bye among the people; we shall never be able to suppress it entirely. Fortunately, blennorrhœa is very amenable to good treatment; if the treatment is commenced sufficiently early a good issue is to be reckoned on almost certainly. Most oculists are agreed on this point, so that I may content myself with citing only a few data in proof of this assertion.

HORNER had in 10,000 cases of eye disease, 108 fresh cases of blennorrhœa; all recovered without injury to the sight. HIRSCHBERG gives an account of 200 cases; 6 of these came with the cornea already destroyed, so they had to be refused admission; of the remaining 194 cases not one single eye was lost. In SCHWEIGGER'S clinic there were 452 cases; of these 123 had already corneal affection, and 43 lost their sight completely. The remaining 329 cases which came under treatment before the corneal affection was present were all cured without injury to the sight. So we may say that a complete cure will be obtained in every case where the treatment commences before the cornea is implicated. Hence the most important thing is to bring the cases early under treatment. In lying-in hospitals where the children are under medical inspection for at least the first eight days, this is easy. Hence the proportionately favourable figures in the table given at p. 118 for the eyes blinded by blennorrhœa in the lying-in hospitals. No doubt the healthy mothers leave the hospital, as a rule, on the 8th to 10th day; if the child's eyes are affected, they are recommended to bring it daily to the hospital for treatment. But it is only very few who are able to do this, most of them must return to their homes on acconnt of their want of funds. The question then arises whether, under such circumstances, assistance should not be given by keeping the mother in the institution until the child's eyes are cured.

In the foundling hospitals, as in the lying-in hospitals, the children are under medical supervision and treatment. Unfortunately in many large foundling institutions the medical staff is so overwhelmed with work that it is not able always to give the requisite attention to the eyes.

It is much more difficult to bring under treatment blennorrhœas occurring outside these institutions. These cases often turn out badly. When they are not treated at all they do better than when mistreated by domestic remedies; the instillation of urine, the application of raw flesh and similar procedures are apt only to increase the inflammation. HALTENHOFF says that midwives, in place of insisting that the child should be taken to a doctor, often on the contrary dissuade the parents from doing so.

What should be done in order that the blennorrhoic children may be brought under treatment in good time? It should be one of the duties of midwives to insist upon parents calling in a doctor. Par. 7 of the Austrian regulations for midwives imposes a penalty on midwives for neglecting to do this. This is also the case in Switzerland. This regulation has been of great service in the latter country. According to HORNER, since 1865, not a single case of blindness from blennorrhœa occurred in the Zurich Blind Asylum.

Midwives should be compelled under penalty to desire the parents to call in a doctor in every case of blennorrhœa. If the parents neglect to do so, it should be the duty of the midwife to give notice of this neglect to the proper authorities, and so acquit herself of responsibility.

I will not here enter into details respecting the mode of treatment of blennorrhœa. I may only say this much. If only one eye of a child is diseased, the question is how to prevent the infection of the other eye. The occlusive bandage which protects the sound eye in adults is not applicable to infants. Great cleanliness, constant removal of the secretion that flows out, making the child lie on the affected side so that none of the discharge can flow over the nose into the other eye—will in many cases, but not in all, prevent the infection of the sound eye. It has also been proposed to subject the sound eye to a regular prophylactic disinfection. Iodoform, solutions of nitrate of silver and corrosive sublimate have all been proposed as disinfectants. Sufficient experience of these methods has not yet been obtained to enable us to pronounce positively on their value.

§ 47. Relying upon what has already been ascertained, I may be allowed to make some *suggestions* relative to the mode in which governments may concern themselves about the prophylaxis of blennorrhœa neonatorum. Government regulations can naturally only deal with the prophylaxis of blennorrhœa among the people which can be entrusted to midwives. Prophylaxis in lying-in hospitals and foundling asylums must be left to the judgment of their medical staff. Government can no more prescribe a fixed method of prophylaxis to their officials, than it can confine the chief surgeon of a hospital to a fixed method of bandaging. These institutions are the places where new methods are tried and put to the test, whereby a constant progress in this field is rendered possible. In my opinion it is the duty of governments:

1. To frame suitable regulations for the midwives.
2. To take care that these regulations are carried out.
3. To adopt means for teaching the public.

As regards the *regulations* to be made for midwives, the following points should be attended to:

1. The midwife who sees a woman some time before her lying-in should ascertain if she has a discharge from the vagina. If this is the case she should warn the woman of its danger, and advise her to see a doctor.

2. The midwife after making an internal examination of the pregnant woman, should every time carefully disinfect her hands. Immediately before delivery the vagina should be cleansed by a disinfecting injection.

3. As soon as the child's head is born, the midwife should

cleanse the still closed lids with a disinfecting fluid. Should the course of the birth not allow this, the cleansing of the lids should take place before tying and cutting the navel string, or at all events before bathing the infant.

4. In the first, as also in the following baths, the midwife should use for cleansing the eyes separate water, sponge and towel or linen rag.

5. After the first bath, a drop of a two per cent. solution of lunar caustic is to be inserted into each eye.

6. After delivery, the midwife should warn the mother that the infant may yet get bad eyes by the introduction into them of vaginal secretion, and she should inform the mother how infection may be avoided.

7. As soon as ophthalmia (even of a slight character) shows itself in the infant, the midwife should warn the parents that it is a dangerous and infectious disease; she should tell them by what means the conveyance of the disease to others may be avoided, and she should direct them to seek the advice of a doctor without delay. If the parents neglect to do so, the midwife should report their conduct to the proper authorities, in order to get rid of responsibility. A penalty should attach to neglect on the part of parents.

To these points the following remarks may be appended: They should only give a general outline of the course to be pursued. On this account I have not named any particular disinfecting fluid to be used for cleansing the eyes. Where midwives are required to have with them a carbolic solution, this would naturally be the one employed for the eyelids.

For the disinfection of the conjunctival sack, I would advise CREDÉ'S method, because wherever it has been employed it has proved itself the surest. I differ from CREDÉ in this, that I should require the midwife to cleanse the lids immediately with a disinfectant lotion. As we can never place implicit reliance on the carrying out of a method by midwives, this gives us an additional guarantee that infection will be prevented.

Some states (*e.g.*, Saxony) strictly forbid midwives to treat blennorrhœa themselves; this rule should be maintained, but they must in addition be required to give notice in case the parents will not call in any doctor.

The government must provide for the strict carrying out of these regulations by a supervision of the midwives, imposing penalties for neglect of the directions, &c. When a neglected case of blennorrhœa is brought to the doctor and he finds that the midwife has not done her duty, the doctor should not only be allowed but he should be required to complain of the midwife.

The chief objection to the disinfection of infants by midwives, is that they do it badly and may thus do more harm than good. It is evident that we can only expect a proper execution of this method from such midwives as have seen it practised and have practised it themselves. Hence:

1. In future all women educated as midwives, should receive proper instruction relative to the blennorrhœa of new-born infants, and learn the prophylactic treatment practically in the hospital. For midwives so instructed the carrying out of the government regulations regarding prophylaxis would then be obligatory.

2. What is to be done with midwives already engaged in practice? Some of these reside in large towns where there are schools for midwives. Some plan could be adopted in order to attract these midwives for a short time to the institution where the requisite instruction may be imparted to them.

For the majority of midwives who live at a distance from such a school, this plan cannot be carried out. Under such circumstances the government might act in the following way. It might provide them with a plainly written pamphlet, which besides giving full instruction about blennorrhœa, should contain a detailed description of the prophylactic treatment. The midwives should not be obliged to carry out this treatment, but they should be at liberty to do so. I believe that those midwives who from their own inclination, or from desire to do their duty should wish to carry out the new method, would read the pamphlet with due attention and follow its directions.

I have already indicated how the government may provide for the instruction of the public. The introduction of instruction for parents in the marriage-book, in popular almanacks, &c., will serve to spread a knowledge of this malady.

Chapter III. Blennorrhœa acuta adultorum.

§ 48. Like the blennorrhœa of new-born infants, that of adults comes also by infection, the origin of which is to be sought either in the genital organs or in another blennorrhoic eye. In the former case it is the gonorrhœal inflammation of the male urethra or of the female vagina which furnishes the infectious secretion. This is usually introduced into the eye by a dirty finger. Cases are recorded (I myself have seen two such) where the infection was communicated by a man labouring under gonnorrhœa washing his eyes with his own urine (a favourite domestic remedy for inflammation of the eye among the common people). It seems that even a non-virulent catarrh of the vagina may under certain conditions cause acute blennorrhœa, which may be as dangerous as that produced by a gonnorrhœa. This is shown by the fact that little girls affected with vaginal catarrh sometimes get acute blennorrhœa if they bring the vaginal secretion into the eyes (v. ARLT,* HAUSSMANN,† HIRSCHBERG‡).—Acute blennorrhœa is also caused by infection from another eye suffering from blennorrhœa, whether the latter is affected with blennorrhœa neonatorum or with the acute blennorrhœa of adults.

Infection by the secretion of diseased genitals or of diseased eyes is apt to attack doctors and nurses especially, because when treating such patients some of the secretion gets into the eyes. This is also the case with mothers and wet-nurses who suckle children with diseased eyes, and to a still greater degree, for such persons are often not sufficiently careful and cleanly. Hence in many foundling hospitals a considerable number of infected nurses are found. HAUSSMANN gives the following figures relating to these foundling hospitals.

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* *Krankheiten des Auges*, 1881, p. 38.

† L.c., p. 35.

‡ *Centralblatt f. Augenheilkunde*, 1884, p. 311.

	Blenn. Children.	Blenn. Nurses.
Petersburg	2918	345 (11.8 %)
Vienna	3964	49 (1.23 %)
Prague	543	4 (0.73 %)

PIRINGER says that nurses in foundling hospitals sometimes deliberately infect their own eyes, in order to be dismissed from the institution on account of their eye disease.

In spite of the frequent opportunities for infection, acute blennorrhœa of adults is not very common. According to HIRSCHBERG it forms 1.18 per mille, according to FIEUZAL* not quite 0.5 per mille of all eye diseases. Among 1,000 blind eyes, COHN found 26 which were lost by gonorrhœal conjunctivitis.—The acute blennorrhœa of adults is much more dangerous than that of new-born infants; in severe cases the best treatment is not always able to ward off an unfortunate result.

§ 49. In the prophylaxis of this disease it suffices to prevent the introduction of infectious matter into the eyes. Want of cleanliness and ignorance are to blame for the neglect of necessary precautions. When patients present themselves for treatment for gonorrhœa or virulent vaginal catarrh, the physician should obviously call their attention to the danger threatening their eyes. Unfortunately many persons so affected do not consult a doctor, sometimes from a feeling of shame, sometimes from mere carelessness.—In the army, as a rule, provision is made for the early treatment of gonorrhœa by the regular medical inspections of the men. These are generally made

* *Congrès internat. d'Hygiène.* Geneva, 1882. Vol. I., p. 225.

once a week and are specially directed to the detection of venereal diseases.—When, with the spread of education, attention to cleanliness increases among the poor, the number of cases of acute blennorrhœa will be proportionately reduced.

The communication of blennorrhœa by means of new-born children can be prevented in lying-in and foundling hospitals by the requisite care and cleanliness. What improved nursing in this respect may do, is shown by the Vienna Foundling Hospital. In 1812-13, according to the report of JUST, to 100 blennorrhoic infants there were 15.7 blennorrhoic nurses; from 1856 to 1863 only 1.23. A still stricter attention to cleanliness would, no doubt, diminish still further the number of cases. The most effectual means of preventing the communication of blennorrhœa from infants to adults would be the stringent adoption of the prophylaxis of the blennorrhœa of the new-born infants themselves and that both in and out of lying-in hospitals. The number of sucklings with bad eyes would thereby be greatly lessened; in case of the disease appearing the midwife would at once acquaint the parents with the risk of infection, and the physician who is called in would do the same.

Physicians and nurses know the danger of infection and protect themselves by proper precautions and cleanliness. Most dangerous are the injections made into a blennorrhoic urethra, vagina or conjunctival sack, whether done for the purpose of cleansing or introducing medicinal substances. During this operation the fluid is apt to spurt out in all directions, and may get into the eyes of the operator. Oculists protect themselves by wearing spectacles to protect the eyes;

as far as I know this is not done by medical practitioners when treating gonorrhœa, but they might do it with advantage.*—As regards acute blennorrhœa of the conjunctiva, the old method of cleansing the eye by syringing is given up in many hospitals, and is replaced by other modes of cleansing. Syringing is not only dangerous for the nurse but also for the patient's eye, which may easily be injured by an unskilful use of the syringe.

If the disease have already broken out, speedy medical aid is urgently needed. If but one eye is affected the other must be protected by an occlusive bandage. At the first sign of conjunctivitis in the other eye (I do not mean the catarrh which is apt to occur in a bound-up eye) I and others besides myself have found that the most efficacious treatment is to touch the conjunctiva once or twice a day with a two per cent. solution of lunar caustic. In some instances I believe I have in this way prevented the occurrence of the disease. This, however, only applies to those cases where the disease is seen in its very earliest stage. If the disease have become developed cauterisation should not be had recourse to until the chemotic infiltration of the conjunctiva has receded and copious purulent secretion has set in.

Chapter IV. Trachoma.

§ 50. Under this name I include, as I have above explained, both the papillar and the follicular forms which I regard as essentially the same.

* One of my colleagues, when injecting a gonorrhœal patient, lost his eye by getting it infected in this manner.

For a long time i was usually believed that trachoma was first brought to Europe by the soldiers of Napoleon I. His army was attacked by this disease in Egypt, hence the name ophthalmia Ægyptiaca. But the disease has always existed in Europe: its occurrence as an epidemic during and after Napoleon's wars only directed general attention to it. Epidemics of ophthalmia were not unknown in former centuries. VON ARLT gives a long list of them, among these one which raged among the soldiers in Westphalia in 1761. It is not absolutely certain but very probable that it was of the nature of trachoma. VON ARLT quotes a passage from CELSUS containing an accurate description of trachoma, proving that it was known in Italy in the days of the Roman empire.

The disease is certainly contagious and is propagated by *infection.* It is, however, hard to prove that this is the only way in which it arises. In many cases it is impossible to prove infection. The cause of this is that the disease at first runs a completely latent course; it is only noticed by the patient when it has attained to a certain height. On this account other causes have been sought for the occurrence of trachoma. VON ARLT who was the first to give a clear description of granular trachoma, and to prove it to be a specific form of disease, thought that it was dependent on scrofula, and in some instances on tuberculosis. HORNER* believes that the granular form is caused by miasmatic infection (by foul air), the papillar form by contagious infection (by the secretion from a diseased eye).

* *Gerhardt's Handbuch der Kinderheilkunde*, Bd. V., p. 313.

VON ARLT has lately altered his opinion; he attributes all cases of trachomatous conjunctivitis to infection from another eye, and in this I agree with him.

If this view is the correct one and infection is indispensably requisite for the production of trachoma, there are, however, certainly other circumstances which have to do with the production of the disease, in this way, that they contribute to the communication of the disease from one individual to another. The differences in the severity and extent in which trachoma occurs depend on the presence or absence of these circumstances. Thus, in former times, as VON STELLWAG rightly remarks, there was an absence of the proper foci of trachoma, such as large standing armies, numerous educational establishments, orphan houses, &c. The beginning of the present century brought with it a considerable increase and extension of this disease, apparently by the long wars which brought the armies of all Europe in frequent contact with one another and with the civil populations. The disease ravaged one country after another in the form of widespread epidemics. It was observed with trachoma, as with other maladies, when an endemic disease develops into an epidemic: it took on a much more acute character. The disease was attended with great purulent secretion, whereby naturally its rapid spread was still more promoted.

The spread of trachoma is mainly promoted by the dwelling together of many persons (in barracks, educational institutions, &c.), for thereby the communication of the contagion from one person to another is facilitated. The communication is, as a rule, effected indirectly, by the common use of different objects, such as sponges, towels and other washing articles, by washing water, &c. The necessary antecedent condition is of course the presence of a person suffering from the eye affection, from whom the infection spreads among his companions. This explains why in identical modes of barrack-life, sometimes one particular portion of a body of troops is attacked whilst others remain free, if among the latter there was from the beginning no one affected with the eye disease. This was the case, for example in Mayence, where in 1819 a violent epidemic prevailed among the Prussian army of occupation, so that one third (1,146 men) fell ill in a few months. The Austrian contingent of the allied army, however, remained quite free from the disease.

I have already touched on the question, whether infection may also take place through the *air*. I will not deny the possibility of this mode of propagation; there must, however, be a very long sojourn in such vitiated air. MUELLER, who was attached to the Mayence garrison during this epidemic, considers that there is no danger in remaining the whole day in a ward filled with such patients, but he would on no account pass a night in such a situation. He believes that the defective ventilation during the night increases the infectious property of the air. In schools where there are boarders, those who sleep in the establishment are much more liable to infection than the day scholars. In 1867, COHN examined a deaf-mute institution in Breslau;* of 111 children who lived in the institution, 84 had trachoma, while not one of the external pupils had the disease,

* See *Hygiene des Auges in den Schulen*, p. 170.

though they spent a great part of the day with the others. But is it really the air that does harm to those who sleep in such establishments, or not rather the common use of washing utensils, &c.? The latter appears to me to be much more probable.

Though vitiated air may not perhaps be able to communicate infection directly, yet it may very likely favour it. A sojourn in bad air brings on conjunctival catarrh and particularly the formation of follicles in the conjunctival sack. Every medical man knows the so-called hospital-catarrh, a catarrh of the conjunctiva, which attacks many patients who are long in hospital. Among the eyes of school-children, soldiers, &c., we find, besides the trachomatous, many suffering from catarrh. In the first half of 1870, many schools in Germany were medically inspected in consequence of a report that an epidemic of Egyptian ophthalmia had broken out in the schools. COHN, BECKER, MANZ, FOERSTER, SCHROEDER and others on this occasion examined a large number of school children.* They found only from 0.2°/₀ to 0.4°/₀ of trachomatous children, but on the other hand, in from 12 to 18°/₀ of the children examined, conjunctival catarrh and follicles were present, Trachoma is never spontaneously developed from these latter affections, but on the other hand such eyes are more susceptible of infection when the secretion of a trachomatous eye gets into them.

§ 51. As regards the disease among *soldiers*, the first accounts we have date from the period of Napoleon's Egyptian expedition. At that time almost the whole army (32,000 men)

* REYMOND made similar examinations in the Turin schools.

were affected by it, as also the British troops who were in Egypt. During the following twenty years the disease spread through almost all European armies. The French army was proportionately least affected, but on the other hand the disease soon became epidemic in all other European armies. From the copious literature upon this epidemic I shall extract only a few data, in order to give an idea of its prevalence. In the British army in 1818, there were more than 5,000 blind invalids as a consequence of this disease. In the Prussian army from 1813 to 1817, between 20,000 and 25,000 men were attacked, of whom 150 lost both, 250 only one eye. In the Russian army between 1816 and 1839, 76,000 men were affected, of these 876 lost one eye, 654 both. In Italy, of 1,500 soldiers attacked with the disease, 97 lost one eye, 49 both. In the Belgian army in 1840, there was one trachomatous soldier out of every 5; up to the year 1834, 4,000 soldiers had lost both eyes, 10,000 one eye. In Portugal, the disease first appeared in 1849, and then in rather a mild form. In 8 years 10,000 soldiers were affected, of whom only 55 were rendered quite blind. In 1848 the disease invaded Denmark, and in Copenhagen alone out of 6,171 men, 1,156 were affected.

At present trachoma no longer occurs in armies with such epidemical severity, but it still exists in them. Every year a number of new recruits are attacked by it; many of these return home uncured and spread the disease around them. Thus the standing armies constitute a permanent focus for the spread of trachoma, which is a real scourge in many countries.

Unfortunately we have no accurate data respecting those who get trachoma in the military service and return to civil life with the disease. We only know how many soldiers are invalided from this cause, but that is only a small portion of all those who are affected by it. REICH* gives the following data relative to the army of the Caucasus in which a periodical inspection of the soldiers is made. Among nearly 40,000 soldiers 2909 suffered from granular ophthalmia = 7.2°/₀, but among 3,401 recruits there were only 3°/₀ of cases, hence we infer that the remaining 4.2°/₀ first got the disease in the army.

As in the land army, so also in the navy granular conjunctivitis occurs: it has raged with much greater severity in the navy than in the army. According to UHLIK† in 1875 in the Austrian navy about every sixth man was affected with trachoma. The disease is also endemic in the invalid hospitals and in the military training establishments.

§ 52. From the army the disease spreads among *civilians*, by the dismissal of soldiers affected with it, by billeting, by war. In St. Hubert in Belgium, for instance, where trachoma was hitherto unknown, a severe epidemic broke out in 1874 after the billeting of affected soldiers; the following year the disease had spread to such an extent, that hardly any normal eyelids were to be seen among the population except among children and old people.‡

Among the civil population, those establishments where a considerable number of persons live together, are especially favourable to the spread of trachoma. Among these may be

* *Kaukasische medicinische Gesellschaft*, 1878, No. 26 (cited in NAGEL'S *Jahresbericht*).

† *Statisticher Sanitätsbericht der k.k. Kriegsmarine.* Vienna, 1877.

‡ DASTOT, *de l'Ophthalmie granuleuse dans les écoles.* Mons, 1878.

mentioned the orphan houses, foundling hospitals, infant asylums, schools, educational establishments, blind asylums, alms houses, work houses, prisons, refuges and asylums of various kinds, &c. Among the schools it is especially those where there are boarders which are subject to trachoma. In the following list I shall only adduce a few instances from the copious literature on the subject. In the English educational establishments BOWMAN found 59°/₀, NETTLESHIP between 50 and 60°/₀ of the children affected. In the poor schools of Holborn, according to BADER,* all the 500 children had trachoma. The same was observed by AGNEW in the New York Asylum for Children.† HAIRION found in 1840 in the Orphan Asylum of Mechlin among 66 orphan girls, 64 trachomatous ; in Mons, among 74 orphan girls 71 were affected.‡ In the Dublin workhouse, according to KIRKPATRICK, from 1849 to 1854, no fewer than 134,838 individuals were affected. In former times, when the disease broke out on board ship, as the proper treatment was not then so well understood, almost the whole crew were attacked. A slave ship, the *Rodeur*, had 22 sailors and 160 slaves on board. During the voyage the disease broke out; one sailor only escaped. When the ship reached its destination, 39 negroes and 12 sailors were quite blind, many others lost one eye or were seriously injured.§

Age is not without its influence on trachoma. Children and

* *Lancet*, 1877, p. 235.

† *The Med. Record.* New York, 4th July, 1882.

‡ DASTOT, l. c.

§ MACKENZIE, translated by Longier and Richelot. Paris, 1844, p. 309.

old persons are less subject to it than the intermediate ages. According to SAEMISCH,* 1151 cases of trachoma treated by him were distributed according to age thus:—

From	1 to 10 years	6.9°/₀
„	10 to 20 „	39.5°/₀
„	20 to 35 „	44.4°/₀
„	35 years and upwards	9.1°/₀

I have already mentioned that where many persons live together, it is their common use of various utensils that is chiefly responsible for the communication of the disease. The same is the case also outside such establishments. Want of cleanliness is one of the most important factors in the propagation of trachoma. This is much more frequently found among the poorer than among the well-to-do classes. Its great prevalence in certain countries, *e.g.*, in Oriental countries and in Ireland, may to a great degree be referred to uncleanliness and poverty. For the same reason certain races seem to be particularly subject to trachoma. In Constantinople, according to MANNHARDT, the Armenian porters, who are distinguished for their very dirty habits, are extremely liable to trachoma. In Finland, the Finns suffer much more from it than the Swedes, who are much better off in social respects. The great prevalence of trachoma among the Jews is well-known in Holland, as also in the Eastern parts of Europe.

§ 53. *Geographical extent.* Certain climatic influences are among the factors which favour the spread of trachoma. Other-

* *Handbuch der Augenheilkunde von* GRAEFE-SAEMISCH Bd. IV., p. 63.

wise it would be difficult to understand why some countries are so much more subject to the disease than others. This is so in countries in which the habits of life, cleanliness, &c., are very much the same, as for example in different parts of Germany.

As regards Europe, at the present time, trachoma is most prevalent in the Eastern parts of the continent. European Turkey, with the adjoining Danubian states, Greece and Russia are very subject to it. Thence it spreads to the Black Sea provinces of Russia, as also to the Eastern provinces of Austria and Prussia. In the Austrian dominions, Galicia, Hungary, Croatia and Dalmatia have the largest number of cases of trachoma; it is rarer in Bohemia and Moravia; in the German provinces of Austria, and particularly in the mountainous districts (Tyrol), it is almost unknown. In Prussia it is also the Eastern provinces, namely, Prussia, Posen and Silesia which suffer most from trachoma. In Middle and South Germany the disease is rare. We find it again in the Rhine valley, and in increasing intensity as we descend the Rhine. In the upper course of the Rhine, in Switzerland and Baden, trachoma is seldom seen; from the junction with the Main it begins to be more common, and attains an increased extension in Holland and the neighbouring Belgium.

Trachoma is not generally prevalent in France; more so in Spain; still more so in Italy, where it is very prevalent. Of northern countries Finland has a great deal of it, Norway and Denmark less, Sweden hardly any. In Great Britain it is universally prevalent, but much more so in Ireland (in America also the Irish emigrants are the chief sufferers from this disease).

Of non-European countries Egypt is the chief seat of the disease. It is found in like manner in all Northern Africa; in some parts of Algeria almost everyone has it. It diminishes in Egypt towards the south, and is rarely met with in Nubia. The negroes of Central Africa are pretty nearly exempt from it; but on the West Coast of Africa it is again common. There is very little trachoma in the Cape.

Asia is pervaded by trachoma throughout its whole extent. It is extremely frequent in Arabia, one-fifth part of the population is said to be affected by it. Both Indies, China, Japan and Siberia suffer very much from trachoma. The same must be said of the Polynesian Islands, whereas the Anglicised parts of Australia have very little trachoma. In North America, the Western States are more affected by it than the Eastern. It is immensely extended in Mexico and South America, except in the dominions of the Argentine Republic.

In what way climate influences the spread of the disease is not certainly known. Usually glaring sunlight, heat, dust and dry air are alleged to be the chief noxious agents (in Arabia, Egypt, &c.). But, on the other hand, we find it prevailing enormously in moist and foggy Ireland. Probably the height above the sea level has more to do with it; in Europe the mountainous countries (Switzerland) are free from it; in the Nile valley it becomes rarer the nearer we approach the sources of the river. On the other hand, there are mountainous countries, as for instance the Caucasus, where trachoma is very rife.*

* FALK gives a detailed account of the geographical distribution of trachoma in SCHMIDT'S *Jahrbücher der gesammten Medicin*, Vol. CLIX., p., 209, 1873.

All *races* are not equally liable to trachoma. No doubt, as I before observed, in judging of races we must bear in mind their degree of culture, and not put down as peculiar to race what depends only on want of cleanliness, crowded population, &c. BURNETT and KNAPP* allege that the negroes in North America enjoy almost complete immunity from trachoma; and the like is reported by travellers in Central Africa. As it cannot be asserted that the negroes are superior in cleanliness to the whites we must attribute this to a racial peculiarity.

§ 54. *Dangers of Trachoma.*—The epidemic of trachoma which prevailed almost all over Europe in the four first decades of this century was distinguished by its malignant character. The acute forms were by far the most frequent. The disease began with swelling of the eyelids, copious purulent secretion, and the cornea was soon involved. Hence the number of cases of blindness was disproportionately large. In the European armies on an average 0·5 to 0·8 per cent. of the soldiers attacked lost both eyes, a much larger proportion one eye only. Now-a-days the number of those who are rendered totally blind is much smaller. The disease assumes a more chronic form, giving the patient time to resort to medical aid. The knowledge of the disease and of its treatment is more generally distributed among medical men than was the case at the time of the invasion of the epidemic. COHN had among 1000 blind eyes 17 which had been destroyed by trachoma. MAGNUS found among 707 cases of total blindness examined by him, 2·2 per

* *Bericht über die Heidelberger ophthalmologische Versammlung*, 1881 p. 38.

cent. caused by trachoma. DAUMAS had among 1178 cases of blindness of both eyes 5·4 per cent. caused by trachoma, CARRERAS-ARAGO among 395 blind, 9·1 per cent. from this cause.

If we look only at the number of cases of blindness, we shall not obtain a right conception of the extent to which trachoma proves a scourge in many countries. In the chronic form of this disease, those affected by it are often for years incapacitated for work before turning blind, and no statistician takes account of those who after years of suffering do not become totally blind, but retain only very imperfect sight. What a great loss of working power does not that imply for a busy industrial country like Belgium, where, in 1830, one sixth part of the population were suffering from this disease (JUENGKEN).

§ 55. *Prophylaxis.*—The same may be said of trachoma as of the blennorrhœa of new-born infants: if sufficient care be exercised no one ought to lose his sight by it. The object of prophylaxis here also consists of two points: Avoiding communication and treatment of the affected persons.

The communication of the disease will be best prevented by stringent separation of the healthy from the diseased. Where this cannot be done, everything must be avoided that can effect the communication of the infectious matter from one person to another: living too close together, a common use of washing utensils, towels, &c. Good ventilation of localities occupied by many persons is imperative for other reasons, though we may not believe in the miasmatic origin of trachoma. In addition to this, those affected with the malady, and those who come in contact with them, should be enlightened as to the infectious character of the disease.

It is of great importance to continue the treatment of the diseased until they are completely cured. In consequence of the extremely chronic character of the disease, this is very rarely attended to.

I will now proceed to show in detail how these requisites of hygiene are to be carried out in the army, in civil establishments, and among the people.

I. THE ARMY.

In almost all countries where trachoma is rife, there exist special regulations relating to trachoma among the military class. The most thorough and the best of these are to be found in Belgium, in whose army trachoma is most prevalent. Many of the points I am about to propose agree with the existing regulations, therefore I will not repeat them in this place. The particular points to be attended to in the promulgation of such regulations are the following :—

1. Before all things it is necessary that *military surgeons* should have a thorough knowledge of this disease. The duty of the military surgeon is not only to treat the trachomatous, but also to determine what trachoma is and what it is not. In order to be able to do this, he needs not only theoretical knowledge but also considerable practical experience.

2. *Recruiting.*—Should trachomatous recruits be received or rejected? In the German army they are rejected, in the Belgian accepted, provided they are not too severely affected. I think that some latitude should be allowed in this matter. In countries

where trachoma is extremely prevalent, as, for example, in Belgium, we should be unable to raise the required number of men in certain provinces at least, if we were to reject all the trachomatous. Moreover it is to be feared that many conscripts would purposely inoculate themselves with trachoma in order to escape military service. In such countries the severe forms of trachoma (with pannus, &c.) should be rejected, but the slighter cases should be accepted. Trachomatous recruits ought not to be brought among the healthy soldiers, but should be put where trachomatous soldiers are kept.—In countries where little trachoma exists, it seems to me to be better to prevent the infection spreading in the army by rejecting all those affected with trachoma.

3. It is essential to avoid overcrowding in *barracks*. Twenty-five cubic metres of air-space per man should be regarded as the minimum. Provision should be made for good ventilation. In former times greater importance was attached to the disinfection of the wards, as trachoma was held to be mainly due to miasmatic influences. This is no longer the case, and a special disinfection does not appear to me to be necessary. But, for other hygienic reasons, it is advisable to clear out every barrack ward once or twice a year, for a week or two, in order that it may be thoroughly ventilated and whitewashed.

For washing purposes the soldiers should, if possible, have at their command a sufficient supply of cocks with fresh flowing water. When this is not practicable, each soldier should have his own basin and by all means his own towel. In the Belgian army every soldier carries his own basin in his knapsack.

4. A regular *medical inspection* of the soldiers' eyes is of great importance. This must be done thoroughly, that is, the lids must be everted. This is all the easier to do as in most armies the soldiers are at any rate examined once a week for venereal diseases. In countries where trachoma is endemic a weekly inspection of the eyes is obligatory (first introduced in the Belgian army); where trachoma is rare an inspection once a fortnight or once a month will suffice.

In Belgium there is besides this excellent arrangement, that every soldier on applying for furlough is examined, and it is only granted to him if he is free from trachoma. In like manner he must at once be examined on returning from furlough.

5. *Treatment of the trachomatous.*—A separation as complete as possible of the trachomatous from the healthy is the first requirement of hygiene.

How can this be effected? The severe cases, that is to say all those whose cornea is affected or who have a profuse discharge, must be sent to hospital. In this there ought to be special wards for the trachomatous, and the intercourse between trachomatous and other patients must be carefully supervised. For a long time there was a central hospital in Louvain in Belgium under HAIRION for the severe cases which seemed to require a lengthened treatment. The trachomatous patients were either kept in the hospital until completely cured or until so far advanced in recovery that they might be allowed to mingle with the slighter cases.

The slighter cases constitute the great majority, and their treatment offers greater difficulties. To these belong the recruits slightly affected with trachoma, as also those soldiers whom the weekly inspection shows to be trachomatous. In the Belgian barracks there are special wards for trachoma to which these soldiers are relegated. The occupants of these wards are placed under medical treatment, do not attend drills, and are not allowed to go out. This system has some disadvantages. The contact of healthy and diseased soldiers is not completely avoided; the diseased soldiers are deprived of fresh air and exercise which are very necessary for the trachomatous. For those armies which have many trachomatous soldiers it would be much better to bring them all together (except the severe cases) in one barrack. This ought to be situated in a healthy locality, free from dust, and where possible in a hilly situation; the soldiers should be under medical treatment and in addition they should go through the military exercises, but not to a very fatiguing degree. The establishment of such barracks has been recommended by others (PELTZER, FIALKOWSKI). With suitable arrangements such barracks may also be used in winter.

6. *Dismissal from Service.*—No trachomatous soldier should be allowed to quit the service, in order that he may not spread the disease in his home. In consequence of the long duration of the treatment of the disease it may be feared that thereby a great burden would be imposed on the State. But if the regulations concerning trachoma are strictly carried out, this would not be the case. In recruiting only the slight cases would be accepted and at once put under treatment; in the weekly inspection every fresh case of infection would be immediately detected and subjected to treatment; thus severe and long lasting cases

would be only exceptionally encountered. Only those cases in which there is a considerable discharge should be kept back, the others might be sent home. But it often happens that a trachomatous subject does not put himself under treatment because he has no discharge and suffers no inconvenience, and a few weeks later he gets a fresh relapse with copious discharge. No trachomatous person is safe until he has been thoroughly cured. The following precautions seem to me to be needful :—

(a) For Countries with much Trachoma.

1. In recruiting only the slight cases should be accepted and immediately put under treatment.

2. In the barracks there should be at least 25 cubic metres of air space per man. The wards must be well ventilated and stand empty and be whitewashed for a fortnight per annum.

3. Every soldier should have his own washing basin and his own towel; where practicable running water should be used for washing.

4. A medical inspection of all soldiers should be made once a week. Further, every soldier going on furlough and returning from furlough should be inspected. No furlough should be granted to a trachomatous soldier.

5. Severe cases of trachoma should be sent to the military hospital, and treated there in special wards. The slighter cases should be put all together in a barrack, and there treated. Where this is not possible, there must be special wards for the trachomatous; intercourse of these soldiers with healthy ones should as far as possible be prevented.

6. No trachomatous should be allowed to quit the military service until quite cured.

(b) For Countries with little Trachoma.

1. In recruiting all trachomatous subjects should be rejected.

2. Medical inspection of all soldiers should be made every four weeks; all soldiers returning from furlough should also be inspected.

3. Everyone suffering from trachoma should be sent into hospital and treated there until thoroughly cured.

4. No trachomatous soldier should be dismissed from military service until he is thoroughly cured.

II. CIVIL ESTABLISHMENTS.

§ 56. As regards civil establishments, there is a difference between such as have boarders and those that have none. It is in the former especially, where trachoma occurs endemically, that its spread is promoted by sleeping and washing in common. Establishments with boarders are foundling hospitals, infant asylums, educational and orphan homes, many schools, blind institutions; then, again, workhouses, prisons, almshouses (to these belong the military invalid establishments), hospitals, &c. For these establishments the same principles are applicable as for barracks. Modifications are of course required according to the arrangement and object of the establishment and the character of their occupants. It makes a difference whether trachoma is or is not prevalent in the neighbourhood.

I subjoin a brief statement of the prophylatic measures that are applicable to establishments with boarders.

1. The establishment must fulfil the general requirements of hygiene; sufficient air space in the wards, a good ventilation, &c. It is very important that the ablutions of the residents should be performed either with running water or that each should have his own basin, and, of course, each should have his own towel. It has been positively ascertained that many epidemics occurring in such establishments have been caused by infection by means of washing water and towels.

2. Every candidate for admission into the establishment should be subjected to medical inspection in regard to the state of his eyes. If the purpose for which the establishment exists allows of it, the trachomatous should be rejected; if they are received, they must be treated in the manner I am about to relate.

3. In places where trachoma is endemic, frequent medical inspection should be instituted; if necessary, once a week.

The inspection should be made of all the residents in the establishment except the officials; but the inferior class of these (servants, nurses, &c.) should be inspected. In places where trachoma is rare, these inspections should be made at longer intervals. As most establishments have their own medical officers, such inspections may be easily arranged. When this is not the case, it should be obligatory on the authorities of the establishments to have every resident suspected of an eye disease medically examined.

4. The separation of the trachomatous from the healthy is a matter of the greatest difficulty. In establishments where there

are very many trachomatous there ought to be a separate department for them, so that they should not come in contact with the healthy. At Mons, in Belgium, when trachoma was very prevalent there, a special *école infirmerie* was arranged for the trachomatous children. In this school these children were educated, and at the same time subjected to medical treatment.* The following arrangement might be made: in each category of establishments a department might be devoted to the reception of the trachomatous residents. Thus, for instance, one of the orphan houses of the country might be arranged for trachomatous orphans, who should be transferred hither from all the other orphan houses. The same might be done for all the other establishments, such as prisons, almshouses, &c.

In many cases a complete separation of the trachomatous from the healthy is not possible; either from external causes, or in consequence of the small number of the trachomatous such a stringent rule may not seem to be absolutely necessary. What is to be done under such circumstances? Those cases where there is a great discharge must not be allowed to mingle with the healthy; they should go to the hospital. Those cases where there is little or no discharge might in my opinion be allowed to associate with the healthy during the day, in the same school-rooms, working rooms, &c. In the examinations of the German schools by COHN, MANZ, &c., which I have mentioned above, it was shown that in all the schools there was a small number of trachomatous children (2 to 4 per mille), from whom however the disease was not com-

* DASTOT, *de l'Ophthalmie granuleuse dans les écoles.* Mons, 1878.

municated to the other children. The greatest danger, as I believe, is incurred by sleeping together. Therefore the trachomatous should have separate sleeping apartments, and the greatest care should be taken not to allow trachomatous subjects to be iutroduced into the sleeping apartments of the healthy; but healthy and diseased might perform their day work together.

6. Under no circumstances should uncured trachomatous cases be sent home, where not only would their eye disease be neglected, but they might communicate the disease to their families. For this reason the breaking up of an establishment, which used formerly to be adopted, is objectionable. Instead, however, of keeping the trachomatous in the establishment until they are cured, it would be better to send them into convalescent institutions, where such cases, under the influence of good air and moderate exercise, are much more quickly cured.

As regards day scholars or pupils, they run no risk of infection in the school, if the cases with much discharge are excluded. The supervision of the eyes of day scholars and boarders is one of the most important duties of the school doctor. I have given some hints respecting the organization of such institutions when treating of school-myopia. As regards trachoma, the duties of the school doctor are the following:

a. Regular inspection of the eyes of the school children, the frequency of which should be determined by the prevalence of trachoma in the locality; those suffering from eye affections should be pointed out to the doctor by the teacher.

b. The school doctor decides whether the trachomatous scholar should be allowed to pursue his studies or not. The former should only be permitted to the slight cases without discharge.

c. All diseased scholars should be obliged to submit to medical treatment. The parents of the scholars should be made responsible for their regular treatment. There should be penalties for the parents' neglect, just as there are now for non-attendance at school in those countries where compulsory education exists. The treatment of the affected children may be carried out by the school doctor. If the parents prefer to have their children treated by another medical man (the family physician or a specialist) they should be free to do so. But in that case they should be obliged to get a certificate from the physician they employ, to the effect that the child is under his regular medical care.

d. In all cases the school doctor should alone decide when the child should again be allowed to receive instruction in common with the others.

e. On the breaking out of an epidemic of trachoma it will be necessary to shut up the school. In countries where there is much trachoma parallel schools for the trachomatous may be established as at Mons.—The school doctor should furnish regular reports containing the results of his examinations.

III. THE GENERAL CIVIL POPULATION.

§ 57. The treatment of trachoma among the civil population is attended with the greatest difficulties. The trachomatous are often prevented from obtaining regular treatment by their distance from the doctor, by their occupations or by carelessness. Moreover the treatment is such a long affair, that even the most persevering sometimes get impatient. Hence many authors have declared that all efforts in this direction are in vain. I do not go so far as that, on the contrary I think the following rules are calculated to effect a diminution of trachoma.

a. It should be the duty of the physician to report to the sanitary authorities either all trachomatous patients or at least those who in consequence of great discharge or other circumstances are liable to spread the disease. Medical practitioners are obliged to do something similar respecting many infectious diseases. I do not doubt that such a regulation is capable of being carried out. We could not indeed expect that every trachomatous patient should be conscientiously reported by his medical attendant. Thus the wealthier patients of private practice would often enough fail to be reported ; but in these cases it is less important than in the poorer classes. On the report of the attending physician being received the parish doctor should visit the patient. If he lives in a family the other members of his family should be examined, and if any of them are found to be affected they should be warned of the serious character of the disease, and the necessity for its treatment. They should be told how to avoid communicating the disease. If the patient resides in a lodging-house, a crowded locality, or the like, the other occupants of the room should be examined and the necessary information imparted to them. The landlord of the lodging-house should see to it that each of the occupants has his own washing apparatus. If this precaution is neglected or if the locality does not come up to the standard of hygienic requirements, there are laws under which proceedings may be taken against the landlord.

b. The treatment should be facilitated to the patients as much as possible, by the establishment of dispensaries, &c., respecting which I shall have something to say hereafter. For cases with profuse discharge, which are particularly dangerous to their neighbours, it might perhaps be advisable to make their medical treatment compulsory.

(b) Diphtheric Conjunctivitis.

§ 58. Diphtheria of the conjunctiva attacks as a rule children under 10 years of age. The cases are divided into two groups according to their origin. The cases of the first group are produced by an increase of conjunctivitis. This latter may be of catarrhal nature; those catarrhs that accompany measles and scarlatina sometimes take on a diphtheric character. But the acute blennorrhœa of newborn infants and that of adults may also become diphtheric. The form it assumes in such cases is the patchy kind. These cases occur sporadically, and are usually of the less severe kind.

The cases of the second group are referable to infection by the diphtheric poison, hence they often occur epidemically. These are usually the severe cases. There is often simultaneously present diphtheric inflammation of the fauces and larynx with severe general illness, so that not only the eyes, but the life of the children are in jeopardy.—The diphtheric contagion is allied to the cases of the first group; so that it is chiefly in countries where diphtheria is endemic, and at the time of an epidemic of diphtheria that other conjunctival inflammations show a tendency to become diphtheric.

Epidemics of diphtheria were principally observed in VON GRAEFE'S clinic in spring and autumn.* EMMERT in arranging the answers to the enquiries he sent out, found that the maximum of cases occurred in January (24 cases), the minimum in August (12 cases).†

Like trachoma, diphtheria prefers certain localities, and spares others. It is met with most frequently in North Germany, where also diphtheria of the respiratory organs is most rife. In Middle and South Germany it is rare; the same is the case in all other European countries; Holland alone seems to be an exception. In the following I give a short account of its prevalence in some countries. I have purposely only taken statistics where the figures are large, as the disease is rather rare, and in a small number of patients accident plays too great a part.

Country.	Town.	Author.	Total number of patients.	Cases of diphth. per mille.
Germany	Königsberg	Jacobson	10,000	6.2
	Berlin	Hirschberg	21,440	2.0
	Berlin	Schöler	10,000	0.6
	Düsseldorf	Mooren	108,416	1.1
	Leipzig	Coccius	7,898	0.2
	Heidelberg	Becker	7,547	1.2
	Stuttgart	Berlin	9,827	1.2
Holland	Utrecht	Donders‡	—	2.3

* SAEMISCH, in the *Handbuch der Augenheilkunde von* GRAEFE *und* SAEMISCH. Bd. IV., p. 106.

† *International Medical Congress* held in London in 1881.

‡ DONDERS' statistics refer to the years 1870—73, and include 3000 patients.

Austria ...	Vienna	... Adler	...	12,000 ...	6.2
France ...	Paris	... Fieuzal	...	34,577 ...	0.4
England...	London	... Moorfields Hospital	...	22,130 ...	0.2

As regards Austria, which is remarkable for its large proportion, I should state, that until some twelve years ago, diphtheria, whether in the eyes or throat and larynx, was almost unknown. In the beginning of 1870 the disease began to spread from Germany into Austria and assumed the form of a severe epidemic. ADLER'S report given in the above statistical table includes several such epidemic years: 1874 alone furnished forty-six cases.

Diphtheria is a disease that is very dangerous to the eyes, quite apart from the fact that many children succumb to the general illness accompanying it.

HORNER states that

Under v. GRAEFE,	out of	46	cases	9
„ HIRSCHBERG,	„	94	„	35
„ JACOBSON,	„	22	„	5

eyes were totally blinded, whilst many eyes were much injured. According to the statistics of blind persons furnished by COHN, diphtheria was the cause in 0.3 °/₀ of all blind cases, MAGNUS gives nearly the same figures (0.356 °/₀).

The *prophylaxis* of diphtheria demands still greater care than that of acute blennorrohœa. The diphtheric infection may be effected without direct communication of the secretion. When therefore one child in a family falls ill of diphtheria, the other children should, if possible, be removed, and only those should remain who are required for attendance on the patient. Hence, treatment in a hospital is imperatively necessary in the case of poor people. As in the case of many infectious diseases, so in this disease the transference of the patient to a hospital should be compulsory, whenever the necessary nursing cannot be carried out at home. There should be separate rooms for diphtheric patients in the hospitals, otherwise there will probably happen what ADLER observed in a children's hospital during an epidemic, where diphtheria spread from bed to bed. The greatest precautions should be exercised by physicians and nurses to prevent the diphtheric secretion getting into the eyes; especial care is required to obtain good ventilation. During the epidemic of diphtheria in the Vienna children's hospital just alluded to, all the assistant physicians and eleven nurses who had to do with the affected wards got inflammation of the conjunctiva, which was however of a slight character and passed off in a short time without bad effects.

When one eye is already affected the other eye must be protected from infection by a bandage that occludes it completely. In one case ALFRED GRAEFE arrested the disease when profuse secretion was present, by brushing over the conjunctival sack a one per cent. solution of carbolic acid and covering the eye with a bandage also soaked in the carbolic solution.

Part VI.

Influence of the Occupation on Eye-diseases.

§ 59. The affections caused by the occupation are partly non-traumatic, partly traumatic. The principal of the former is myopia. Myopia is the malady of the learned professions. But certain trades also bring the eyes in danger of becoming short-sighted. To these belong all trades which require minute and long continued looking at objects close to the eyes. COHN examined a large number of artisans in Breslau for short sight. He found among the

Watch-makers	9.7 °/₀	of myopes
Gold and silver workers	12 °/₀	"
Lithographers	45 °/₀	"
Compositors	51 °/₀	"

EMMERT found a larger proportion of myopes among the watch-makers; in four Swiss watch-makers' schools the proportion of myopes was 14 °/₀.* MOTTAIS† examined 97 compositors, of these 51 were short-sighted. With these data the list of trades conducive to myopia is by no means exhausted; to it

* NAGEL'S *Jahresbericht* for 1877, p. 368.

† *Hygiène de la vue chez les typographs.* Paris, 1883.

may be added tailors and seamstresses, shoemakers and many other artisans.

TSCHERNING arranged in six classes 7,523 persons examined by him, according to the demands made by the occupation of each upon the eyes. The number of the short-sighted rises from 2°/ₒ in the lowest class, to 32°/ₒ in the highest.

It is remarkable—especially after COHN'S investigations—that there are so few short-sighted individuals among the watch-makers and workers in gold. COHN says this is mainly owing to their employment of a lens which renders both accommodation and convergence during work superfluous. This gives a hint as to how such artisans may protect themselves from short-sightedness, they ought to use the lens diligently.

Good illumination of the work-shop is of the greatest importance. The rules laid down for the lighting of schools are generally applicable here. The light should come in sufficient quantity and from the proper side. In many large factories more care is exercised as regards lighting than in most schools. The new factory buildings are mostly provided with numerous windows or with roof-light; the electric light has been very often introduced as the artificial illuminant; the older factories often leave much to be desired. Printing establishments in particular are often in very dark localities, and this may be the cause of the large number of myopes among compositors; still worse is it, as a rule, in the work-rooms of artisans working by themselves. Good work-rooms and good methods of illumination are very necessary. I shall recur hereafter to this subject.

Of non-traumatic eye diseases, I may mention here those caused by lead-poisoning, of which I have already spoken. The blepharitis and conjunctival catarrh so often caused by the occupation, the nystagmus of miners, &c., do not seriously endanger the sight and so need not be treated of here.

Abscess of the cornea (hypopionkeratitis, ulcus serpens) occupies a middle place between spontaneous and traumatic eye diseases. In most cases a slight injury gives the impulse whence, with the concurrence of other factors, the abscess is developed. Of such factors I may mention in especial the presence of infectious germs in the conjunctival sack (conjunctivitis, dacryocystoblennorrhœa) as also great heat. It is well known that abscess of the cornea is particularly prevalent in summer. EMMERT* has shown that it has its maximum in August (411 cases), its minimum in December (191 cases). Hence it is so frequently met with in reapers who work during the hottest days of the year, and are subject to frequent small injuries to the eyes (by the beard of the corn)—(kératite des moissoneurs).

Abscess of the cornea is by no means a rare disease. According to HIRSCHBERG'S statistics,† it constitutes 0.5°/₀ of all eye diseases. It is more frequently encountered among country folk than among town folk. MARTIN‡ found that among the former 67°/₀, among the latter only from 8 to 10°/₀ of the cases of blindness were caused by abscess of the cornea. Many circumstances contribute to this result. This kind of injury (superficial scratching of the cornea by ears of corn, branches, &c., seems

* *London International Med. Congress*, 1881.

† *Beiträge zur praktischen Augenheilkunde*, 1878, p. 102.

‡ *Association Française*, &c., Session à la Rochelle, 1882.

to be particularly dangerous in this respect), the frequency of chronic catarrh of the conjunctiva, neglect of the disease in the commencement. In abscess of the cornea speedy and energetic treatment is attended with a success such as few other diseases can show. The number of eyes lost by abscess of the cornea would be much diminished if on the one hand the intelligence of country people were greater, and on the other if they could more easily obtain medical aid.

There is no actual prophylaxis of abscess of the cornea, unless it be the treatment without delay of chronic affections of the conjunctiva and lacrimal sack; accidental injuries that are the exciting cause of the abscess cannot as a rule be avoided.

§ 60. *Injuries* to the eye in the narrower sense of the term are very frequent causes of blindness. FIEUZAL* had among 300 blind persons in the Hospice des Quinze-Vingts in Paris, 9.8°/₀ of blindness from injuries. Other records agree very nearly with this. MAGNUS in his tables, makes the proportion of traumatic blindness 8.5°/₀. Among the blind persons in Austria, the cases due to injuries come to 7.9°/₀ (about 1 in 20,000 inhabitants). Much more numerous are the cases of blindness of one eye from injuries; according to COHN they constitute 24.2°/₀ of all (one-sided) blindness. Many of these unfortunates live in constant danger of losing the other eye by sympathetic inflammation.

Blindness occurs either by direct injury to both eyes (simultaneously or successively) or by the injury of one eye causing sym-

* *IV. Congrès d' Hygiène.* Tome I., p. 218.

pathethic disease of the other. The former category comprises $4\,^{\circ}/_{\circ}$, the latter $4{\cdot}5\,^{\circ}/_{\circ}$ of all cases of blindness (MAGNUS). The injuries are produced either by the occupation, or by accident, or by carelessness, or by design on the part of others. Among men, the blindnesses caused by the occupation are the most numerous, among women and children those owing to accident or carelessness. The injuries which destroy both eyes simultaneously occur chiefly whilst engaged in the occupation; explosions of gunpowder, burning with lime, injuries caused by fire-arms, &c. According to MAGNUS 4-5ths of all the cases where both eyes are simultaneously injured are caused by the occupation.

The several kinds of occupation vary very much in regard to this danger. COCCIUS gives the following list of injuries to the eye observed by him in 1868 and 1869:*

Locksmiths	156
Handicraftsmen	67
Masons	43
Smiths	23
Machine makers	22
Millers	18
Carpenters	14
Stone-masons	8
Metal turners	6
	357

These figures are too small to allow us to form definite conclusions, but they give a good idea of the danger *e.g.*, of the lock-

* Quoted by MAGNUS, p. 197. I have put both years together.

smith's trade.—Two large categories of injuries are not included in this list: injuries received in war, which are injuries incident to an occupation, and injuries to miners. The latter are extremely common in coal mining districts.

In the injuries incident to occupation, carelessness and inexperience of individuals have much to do with their production. Hence, children employed in factories are very liable to injuries. This is evident from the following little table, given by LAYET, where the frequency of injuries in general are given among workpeople of different ages. Of 100 injuries, there were—

Among children under 15 years old	41
„ workpeople from 15 to 25 years old ...	36.4
„ „ „ 25 to 40 „ ...	13.1
„ „ „ 40 to 60 „ ...	9.5
	100.0

It is easy to understand that children will supply a large contingent of the injuries caused by accident. Their liability to injuries is promoted by the heedlessness of parents, who allow them to play with dangerous toys, such as percussion guns and such things. SEIDELMANN* had, among 233 cases of blindness, 40 caused by injuries incurred by children in their play.

I shall now proceed to consider the several kinds of injuries.

a. Injuries to the eyes by *burns.*—Among these are reckoned not only the injuries caused by the contact of the eye with heated bodies or with flame, but also the injuries caused by

* *Zur Aetiologie und Prophylaxe der Erblindungen.* Inaug.-Dissert. Breslau, 1876.

corrosive substances, such as lime, strong acids, &c. The most frequent of these are the injuries caused by lime or mortar; in the list given by COCCIUS of injuries caused in this way masons contribute 12°/$_{\circ}$.

b. Injuries by *foreign bodies.*—These constitute the majority of injuries. The small metallic particles which fly off as sparks when iron is hammered, &c., when they hit the eye, often remain sticking in the cornea. They are usually removed from the eye more or less skilfully by some workman in the factory. The numerous cases which come to the hospital constitute only a small part of those that daily occur. Besides metallic particles, fragments of stone are a frequent cause of these superficial injuries among stone-breakers, stone-masons, millers, &c. Among workpeople who grind metal (steel) on stones, we often find a particle of metal in the cornea in place of the stone particle we might have expected.

When the foreign bodies are larger and impinge upon the eye with greater force, they perforate its membranes and penetrate into the interior of the eye. Eyes injured in this manner are generally lost, and, moreover, they are very apt to occasion sympathetic ophthalmia.

Injuries by foreign bodies are much more frequently met with among workers in metals. In the table given above of 357 injuries (severe and slight together) which COCCIUS observed in two years, 207 (58°/$_{\circ}$) occurred among workers in metals. Of 783 severe injuries to the eye in the Munich clinic, 183 (33°/$_{\circ}$) occurred among workers in iron, 127 (16°/$_{\circ}$) among workers in stone.

The investigations of COHN are very interesting. He states that every single one of the 1,283 workers in metals from six factories, examined by him, suffered two or three times a year from injuries to the eye. About one-half of those injured (633) were compelled to seek medical aid; of these, 36 (2.8°/₀ of the total number) were partially deprived of sight; 16 (1.2°/₀) lost the sight of one eye totally. On carefully examining the cornea of one of these workmen who come to the hospital on account of a foreign body in the eye, we may often find about a dozen small point-like opacities in the cornea, which have all been caused by foreign bodies. Very little is wanting to cause such a foreign body to penetrate the cornea or sclera and so bring the eye into great danger.

c. Injuries from *explosive substances.*—Most of such injuries are caused by the explosion of a powder mine. They are often characterised by a combination of burn and injury by a foreign body. The foreign bodies found are grains of powder, as also particles of the exploded material, stone, sand, coal, &c.

Injuries by gunpowder are usually much more dangerous than simple injuries by foreign bodies, not only on account of their greater intensity, but also because they generally involve both eyes. As injuries by foreign bodies are frequent in the districts where there are iron manufactories, so injuries by gunpowder are most common in coal mining districts. According to LAYET, of 106 persons rendered blind by injury in Liege (1832-38), 60 of them lost their sight by gunpowder explosions in coal mines. This we can easily understand, when we are aware of the incredible carelessness sometimes displayed by miners.

Injuries by explosive substances are met with in manufactories where they are made, among persons who have to do with fireworks, among gamekeepers, &c. Children furnish a large number of the injuries caused by explosives. Sometimes they secretly obtain the explosive substances, like percussion caps, &c.; sometimes they are given to them as toys (percussion-cap toy-pistols, fulminating preparations, &c.) BOISSONEAU, the well-known Paris manufacturer of artificial eyes, found that among 3,984 persons who applied to him about an artificial eye, 939 had lost their eye in childhood. Of these, 343 had their eye destroyed by letting off percussion caps, or by fire-arms. I may mention here that exploding toys are not the only dangerous ones. Pea-shooters and catapults, the missiles from which hit the eyes of the companions of the children who use them are frequent causes of loss of sight.

d. Injuries by *blows, thrusts, pricks, &c.*—These injuries are generally caused by accident, which cannot be foreseen and consequently cannot be avoided. They are not, therefore, like the injuries by foreign bodies in the narrower sense of the term, attributable to definite occupations. In the country, cows are often the cause of such injuries, by thrusts of their horns or blows with their tails when being milked. Such injuries are frequent among children, who incur them themselves, or cause them in others. Finally, most of the injuries purposely inflicted belong to this category.

e. Injuries incurred during war.—The following table, given by REICH,* shows the frequency of injuries of the eye in proportion to the total of the wounded :—

* ZEHENDER'S *Klin. Monatsblätter*, 1879, p. 98. I have modified the

	No. of all the Wounded.		Injuries to the Eye.		Per Mille.
American Civil War ...	408,072	...	1,190	...	2.9
German-French War ...	75,321	...	464	...	6.1
Armenian War ...	13,091	...	290	...	22.1

This table does not show how many eyes were so seriously injured that they were destroyed.

As regards blindness from injuries received in war, COHN* gives the following data:—In the Italian-Austrian war (1859) there were 55 cases of shot-wounds of the eyes, with 19 cases of blindness of both eyes; in the Crimean war 46 eyes, in the last English campaign in India 13 eyes were lost.

About one-half of those who are blinded by injuries, lose the second eye not by the injury itself, but by sympathetic ophthalmia. This occurs, as is well known, almost exclusively after injury to one eye. It is a constant source of danger to those who continue to retain an eye blinded by injury (especially when it is shrivelled up). Though we are unable to prevent most injuries, we can usually ward off the sympathetic ophthalmia. Every case of sympathetic blindness is the fault, sometimes of the physician, who has not perceived the threatened danger in time, but much more frequently of the patient, who has sought medical aid too late, or has refused to submit to the proposed operation.

Blindness also comes on after injuries which do not affect the

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table so as to give for all the three wars the percentage of eye-injuries to the total number of the wounded. The high percentage in the Armenian war is owing to this, that it is based on the observations of an oculist (REICH) who noted the most unimportant injuries to the eye.

* *Schussverletzungen des Auges*, Erlangen, 1872.

eye directly, but the skull. Such cases, according to MAGNUS, constitute 0.27°/₀ of all cases of blindness. The mode in which injury to the skull leads to blindness is very various; in many cases BERLIN* has demonstrated that fractures of the bone, especially in the optic canal, are present, which cause bruises and lacerations of the optic nerve.

§ 61. *Prophylaxis of injuries.*—Those injuries that are caused by accidents or by human malice cannot be foreseen and hence cannot be provided against. The same may be said of injuries incurred in war. Prophylaxis is chiefly possible for those injuries that are the consequences of certain occupations. This prophylaxis is made up of the following points:—

1. In manufactories where explosive matters are made, in magazines where such substances are stored and sold, strict rules should be enforced in order to prevent the danger of explosions as much as possible (prohibition of smoking, arrangements about lighting, &c.).

2. The flying off of small particles in the working of metals and stone cannot be altogether avoided. Therefore, the workman must protect his eyes by *spectacles*. These should be sufficiently large to protect the eyes not only in front, but at the sides. Glass, as being too brittle, may be replaced by fine wire-net or mica (COHN). All spectacles have this disadvantage—that they soon become dirty from dust which is deposited on them, from the workman's perspiration, &c. This is especially the case with the wire-net, the fine holes of which soon get

* *Versammlung der ophthalmologischen Gesellschaft zu Heidelberg*, 1880.

stopped up. The workman sees but dimly through the dirty spectacles, and leaves off wearing them. This is why, with few exceptions (stone-breakers), workmen cannot be persuaded to wear spectacles. For some time I presented every workman who came to my clinic on account of a foreign body in the eye, with a pair of protective spectacles, until I became convinced that they were not used by these workmen, not even by those who had already lost one eye and should have become wiser by experience.

If workpeople are not prudent enough to protect their eyes by spectacles there is nothing to be done but to make the wearing of them compulsory. There can be no doubt that the State has the right to do this just as it frames regulations with respect to other dangerous manipulations. When such a regulation has been strictly enforced for some time the resistance to it ceases. The workmen regard the wearing of spectacles as something quite reasonable, as *e.g.*, they now do the wearing of respirators in certain factories, &c. The means to be employed to get the workmen to wear spectacles are:

a. Direct order of the government compelling the proprietors and directors of factories under penalty to insist on those of their workmen for whom it is necessary wearing spectacles.

b. The accident assurance companies in which the workmen insure themselves or are insured by the proprietors of the factories, should not take on any workman who does not wear protective spectacles—of course if the nature of his work requires them.

I shall show hereafter how necessary it is to make the employer to a certain extent pecuniarily responsible for his workmen's injuries. If this were the case then the employer in his own interest would take care that the eyes of his workpeople were protected.—MAGNUS very properly says that one-eyed workmen should not be employed in occupations which jeopardise the eyes. In certain operations (puddling, hammering, stirring up the molten iron) when the whole face requires to be protected, a mask made of fine wire net might, as LAYET proposes, be worn over the face.

3. With regard to children's toys, the most dangerous sorts should not be allowed to be sold. As the authorities forbid the sale of toys painted with poisonous colours, so they are entitled to do the same with regard to toys dangerous in other ways. To these belong in especial such as consist in part of explosive preparations, like percussion pistols, pea-shooters, and the like, as also sharp pointed missiles for cross-bows or blow-tubes.

4. In many cases of severe injury the eye may be saved if medical aid is obtained in time. In recent times the employment of the magnet has extended the range of such cases. On the other hand many injuries to the eye which are comparatively slight cause the eye to be lost if they are neglected. The maintenance of the injured eye in a condition where the sight is preserved and inflammation warded off is the best protection against sympathetic ophthalmia of the other eye. Therefore it is of great importance that the injured workman should at once resort to medical aid and remain as long as necessary under treatment. In large manufactories there is usually an appointed medical man. When there is no appointed medical man, the workpeople must apply to some other doctor who may live at a distance from

the factory. In either case the workman will often refrain from resorting to the doctor for fear he might lose his wages if he discontinued his work. This is all the more likely to happen should the workman be required to abstain from work for a considerable time for medical treatment. He runs the risk of subjecting his family to privation and hunger.

The withholding of the workmen's wages in such cases is done in various manners according to local conditions. In the larger establishments a certain proportion of the wages (usually one-half) is paid to the sick workman for a certain time. In other cases this is done by a sick fund to which the workman is affiliated. But very often neither of these methods exists; thus employers of labour on a small scale often pay no wages from the day on which the workman is injured and unable to work. Hence it happens that the workman goes on working in spite of his injury as long as he can, and thus exposes his eye to the greatest risks. In this there lies a great social evil; this is diminished if the workman is a voluntary member of sick and benefit societies, but this does not entirely do away with the evil. Here it seems to me the interposition of the law is required, either by compulsory insurance against accidents, or by making the employer responsible for injuries to his workmen, as is practised in some states.

Sympathetic ophthalmia is amenable to prophylaxis if taken in time, more than any other disease; enucleation of the injured eye as long as the other eye is perfectly sound, secures almost absolute protection. No doubt sympathetic ophthalmia sometimes comes on only after enucleation, but this is an extremely rare event. I have only met with fourteen such cases in medical literature.* The sympathetic inflammation occurred in these on the second to the thirty-fifth day after enucleation, but all these cases recovered with two exceptions. Thus they were of a very mild character, so that even in them the good influence of enucleation was manifest.

Enucleation is easily performed, so that every practical surgeon can undertake it. This alone is a strong reason for preferring it to other operations more difficult of performance, such as neurotomia optico-ciliaris. Another reason for preferring enucleation is that the last-named operation even when well performed does not secure the perfect protection that it would seem to do from the published accounts of some cases.† Therefore enucleation should be performed in all cases where the injured eye has lost the sight or will inevitably do so, and where the possibility of a subsequent sympathetic inflammation of the other eye is to be apprehended. English surgeons are often reproached by their continental colleagues with resorting too soon to enucleation. This reproach is unjust; it is always better to remove a blind eye which might have been retained, than to allow a sympathetic ophthalmia to occur which might have been avoided.—Unfortunately the proposal to enucleate his eye too often meets with opposition from the patient. The extension of general culture among the public will render them more amenable to the reasons given by the surgeon.

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* These are recorded by SNELL, CRITCHETT, NETTLESHIP, MUELLER, COLSMANN, PAGENSTECHER, SCHMIDT, BRUDENELL CARTER, FROST, STEINHEIM.

† LEBER, PONCET.

Part VII.

Influence of Social Conditions on Eye-diseases.

§ 62. Eye diseases, like so many other diseases, are the special scourge of poverty. There are, it is true, no statistics which divide eye patients into poor and rich, but a glance at the ophthalmic dispensaries of large towns will afford convincing proofs of the truth of what we say. Ignorance goes hand-in-hand with poverty. The statistics of blindness show that under otherwise identical conditions, the poorer and more ignorant a population is the more blind persons are met with. SORMANI found a strikingly large number of blind persons in the southern provinces of Italy, in which over 70 °/₀ of the military conscripts can neither read nor write.* A similar state of things has been shown to prevail in Spain and Finland. But it is most strikingly manifest in Prussia. On an average there are in Prussia, 8.3 blind persons in 10,000 inhabitants, and the proportion rises in some provinces to 9 and 10 blind persons. On the other hand Berlin has much the smallest proportion, namely, 6.6 blind to 10,000 inhabitants, although the presence of a blind educational institution draws a number of blind persons from the country to the town.

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* *Geografia nosologica dell' Italia.* Roma, 1881.

In the following remarks I enumerate some points bearing on social relations which influence the health of the eyes. I must limit myself to a few indications, as a thorough elucidation of these important national economical questions would greatly overstep the limits of this treatise.

1. *The degree of culture* of the people has a great influence on the opportune treatment of eye diseases. An ignorant person either neglects his disease entirely, or attempts to cure himself by the employment of domestic remedies recommended to him by some old woman or quack. In addition to this is a truly superstitious dread of every operation which we meet with in many uneducated people, so that they would sooner lose their sight than submit to the slightest operation. This is much more seldom met with among the educated classes. Statistics show that with the increase of general cultivation, the number of eye diseases increases but that of the blind diminishes. The former is only apparent; those affected with eye diseases resort to the eye clinics more readily, hence the increase of the number of patients in all dispensaries, although the number of the latter always goes on increasing. The decrease of the number of blind may be illustrated by the following two examples. In England for every million inhabitants there were—

In 1851	1020 blind
„ 1861	964 „
„ 1871	951 „
„ 1881	879 „

In Prussia the number of the blind from 1871 to 1880 became smaller by 1.3 °/₀₀, whilst at the same time the population had increased by 10.6 %. Similar proportions occurred in some other countries.

I have no hesitation in ascribing this favourable alteration of the proportion of the blind in great degree to the increasing extension of education among the people.

2. *Cleanliness* stands in very close relation to general culture. The influence of cleanliness on the spread of infectious diseases, as for instance trachoma, and on the occurrence of catarrhal and scrofulous eye affections need not be dwelt upon.

3. The *alimentation* of the people becomes better and more rational as their prosperity increases. In consequence the number of scrofulous children diminishes considerably. I may mention also those cases of chronic iridochorioiditis, which are especially common among ill-nourished elderly people (*e.g.*, the poor Silesian weavers—v. ARLT).

4. As regards *work*, I shall only here allude to the employment of children in factories. Besides the great harm that factory work entails on the physical and mental development of children, it should be remembered that children are more liable to injuries of all sorts (also of the eyes) than adults (see page 179).—Various legislatures have already considered this question and enacted regulations for the employment of children, some of which fix the age at which they may be employed, others the number of hours of work. The age varies between 10 and 14 years. In Switzerland the legal age is 14 years, in Germany, France, Holland, Sweden and Norway 12 years, in Hungary 12 and 10 years, in Austria and Denmark 10 years, in England 10 and 8 years. From the 13th to the 18th year,

the daily working time should not exceed eight hours. Children should never be employed in night-work, or in certain especially dangerous or unhealthy occupations.

5. The *habitation* has the greatest influence on the health. How often is it seen that previously healthy children incur scrofulous affections, especially of the eyes, when they are transferred to a damp dwelling place. Smoke and foul air dispose to maladies of the conjunctiva; crowded dwellings promote the spread of trachoma. Badly lighted dwelling rooms and workshops favour the production of short-sightedness. As men advance in prosperity and culture, their requirements in respect to their dwelling place increase. The habitation question in modern times has entered on the path of progress. To this belong the hygienic conditions of a good habitation, the framing of necessary regulations for the inhabited-house police, construction of work-houses, &c.

§ 63.—6. *Lighting.*—I need not waste words upon the importance of lighting for the eyes. It is evident that in every way daylight is the best kind of illumination. But in spite of this we often find work-places underground, where artificial light must be used all day. The same may be said of many magazines and offices, the few windows of which look on a small court-yard, so that the employés have to work for some hours by inadequate daylight, but the greater part of the day by artificial light. These conditions are in large towns unfortunately too frequent, so that well-lighted offices are almost exceptional. Not unfrequently, indeed, it is the public offices which in this respect set a bad example to private bureaux. The same disadvantages are frequently found in shops, as also in the smaller work-rooms. The first requirement is plentiful and well distributed daylight. In such places the same rules are applicable as for the lighting of schools (§ 14).

In artificial lighting what is required is sufficient light, and proper distribution of it. The following points should be attended to:

a. Brightness.—As regards this, the requirements are the same as those I have mentioned as applicable to the daylight illumination of school-rooms. We may accept COHN'S* standard of brightness, viz., that the healthy eye should be able to read fine print (*Snellen* 0.5) comfortably at 20 inches. COHN thinks that this corresponds to an illumination of 12 normal candles or a little more.—We need have no fear of too bright an illumination; in the employment of artificial light it is not to be dreaded, provided that the dazzling light source itself does not fall directly on the eyes.

All the methods of illumination at present in use are capable of furnishing adequate brightness. Which of them is to be preferred in special cases depends on their other advantages or defects, which will appear in our consideration of the other points.

b. Dazzling.—As already stated, artificial light is only dazzling when its source throws its image directly on the retina. The numerous gas jets of a theatre, the chandelier of a room, &c., may dazzle and fatigue the eye. The dazzling is most

* *Zehnte Versammlung des deutschen Vereins für öffentliche Gesundheitspflege.* Berlin, 1883, p. 91.

intense in the case of the electric arc-light, when looked at directly. NODIER,* ROCKLIFF† and EMRYS JONES‡ have seen cases where violent inflammations of the conjunctiva have been caused in this way, but went off without injury to the eye. In all cases the subjects were persons who had to set a-going the electric illumination. They were in very close proximity to the source of the light, but had neglected to put on dark protective glasses. If these are worn and some caution exercised, such accidents might easily be avoided. I myself observed the following in a case in Vienna. A cobbler's apprentice went to a circus performance and while there fixed his eyes for a long time on one of the electric suns placed in the roof. In one eye he got a central scotoma, which never afterwards disappeared. This case is analogous to those caused by dazzling from direct sunlight (looking at the sun during eclipses), as described by SULZER, HAAB, HALTENHOFF, DEUTSCHMANN and others.

In order to avoid dazzling, the source of the light may be tempered by means of ground glass in the form of globes, saucers, &c. These arrangements certainly cause a great loss of light. Ordinary milk glass globes weaken the light by from 33 to 60%, ground-glass lamp saucers by 60% (HARTLEY). For very bright light like the electric light, the dimming by means of ground glass is not always sufficient. In such cases it is best to with-

* *Sur une ophthalmie causée par la lumière électrique*, Thèse de Paris, 1881.

† *The Ophthalmic Review*, September, 1882.

‡ Ibid, April, 1883.

draw the source of light completely from the sight. Indirect illumination of this sort is applicable not only to the electric light (technical school of Liege) but also to gas illumination (House of Parliament in Berlin) and is very grateful to the eye.

c. Steadiness of the light.—The flame should not flicker. Working by a flickering light is extremely disagreeable and fatiguing. Oil and petroleum lamps do not flicker. Open gas jets always flicker (the bat's-wing jet most of all); they should therefore be banished entirely from places where they might be used for working by. For this object argand burners with glass or mica chimneys are required. Even with this arrangement flickering sometimes occurs, but its cause lies in some derangement of the pipes (especially in winter), and it may generally be easily remedied. Electric lights also often flicker, but improved construction produces steady electric light as the Health Exhibitions in Berlin and London proved.

d. Colour of the light.—All artificial methods of lighting give light which contains more long-wave rays than does daylight, consequently they have a yellowish tinge. This is the case even with the electric light, which, when contrasted with gaslight, appears bluish; but when contrasted with daylight looks pale straw-coloured (KRUESS, MEYER). O. E. MEYER gives the following data relative to the quantity of long-wave and short-wave rays in different kinds of light:—

	Red.	Green.	Blue.	Violet.
Electric Light ...	2	1	0.8	1
Petroleum	3	0.6	0.2	0.1
Gas...	4	0.4	0.2	0.1

Thus gas light is yellower than petroleum light; and this, again, is yellower than electric light. In order to diminish the red and yellow rays we may employ a blue glass chimney, as is often done for gas lights.

e. Production of heat.—Every flame produces not only illuminating but also dark rays (heat-rays), the latter, indeed, in excessive quantity. The production of heat is a disagreeable incident attending our sources of light. The heat produced by them makes itself sensible to us in two ways: by heating the air in the neighbourhood of the source of light, and by radiating heat which impinges directly on our head and eyes. Continuous work close to a hot source of light produces the sensation of burning and dryness in the eyes, congestion to the head and headache. FISCHER, ERISMANN and COHN have furnished us with data respecting the production of heat from our sources of light. FISCHER* calculates theoretically the quantity of heat-units produced by the combustion of certain substances. The quantities given are what must be burnt in order to give for one hour the degree of light of 100 candles.

Electric arc-light	57 to 158	heat-units.
„ incandescent light ...	290 to 530	„
Petroleum	3,360	„
Gas	4,860	„
Colza oil	6,800	„

ERISMANN† measured the temperature of the air in the room in which he performed his experiments on illumination, and

* 10*te Versammlung*, &c., p. 76.

† *Zeitschrift fur Biologie* XII., p. 349.

found that it was much higher with colza oil and gas, than with petroleum. COHN* ascertained the temperature from the electric light (Edison's lamp), and from gas light. He placed a blackened thermometer at a distance of 4 inches from the light-source (which had always a light of 20 candles). In this way the radiating heat, which is of great importance, was measured. The relation between the electric light and gas-light proved to be as 1 to 2. Therefore, gas-light gives out twice as much heat as the incandescent electric light.—From all these experiments we infer that of the sources of light in common use the electric light radiates the least, gas-light the most heat. The production of heat by a gas-flame is most felt when the workman is compelled by the nature of his work to have the flame close to him, as is the case for instance with watchmakers.

In order to avoid the heat radiation of the gas flame, it should be placed at a distance of 40 inches from the head. In schools, the gas jets should be placed 40 inches above the heads of the students. When it is necessary to have the source of light close, the electric light or petroleum is preferable to gas-light. Both for petroleum and gas-light, the hygienic normal lamp of Schuster and Bär may be recommended. Its peculiarity is that round the ordinary chimney a second one of larger calibre is placed; the air between the two is constantly renewed by the rising of the heated air. With this lamp the radiation of heat is diminished by about 1° (COHN, FISCHER).

f. As regards the *direction whence the light falls*, it is gene-

* 10*te Versammlung*, &c.

rally best when the light comes from above, front and left. For many occupations another direction of the light is more suitable. Thus, for reading, it is very agreeable when the light comes from the side and behind. The short-sighted should place themselves for reading sideways at the table, and hold the book upright in the hand; the lamp should stand at the side, and a little behind the head. In this way the light and the radiating heat of the lamp would not impinge directly on the eye.

In order to answer the question: what material for producing the light is to be preferred? some points must be considered, not directly affecting the eye, but of importance in determining the choice of the kind of light. I allude to the deterioration of the air by the products of combustion, but chiefly to the cost of the lighting.

g. Deterioration of the air by the products of combustion. These are divided into products of perfect combustion, and of imperfect combustion. The former are carbonic acid and water, the latter carbonic oxide and hydrocarbons. The latter are evolved in larger quantities the less perfectly the flame is regulated by the supply of burning material and air in proper proportions. The flame smokes and the products of combustion announce their presence by their disagreeable smell. In well-regulated flames there are present only traces of the products of imperfect combustion (FISCHER.) The following table gives the results of some investigations made with a view to determine the quantity of carbonic acid produced in combustion. The quantity of carbonic acid evolved by petroleum is taken as 1, and from this as the unit the proportion for gas and colza oil is calculated. The first column gives the quantity of carbonic acid ascertained by ERISMANN by calculation. The results of ZOCH* and FISCHER were obtained by measurement.

Carbonic Acid evolved according to	ERISMANN	ZOCH	FISCHER
From Petroleum	1	1	1
„ Gas	1.9	1.2	1
„ Colza Oil	1.4	0.8	2.3

Experimentally, ERISMANN convinced himself that the products of imperfect combustion of petroleum, gas and colza oil were in the following proportions 1, 4, 4.

The electric light causes no pollution of the air; of the other illuminating materials, petroleum seems to be the best in this respect.

h. Cost of lighting.—This varies naturally according to the market price of the illuminating materials. As yet we have no certain data respecting the cost of electric illumination. The following data of FISCHER and ERISMANN are only approximative. In the subjoined table, I have taken the price of petroleum for a certain intensity of light as the unit :—

Kind of light.	FISCHER		ERISMANN
Electric arc-light	1 to 2.4	...	—
„ incandescent light	3	...	—
Gas...	3	...	2.3
Petroleum	1	...	1
Colza oil	13.4	...	2.6
Paraffin (stearin)	28	...	11

* *Zeitschrift für Biologie.* Bd. III., p. 117.

Although the estimates of these two investigations differ greatly, still it appears from them: 1. That candles are so dear that they cannot be thought of as the illuminating material on a large scale. Consequently in my remarks on the other points I have omitted all consideration of them. 2. That petroleum is much the cheapest of all illuminating materials.

The following conclusions are deducible from what has just been said regarding lighting: From a hygienic standpoint the electric light must be regarded as the best, provided a proper construction of the apparatus shall secure the necessary steadiness of the light, and that when the intensity of the light is great its source shall be concealed from the eye.

By the electric light the air is neither polluted nor heated. The illumination is so excellent that the acuteness of vision is increased by $\frac{1}{5}$ to $\frac{1}{2}$ compared with gas. The acuteness of vision for colours is doubled or quadrupled (COHN). Where the electric light has been employed on an extensive scale no complaints have been made of straining of the eyes (JAVAL, PONCET DE CLUNY, COHN); I can corroborate this for the Liege schools.

The advantages of petroleum lie in the slight degree of yellowness of the flame, in the small development of heat, in the small quantity of the products of combustion and especially in its extreme cheapness. This last advantage allows the poorest workman to obtain a brilliant illumination. The disadvantage of petroleum lies in the care that must be bestowed on the regulation of the flame to prevent it smoking. Hence petroleum is ill suited for illumination on a large scale; but for single lights it is the best of known illuminating materials.

Gas possesses the advantage of great convenience in its management. Its disadvantages are principally the great heat it develops, further the pollution of the air and its relative high price.

Part VIII.

Influence of Climate and Race.

§ 64.—1. *Climate.*—It is well known that in hot countries blindness is much more common than in temperate and cold countries. ZEUNE and after him CARRERAS-ARAGO endeavoured to prove the existence of a progressive law in the decrease of blindness from south to north. According to CARRERAS-ARAGO, there are to every 10,000 inhabitants in Spain 11.09 blind, in Italy 10.15, in France, 8.36, in Germany, 8.79. But then again there comes Norway with 13.63, and Finland with the large proportion of 22.45, whilst Sweden which lies between these two has only 8.05 blind; so that it is impossible to establish any fixed law regarding it.

Localities situated on the coast seem to have more blind persons than those at a distance from the sea (particularly mountainous regions). SORMANI found the maritime regions of Italy peculiarly rich in blind persons; the south coast of Sicily most so. The same proportion in regard to the sea-coast obtains in

France, according to DUMONT. In Belgium also, the coast shows the largest quota (9.67 to 10,000) the southern hilly provinces the smallest (5.0 and 5.16). As regards hilly countries, Switzerland has a remarkably small proportion of blind (7.61), whilst the equally hilly Norway possesses a very large proportion of blind (13.63).

What are the climatic peculiarities in the several countries which influence the production of blindness, is not yet known for certain. As regards hot countries, the glaring sunlight, the dust and the dryness of the air (North Africa) are blamed; as regards coast localities the opposite condition of humidity of the air. Trachoma, which, more than all other eye diseases (except diphtheria) has an unequal geographical distribution, prevails as much in hot and dry countries (Egypt, Arabia) as in cool and moist countries (Belgium, Ireland).

The influence of the season of the year on many diseases, such as conjunctival catarrh, hemeralopia, &c., is indubitable. As to the more serious diseases, which alone concern us here, nothing certain has as yet been ascertained. Only as regards abscess of the cornea it is known that it occurs principally in hot seasons of the year.

2. *Race.*—When on the subject of trachoma I mentioned that in estimating the influence of race on eye diseases, great caution must be exercised. The degree of culture and the mode of living of a people is as a rule of more consequence than the race. In uncivilized or little civilized peoples, want of cleanliness favours the rapid spread of infectious diseases, and defective treatment of serious diseases of the eye more frequently leads to blindness.

I can only point to the frequent occurrence of glaucoma among the Jews as an established social peculiarity. According to RYDEL,* among the patients of V. ARLT'S clinic in Vienna the Jews furnish nearly 23 % of glaucoma whereas they constitute only $11\frac{1}{2}$ % of all the patients. According to my experience in the same clinic, this is especially the case as regards inflammatory glaucoma. WAGNER,† of Odessa, had among nearly 20,000 eye patients one half Christians and one half Jews. Among the former there were 155 cases of glaucoma, among the latter 255 —The immunity of negroes from trachoma testified to by SWAN BURNETT and KNAPP requires further corroboration; the negroes on the west coast of Africa are said to be very subject to trachoma.

Part IX.

Treatment of Eye Diseases.

§ 65. In the preceding chapters we have seen that in many dangerous eye diseases a calamitous result may be prevented if treatment is resorted to in good time. Improper treatment or want of treatment is greatly to blame for the frequency of blindness among the less civilized peoples. In order to combat blind-

* *Bericht uber die Wiener Augenklinik von* V. ARLT, 1867.

† V. GRAEFE'S *Archiv*, Vol. XXIX., part 1, p. 143.

ness effectually it is above all things necessary to provide the possibility of judicious treatment for every case of eye-disease. For this many and well-educated doctors are required. But the public must be instructed to apply for treatment at the right time and the right place. An educated person affected with an eye disease does not put off his application for medical aid until it is too late. Nor does he so readily fall into the hands of quacks as the uneducated. Many countries have special laws against these latter. But they have never been able to suppress quackery to any extent. Hence these laws have been repealed in Germany, and it is considered sufficient to make them responsible for any injury caused by improper treatment. The most efficacious remedy for quackery is the enlightenment of the people.

The education of the people has hitherto been completely neglected on one point, namely hygiene. No one will deny that a knowledge of the fundamental principles of hygiene are of the greatest consequence for all who would preserve their health. Hitherto instruction in hygiene has been so badly provided for, that not all universities possess even a chair of hygiene where regular lectures are given on this subject. A very little has recently been done for the spread of hygienic information in wider circles. The efforts made in this direction in England are principally made by some societies. The National Association for the Promotion of Social Science, the Ladies' Sanitary Association, and quite recently, the Society for the Prevention of Blindness deserve especial mention. By the circulation of popular writings and by lectures they endeavour to spread enlightenment on all hygienic questions. In North America cheap almanacs are published, which, besides the usual information, contain popular information on hygienic subjects. The same is done in Italy at CORRADI'S suggestion (Almanacco igienico of Mantegazza). But hitherto it is only in France that regular instruction of the people in hygiene has been introduced, and this has been done in the primary and normal schools, in the lyceums and the agricultural schools.* It would be well if other countries were to follow this example.

In addition to instruction in general hygiene, it would be of the greatest use to enlighten the people respecting certain important eye diseases which might be avoided by care. To these belong the blennorrhœa of new-born infants, trachoma, school-myopia, injuries, &c. The means of spreading such instruction are public lectures, and particularly pamphlets written in popular language, which appeal to a much larger public than the lectures. Oculists of repute such as BEER, ADAMS, VON ARLT, and others have not disdained to write such pamphlets. I have already alluded to the writings of ROTH, published by the Society for the Prevention of Blindness. COHN'S important work on the Hygiene of the Eyes in Schools is so far popular in character that it is addressed not to physicians but to school authorities.

§ 66. Let us now turn to *medical men*, in so far as they are concerned in the treatment of eye diseases.

As regards medical practitioners in general, the chief thing

* Besides these, lectures on hygiene have been delivered in the normal schools (schools of preceptors) in Belgium and England (see CASTELLA and ROTH, *IV. Congrès internat. d' Hygiène*, T. II.)

required of them is that they should always be able to be found when wanted; with this is conjoined, for our purpose, the second requisite, that medical practitioners should be adequately supplied with a knowledge of ophthalmic therapeutics.

As regards the first point, the most civilised countries show localities where there is a sensible insufficiency in the supply of doctors. On the other hand, there is in other localities, particularly in the towns, a superfluity of medical men. This unequal distribution, which is owing to the conditions of private practice, cannot be prevented. But surely it is the duty of the State to provide medical practitioners for places where they are wanted. Medical men who settle down in certain (poor) districts should receive an allowance to render their existence possible. This is the only way to do in sparsely populated countries. In Norway and Sweden the appointment of medical practitioners paid by the State is carried out on an extensive scale to the great advantage of the people.

The second requisite I have mentioned is that medical practitioners should have an adequate knowledge of ophthalmic therapeutics. Every oculist knows from his own experience what sad deficiences there still are in this respect.

What are the requirements of the medical practitioner in regard to ophthalmic medicine? He must, first of all, be able to diagnose and to treat correctly the slighter eye diseases; as he ought not to require his patient to undertake a perhaps long journey to an oculist for such trifles. He must also be able to treat those serious diseases of an acute character which require rapid help. We do not expect from the ordinary practitioner the diagnosis of the more difficult ophthalmoscopic cases, or of defects of refraction, nor yet the performance of the greater operations. When on the subject of clinical instruction, I shall enter more in detail on those points of ophthalmic medicine which seem to me to be of most importance for the practitioner.

In order that medical practitioners should be sufficiently instructed in ophthalmic medicine, there should be well organised *clinical instruction* in ophthalmic medicine at the university, and a knowledge of this subject should be obligatory for the examinations.

In 1870, the teachers of ophthalmic medicine belonging to the South German universities met at Stuttgart and formulated the following requirements :

1. Every medical practitioner should be theoretically and practically instructed in ophthalmic medicine to the same degree as he is in all other departments of medicine.

2. Every university should offer adequate opportunities for ophthalmological studies.

3. For appropriate opthalmological university instruction, a special teacher, who is himself a practical oculist, should be appointed.

4. The teachers of ophthalmic medicine should have the same privileges as other clinical teachers.

5. There should be a public hospital and dispensary for eye patients, with the museums and apparatus required for instruction.

6. Attendance at the ophthalmological clinics and lectures should be made obligatory, where attendance at other medical lectures and clinics are obligatory.

7. In all medical examinations, a special section should be devoted to theoretical and practical ophthalmic medicine.

8. A practical ophthalmologist should conduct the examinations on that subject.

To these proposals I would add this one: The professor of ophthalmic medicine should be an ordinary professor, in order that his position should be quite on a par with that of the other professors.

The minimum of time devoted to the study of ophthalmic medicine should be six hours per week during one semester, or four hours per week for a whole year. The former can be done in hospitals with a great supply of material, the latter (a whole year of study) in smaller hospitals, where all the cases required for instruction are not always met with in one semester. The most important side of the instruction is the practical one. Students must be exercised in the examination of patients and in the diagnosis of disease. Opportunities should be afforded them to learn practically certain operations, such as everting and cauterizing the eyelids, removing foreign bodies, sounding the nasal duct, &c. To meet the requirements of the practitioner, the inflammatory diseases especially should be studied thoroughly and on as many patients as possible. Not only diseases of the conjunctiva and cornea should be accurately known by the students, but also the inflammations of deeper seated parts. How often does it happen that the practitioner mistakes iritis and iridocyclitis for catarrh and treats them with solutions of lunar caustic; how often does he instil atropia into the eye in cases of glaucoma. Great attention should also be given to injuries and their treatment.

Students should also be instructed in the employment of the ophthalmoscope, so that they may be able to diagnose slight cases so that they may not, for example, confound glaucoma simplex with cataract, as so often happens). They should also go through a course of operations on the dead subject. Most practitioners will not in practice require to perform any operations on the eye. But the practice of operations on the cadaver gives the student a certain amount of manual dexterity and, at the same time delicacy in his movements which will prove of great service to him in small manipulations, such as the removal of foreign bodies, &c. Moreover, in his quality of medical practitioner, he will often enough be placed in a position to determine if an operation is necessary or possible, in which case he would eventually hand the patient over to a specialist. But for this he must know from his own examination not only the indications for the operation, but also the technicalities of the operation itself.

As regards anomalies of refraction we should, in my opinion, limit ourselves to teaching students the most important points, but not attempt to give them a thorough knowledge of them. In the courses of lectures on refraction which I delivered for a series of years, I became convinced that it is extremely difficult to teach students the anomalies of refraction. In a course lasting several months, and with frequent practice on patients, we may succeed in teaching the most gifted of the students how to test the refraction successfully ; but for the great majority this department remains a sealed book. I believe that the time spent on this subject might be employed much more usefully on other important points of ophthalmic medi-

14

cine. Moreover, we can hardly expect that the young practitioner, who must in any case provide himself with a pretty extensive supply of instruments, will also purchase a complete set of lenses.

In the examinations of the candidate for the medical degree, ophthalmic medicine should be the subject of a theoretical and practical examination. In the latter, besides showing his knowledge of cases of disease brought before him, he should be required to make an ophthalmoscopic examination or perform an operation on the dead body.

Let us now see what provision the different States of Europe have made for the instruction of medical students in ophthalmic medicine.

The foremost place of all the States in this respect belongs to *Austria*. In 1776 Maria Teresa appointed BARTH professor of anatomy and ophthalmology. In 1813 a special chair of ophthalmology with clinic attached was established in the general hospital, and BEER was nominated extraordinary professor. This is the first independent professoriate of ophthalmic medicine. Until then ophthalmic medicine was only taught as a sort of incidental thing by surgeons, sometimes also by anatomists, physiologists or hospital physicians. In most countries it retained this dependent position until not very long since; in some it still retains this position.

In 1819 BEER was promoted to the position of ordinary professor. Since then ophthalmic medicine constitutes a subject of examination in the *examina rigorosa*.* Now in all Austrian

* This, as also many of the following data, is taken from BILLROTH

universities which have a medical faculty, viz., in Vienna, Prague, Graz, Innsbruck, Cracow, Pesth and Klausenburg, there are ordinary professorships of ophthalmic medicine. Students are required to take this subject for six months at least, and to devote one hour daily to the hospital and one hour to the lecture. The lecture hour usually includes witnessing the treatment of out-patients in presence of the students.

Examination in ophthalmology forms a part of the third rigorosum (examination for the degree). It is a combination of theoretical and practical examination (both oral only). The practical examination consists in examining and describing a case of eye disease, and in performing an operation on the dead subject.

In *Germany* the first ophthalmic hospital was opened in Leipzic in 1820. Würzburg followed in 1840, Göttingen in 1847, Munich in 1859, Halle in 1864, Heidelberg and Berlin in 1865, &c. At first the professors had to lecture on other subjects besides ophthalmology. Since Jena—the last among the German universities to do so—created a special chair of ophthalmology, all the universities have established independent chairs for this subject. The teachers of ophthalmic medicine are all ordinary professors. The time devoted to ophthalmic studies varies in the different universities. Clinical instruction is given on an average three or four times a week for an hour at a time, and for two sessions of six months (the minimum is 2, the maximum 6 hours per week). In addition to this in some universities there are from 3 to 6 hours weekly of dispensary practice.

(*Ueber das Lehren und Lernen an den Universitäten der deutschen Nation*, Wien, 1876).

Theoretical lectures on ophthalmology occupy up to 5 hours per week. They usually last only one semester, whilst in the second semester lectures are given on some select points of ophthalmic practice, but these are not obligatory. This instruction is further complemented by practical lessons in operations and the use of the ophthalmoscope, as also by lectures on the anomalies of refraction.

Since 1869 ophthalmology is a subject of examination in the State examination. The candidate is required to examine and give the morbid history of a case. He is not by law obliged to show his proficiency in operating.

Switzerland has eye clinics in all its universities. That of Bern is indeed one of the oldest of these (1834). In the German universities of Switzerland the teachers of ophthalmology are all ordinary professors. The eye clinic occupies from three to six hours per week. In addition there are, as in Germany, theoretical lectures on ophthalmic medicine and special courses. In the Geneva university ophthalmology is taught by extra-academical teachers. Clinical instruction is given twice a week, (by one of the teachers only once a week) during the whole year; there are besides theoretical lectures and classes for the ophthalmoscope. The examinations for the degree are different in the different Swiss universities. The State examination which is required in order to obtain the *venia practicandi* in the cantons united by the concordat,* includes an examination in ophthalmology.

* In 1867 most of the northern cantons joined together in an agreement to allow free practice to one another's medical practitioners.

In *France*, by a law of the 14th August, 1862, the so-called *cours complémentaires cliniques* were called into existence. To these were appointed, not professors, but *médecins des hôpitaux* or *agrégés*. It was not till 1879 that a professor of ophthalmology was appointed in Paris. The present state of ophthalmological instruction is as follows :—Of the three State universities, Paris, Nancy and Montpelier, only the two former have lectures on ophthalmic medicine. Lectures are also given in the free University of Lille. Besides the universities, medicine is also taught in the academies (*facultés de médecine* and *écoles préparatoires*). Of these Marseilles, Bordeaux, Lille, Lyons, Tours, and Nantes have ophthalmological lectures or clinical teaching. The others (Algiers, Besançon, Caen, Clermont, Dijon, Arras, Amiens, Grenoble, Poitiers, Limoges, Rennes, Angers and Toulouse) are still without ophthalmological instruction.*

The time devoted to ophthalmic medicine in most of these schools is very limited. In Paris, for the session 1883-4, no lectures are announced, only clinical teaching (*Progrés Médical*, 1883, No. 45), &c. The same is the case in the other schools. The only exception is Bordeaux, where, during the winter season 1881-2, lectures for three hours per week were delivered.

Attendance on the eye-clinic and the lectures on ophthalmology is not obligatory, and is not a subject of examination. In the regulations for the examination, ophthalmology is not mentioned.

In *Belgium* it is only quite recently that independent eye-

* *Annuaire des cours de l'enseignement superieur*, 1882-3. Paris, 1883.

clinics and lectures have been established in all the universities. In Liege, Ghent and Louvain, clinical instruction and lectures occupy three hours a week, during two semesters ; in Brussels, however, only 1½ hours a week, also during twelve months. Attendance on these lectures is not required by law, but it is generally given, for ophthalmology is one of the subjects of examination for the degree. The law, as it at present stands, prescribes as a subject of examination, " la pathologie chirurgicale, y compris l'ophthalmologie." But, at present nowhere is the examination in ophthalmology conducted by the professor of surgery, but by the professor of ophthalmic medicine. A new law on university instruction is contemplated, according to which ophthalmic medicine shall have at the examinations a perfectly independent place.

In the neighbouring country of *Holland* there are now independent chairs of ophthalmology in the universities (Utrecht, Leyden and Groningen.) Ophthalmic medicine is one of the subjects in both the examination for the degree and that required by the State.

In Great Britain and Ireland the organization of the several medical schools varies greatly. There are eye departments in all the large hospitals, but as a rule no regular lectures on ophthalmology are delivered. The examination is limited to this, that the examiner in surgery has the right to put a question regarding ophthalmology to the candidate; but only quite exceptionally (*e.g.*, in Dublin) is the examination on ophthalmology conducted by a professor of that subject.

In March, 1879, the English oculists presented a petition to the General Council of Medical Education calling attention to the great neglect of the study of ophthalmology in England. They demanded that instruction in ophthalmology should be made obligatory. The report of the English medical schools on this petition was unfavourable to its proposals.*

In *Denmark* there is in the Copenhagen University a chair of ophthalmology with an eye clinic, but the time allotted to the study of ophthalmic medicine is very short. Ophthalmology is not a special subject of examination for the doctor's degree.

In *Italy*, there are special chairs of ophthalmology in all the universities. The study is obligatory, every student being required to attend the instruction for two sessions of six months. Candidates for the degree are examined theoretically and practically in ophthalmology. In the practical examinations the smaller operations are required to be performed.

In *Norway* and *Russia* there are special eye-clinics with a professor of ophthalmology at the head. Ophthalmology is a subject of examination for the degree.

The same is the case in *Sweden*, where, however, the eye-clinic is united with the surgical clinic.

In the medical school of *Constantinople* only theoretical lectures on ophthalmology are delivered. In *Athens*, there is an eye clinic, and candidates for the doctor's degree are examined in ophthalmology.

From the above it is evident that the provision for instruction in ophthalmology is still very indifferent. In this respect

* HIRSCHBERG, *Centralblatt*, 1880, p. 28.

Austria may be looked upon as a model for other countries. In every respect ophthalmology there takes its appropriate place. In all its universities there are independent eye clinics with ordinary professors at their head. Attendance at the lectures and clinical instruction is obligatory; in all ten hours a week for a session of six months are devoted to it. In addition to this, there is a course for operations, attendance on which is indirectly obligatory, as a practical knowledge of eye operations is required at the examination for the degree. The candidate is examined theoretically and practically in ophthalmic medicine and required to perform an operation on the eye. All the requirements above indicated as essential to ophthalmological instruction are thus in full operation. In most other countries the time given to ophthalmology is shorter, the examination upon it much less strict. Two large States, France and England, are still far behind as regards ophthalmological teaching. In the majority of the French schools (14 out of 22) no opportunity is given to the student to study ophthalmology, for they possess no eye clinics, and no teachers of the science. In the other 8 schools (2 universities and 6 écoles de médecine) there are eye clinics but the time allotted to ophthalmological teaching is often quite insufficient (*e.g.* in Tours only once a week, on Sunday). In the Paris University there was no chair for ophthalmology before 1879. Finally, in England, there is no provision at all for regular instruction in ophthalmology, and the medical authorities have not advanced so far as to perceive the need for such instruction. Indeed, the Universities of London and Edinburgh declared themselves hostile to the proposal to require from candidates a special knowledge of ophthalmology. There remains, therefore still much to be done before the first and most important requirement is fulfilled which the prevention of blindness demands of us, the general possession by medical practitioners of a knowledge of ophthalmic medicine.

§ 67. *Eye dispensaries.*—If the properly educated medical practitioner is capable of treating by himself many cases of ocular ailments, he will still have to refer the serious cases to the specialist. By serious cases I mean those whose diagnosis presents some difficulties, as for instance many affections of the fundus of the eye, anomalies of refraction, &c., and those whose treatment requires special dexterity, especially cases requiring an operation. Most eye diseases are of such a character that they allow of the patient going to the doctor and even making a journey to see him. Therefore an oculist residing in the centre of a populous district may include a wide circle in his practice. Such being the facts an effort should be made to establish an eye dispensary under the direction of a specialist in every town that requires it. This will depend on the number of inhabitants of the town and of the surrounding country (district, province). In Germany there is generally no lack of oculists, but their distribution is often unequal. Whilst in many middling sized or even small towns there may be more resident oculists than there is room for, in other places there is a want of oculists. In other countries there is everywhere a deficiency of oculists, who, as a rule, are only to be found in large towns. To give an example from my own country, I may mention that the whole province of Moravia does not yet possess a single oculist in its capital

Brünn, although the province is 404 square miles in extent, and has about two million inhabitants. In the province of Upper Austria (218 square miles and about 800,000 inhabitants), and in the province of Salzburg (408 square miles and over one million inhabitants), eye dispensaries have only existed for a few years. They are in a flourishing condition, thereby showing that they were much needed.

It is the duty of the State (or of the province or town) to remedy this bad state of things, and to provide for the settling of an oculist where one seems to be required. This cannot be ascertained by simply reckoning the number of inhabitants. The chief point to be considered is the frequency of eye diseases (especially trachoma) in the locality in question; further, the density of the population. In a dense population one doctor suffices for a proportionately large number of inhabitants. The more sparsely the population is distributed, the smaller the number of inhabitants that should be reckoned for the doctor, so that patients suffering from eye diseases may not have to make too long a journey to see the doctor. It is precisely the scantily-peopled regions, requiring a relatively large number of oculists, which are most destitute of them, for they offer the young oculist no very attractive outlook for his professional career. If the State wishes to attract an oculist thither, it must hold out to him certain advantages which will help him on beginning practice; and, further, the physician on his side should undertake some duties. I shall take the liberty to indicate what appears to me the proper course to pursue.

When it is ascertained that in the chief town of a district or province it is desirable to establish an eye dispensary, and no one voluntarily offers to do so, the authorities should offer the following advantages to a physician:—

1. The physician should be allowed to designate his dispensary as a concession by the authorities, *e.g.*, as a municipal or State dispensary, or the like. Thereby the public will have more confidence in the new doctor, seeing that the authorities guarantee to a certain extent that the doctor in charge of the dispensary has special qualifications as an oculist.

2. The authorities should announce the establishment of this eye dispensary by frequent advertisements in official and other widely-circulated papers. This will obviate the necessity of unprofessional advertisements on the part of the doctor himself; it will have the effect of inducing the public to make extensive use of the dispensary, and will secure for the young practitioner a rapid introduction to a large sphere of action.

3. The establishment of the dispensary should be facilitated to the doctor, *e.g.*, by the contribution of a sum of money to enable him to procure the necessary furniture and instruments, or by granting him some suitable locality, or by paying the wages of a servant or nurse. In the case of a very poor population it would be right to give the doctor some pecuniary aid, which would allow him to give poor patients the medicines and glasses they require without payment.

4. Some beds should be allotted to the doctor in the town hospital for patients who require to be treated in the hospital. If this is not practicable, some beds should be fitted up in a suitable locality for the use of the oculist.

5. In certain cases it might be necessary to offer the oculist a salary in order to induce him to settle in remote poor provinces.

It depends of course on local conditions who shall bear the cost of such an arrangement. Sometimes it would be borne by the province, sometimes by the town. Larger communities might, perhaps, endow a free bed in order that their dependents might be treated in the establishment free of charge. In the case of very poor places the help of the State must be invoked.

The duties which the oculist will have to undertake are the following:—

1. He must prove that he has a special and particularly a practical knowledge of ophthalmic medicine (*e.g.*, that he has filled a sufficiently long time the post of assistant in an eye hospital).

2. He must be at the dispensary for the purpose of seeing patients at a fixed hour at least every other day, and must give gratuitous advice to the poor.

3. He must make a report to the superior sanitary authorities once a year. This report should contain a statistical table of the patients treated; further, it should mention the eye diseases especially prevalent in the province and their causes, as also the cases of blindness that come under his observation.

4. The physician should undertake the examination of the eyes of the scholars in the middle schools of the town in reference to refraction.*

* On pp. 79 and 81 I have stated that I consider an examination as to refraction only necessary for the scholars of middle schools, and once a year

5. The dispensary should be under the control of the chief sanitary authority, in order to prevent it being carried on in an illusory manner for the purpose of enjoying the material advantages accruing from it.

I believe that in this way there would be no difficulty in attracting oculists wherever they are required. When the time comes that every university in all countries shall have its eye clinic, the assistants will furnish a sufficient number of young oculists. All that is required is that a certain influence should be exercised over their settlement. At present the young practitioners often do not know where to settle down on leaving the hospital. Many remain in their university town, where there is generally an ample supply of oculists, or they locate themselves in some other place where there is great competition. But if it could be intimated to them, as above proposed, where an oculist is wanted, if their settlement should be materially facilitated and provision made for their speedy acquisition of a sufficient clientèle, this would prove a strong attraction for young oculists.

In the larger towns there are, as a rule, several eye dispensaries; but their number is often insufficient for the large population. They are then so over-crowded that the proper amount of attention cannot be given to each patient; moreover they are often very unequally distributed over the different quarters of the town.

sufficient. This when practicable should be done by an oculist, as the requisite knowledge cannot be expected in the school doctor. The oculist might undertake the examination of the scholars of the middle schools of neighbouring towns for a suitable honorarium.

Even now in many hospitals eye patients are mixed up with surgical cases and are treated along with the latter by the surgeon to the hospital, who is not as a rule specially conversant with ophthalmic affections. Where this state of things obtains, it should be put a stop to, and a special department set aside for eye cases. This department should also contain separate rooms for infectious eye diseases, and be under the care of an oculist.

§ 68. *Organization of the sanitary authorities.* — In order that the prophylactic measures should be able to have their full influence, they should not exist merely on paper, but they must be practically realized. It is not sufficient that this should be done as hitherto only in model schools, eye hospitals or lying-in hospitals, &c., but these measures must be carried out on a great scale and thoroughly. To secure this, the centralization of the sanitary service is essential, the operations of which all over the country should be superintended by a chief sanitary authority, which should have a sufficient amount of scientific attainments for the difficult task it has to perform. This task is of a twofold character: first it has to organize and direct the sanitary service throughout the whole country, and next it has to carry out scientific works connected with hygiene. By this I do not mean works (*e.g.*, of an experimental kind) which require a laboratory and which properly belong to the universities. The most important task of the chief sanitary authority is to form a scientific appreciation of the material that flows in upon it in the form of reports of all kinds. These are not intended never to be read again, but sent to moulder in the archives. But their scientific elaboration and utilization can only be performed by the chief sanitary authority, because it alone possesses them in a complete form.

This is not the place to enumerate the manifold duties of the chief sanitary authority. I may, however, be permitted to allude to a few points specially affecting our subject, I mean the hygiene of the eyes. As regards this, the attention of the chief sanitary authority should be given particularly to the following points:

1. Furnishing normal standards for educational purposes. These concern the construction of school buildings, school furniture, school-books, methods of instruction, the time devoted to instruction, its arrangement, &c.

2. The appointment of committees for examining and reporting on the schools, ascertaining if they are suited for educational purposes, or what alterations they require in order to make them so. Drawing up a code of instructions for school-doctors, appointing school-doctors.

3. The establishment of eye dispensaries where they are needed. The appointment of oculists to these dispensaries and the supervision of them. The framing of a uniform plan for the reports of these oculists. This is an indispensable requisite for their scientific appreciation. COHN long ago called attention to the want of such uniform reports. He constructed a plan* which he sent to ophthalmic hospitals and oculists, which has been adopted by some of them.

* See NAGEL'S *Jahresbericht für Augenheilkunde*, 1872.

4. The analytical examination of the reports furnished by school-doctors, oculists, &c. These supply excellent materials not only for purely statistical works, but also for solving scientific problems. Delegates or committees should be appointed for the special study of epidemics of eye diseases, or for the investigation of important circumstances.

5. Proposals for the improvement of sanitary conditions. Improvement of the old and introduction of new prophylactic measures, *e.g.*, for preventing school myopia, the spread of infectious diseases, injuries to the eyes of work-people, &c. Proposals in reference to the compulsory treatment of certain infectious eye diseases and the duty of notification on the part of the physicians. An important question bearing on this point, is whether the parents should be made responsible when they neglect to take care of their children suffering from eye diseases and refrain from subjecting them to suitable medical treatment.

6. If the chief sanitary authority sets up a laboratory, the sphere of its work will thereby be considerably extended. This will comprise questions of general importance, such as, for example, the infectious character of certain eye diseases, the conditions of their transmission and their prevention ; the value of antiseptic remedies in ophthalmic medicine, &c.

If we compare the organization of the sanitary service of different countries, we find that it is in general ordered according to three different types.

1. Complete decentralization of the sanitary service. This was the rule in former times. The State troubled itself but little or not at all about hygiene, and left it to the several com-

munities to act as they pleased in regard to it. Holland was the last to abandon this organization; until about 20 years ago the care of the public health was exclusively in the hands of the communal authorities and the superior political authorities could not exercise the slightest influence or control. In Belgium this system still prevails; the sanitation is superintended in every province independently by the *commission médicale* of the province. A similar arrangement obtains in Norway. This system of decentralization has this disadvantage, that sanitation is left to the judgment and zeal of the local authorities. Whilst some towns or provinces enjoy very good public sanitation, in others it is completely neglected.

2. In most States the superintendence of sanitary matters is entrusted to a minister who performs it through his underlings. As a rule with the minister is associated a chief sanitary council, which is, however, only a consultative authority (France, Austria, Italy, Denmark, Russia). The sanitary council is composed of medical experts, hygienists, engineers, &c., but the minister is not bound by their decision. The actual conduct of sanitary matters is left to the minister's underlings who often are quite ignorant of the subject. The men of science who constitute the sanitary council, at length tire of investigating questions brought before them and giving their opinion respecting them, when they see that the decisions they arrive at are often only destined to accumulate dust in the archives of the ministry.

3. The most rational organization of sanitary matters exists in England (and Sweden). In the English Local Government

Board all that is required is united under one controlling power. It is composed of distinguished experts. It receives all reports and statistics. It decides what measures are necessary, and sees that they are carried out. It issues directions relative to the appointment of the lower grades of sanitary officials. The parochial authorities are under its control; it sends out skilled officers to investigate special nuisances. All important sanitary changes in the various parishes and communities must be approved by it before they can be carried out. It has more than 250 laboratories at its command, in order to detect the adulteration of articles of food.

The chief sanitary authority should therefore consist of persons having special knowledge of sanitary subjects, and should at the same time have full power to set a-going those measures they deem necessary and to superintend their execution. It should of course have a sufficient supply of funds at its disposal.

In order that the hygiene of the eye should receive attention proportionate to its importance, it is indispensably necessary that an oculist should have a seat and a voice on the board.

Conclusion.

In the preceding pages I have endeavoured to show what measures we should adopt in order to counteract the production of blindness. Whether these will have the desired effect the future will show, for as yet only a few of them have been carried out to a limited extent. But the experience of them already obtained, shows that we are able to prevent the occurrence of certain diseases with almost absolute certainty. I refer to the blennorrhœa of newborn infants. All that is needed is to carry out universally and strictly what all experts declare to be necessary. Unfortunately, we shall have to wait long before this is done, and many must in the meantime lose their sight which might have been preserved.

Our efforts must be devoted always to take up afresh and to discuss the questions bearing on the prevention of blindness. In this way ever increasing circles will be made familiar with this subject. As each one is made aware of the danger he can the more readily protect himself from it. We must force upon influential circles the conviction that something must be done to ward off the evil. The idea that led to the establishment of the Society for the Prevention of Blindness is an excellent one. This Society keeps up a constant agitation, and thereby hastens the advent of the time when the State itself shall undertake the campaign against blindness in an efficacious manner.

The efforts of hygienists had formerly and, indeed, have still, to war against prejudice and indifference. Their proposals and recommendations are often enough represented as tiresome fussiness and sought to be frustrated. But in view of the important results already obtained by them, they may console themselves. Europe is much more rarely devastated by epidemics than formerly, and the average duration of the life of man has been considerably increased. Hygienists have so many and such vast problems to solve, that hitherto they have occupied themselves but little with the special hygiene of the eyes. It is only right that the oculists should lend their aid to fill up the lacunæ left.

On the part of the State, hitherto nothing has been done for the prevention of blindness (if we except some regulations for schools and precautionary measures against trachoma). And yet the question is not merely a humanitarian one, but is a political economical one of the greatest importance. The burden of the support of the blind falls—with few exceptions—on their seeing fellow countrymen. This burden is by no means small. In Europe there is on an average one blind to every 1,000 of population, which will give for all Europe 311,000 blind persons. If we take the daily cost of these per head at only 10d., this implies a yearly cost of above £4,520,000. If we take for granted that one quarter of the blind need no pecuniary assistance, either because they are in easy circumstances or because they can earn their own living,* there still remain £3,400,000. If we

* ZEHENDER (*Klinische Monatsblätter für Augenheilkunde*, 1870) enquired into the circumstances of the blind in the Grand Duchies of Meck-

allow that one-third of all the blind, that is 103,666 persons, would earn 1s. 8d. per diem if they could see, that would make—reckoning 300 working days—£2,480,000. This added to the cost of maintenance, involves an annual loss of £5,880,000 for the states of Europe.

There is no doubt that a good prophylaxis against disease, a rapid and intelligent treatment of disease when already present, might prevent many cases of blindness. MAGNUS, BREMER, and STEFFAN are of opinion that 40% of the cases of blindness might have been prevented. COHN regards blindness as certainly preventible in 33%, as probably preventible in 43%, and as quite unpreventible in only 24%. Were we only successful in preventing the certainly preventible cases of blindness, then this would amount—following the least favourable estimate of COHN—to one third of all the blind. There would be about 100,000 fewer blind persons in Europe. Who can measure the amount of suffering and distress connected with those 100,000 cases of blindness? The philanthropist can imagine no more worthy task than to contribute to the diminution of this misery. The States themselves would profit thereby. According to the above estimate they would save more than £1,080,000 in the cost of maintenance of the blind. This sum would be more than sufficient to pay for the most extensive prophylactic measures.

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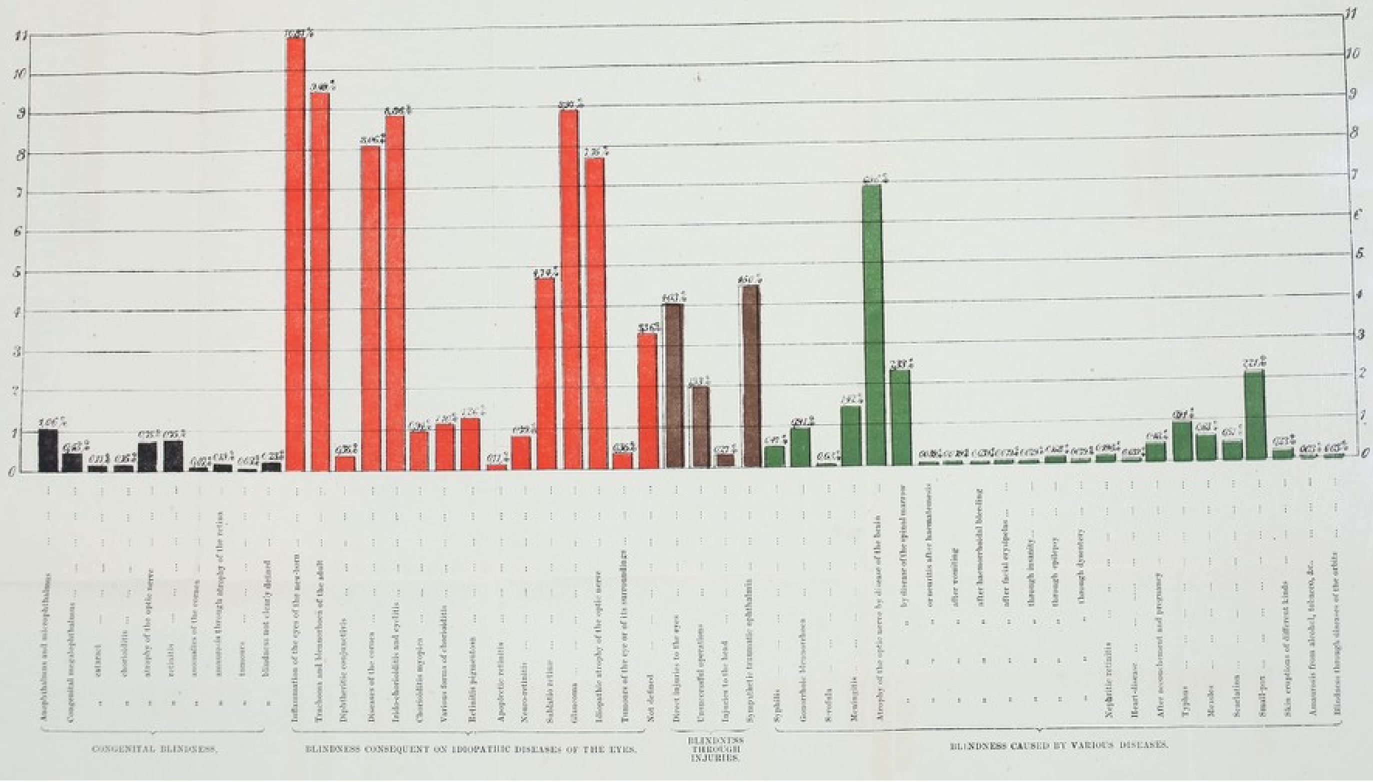
lenburg-Schwerin and Mecklenburg-Strelitz. He found that of 423 blind, 106 were not assisted, whereas 317=¾th of all the blind—were supported, some by their friends, others by public funds.

Almost everything has still to be done in this field; all must work together in order to carry on the war against ignorance, superstition and indifference. Hygienists and oculists, political economists and statesmen, yea all philanthropists, must lend a helping hand in this work—*viribus unitis.*

DR. MAGNUS'S GRAPHIC REPRESENTATION

OF

THE CAUSES OF BLINDNESS IN 2528 EXAMINED CASES OF BLINDNESS.



Appendix No. 1, by Dr. Dudgeon.

Chronic Poisoning.

See page 103.

Poisoning by arsenic is a frequent cause of severe conjunctivitis, which not only prevents the use of the eyes temporarily while it lasts, but which, by repeated occurrence, may prove permanently injurious to the sight. We find this affection in its most severe forms in workmen employed in the manufacture and the hanging up of papers which are coloured with preparations of arsenic, the chief of these being the arseniate of copper, which is much used for the production of a bright green colour. But other colours are often produced by arsenical compounds. Papers so coloured are often very injurious to the health of persons who inhabit rooms hung with them, and severe conjunctivitis is one of their most common effects. Muslin window curtains and even dresses are occasionally coloured with these poisonous dyes, as also the leaves of artificial flowers. In any of these situations the eyes may be and frequently are injured by the poison. A very proper subject for State interference would be the regulation of the manufacture of these articles and the absolute prohibition of the use of arsenical colours for purposes where they may prove injurious to the health.

The plan resorted to by some women, in order to increase the lustre of their eyes, of instilling into them *belladonna* or *atropine*, is always attended by temporary impairment of vision by paralysing the accommodation, but the habit, if persisted in, may cause permanent injury to the optic nerve. It would be well to warn those who have recourse to such objectionable practices of the risks they run.

Appendix No. 2, by Dr. Roth.

Positions while Writing.

See page 54.

The idea of many oculists as well as medical men in general, that it is desirable to support children and students while writing, in a good position, by mechanical contrivances on which the forehead leans, as advised by Professor Fuchs and others, see fig. 5, page 54; or by a support, as suggested many years ago by the late Dr. Schreber, on which the two clavicles lean is entirely erroneous.

It is desirable that persons who sit in bad positions while writing should lean against the back of a chair which is convex in the place corresponding to the lumbar part of the spine, while the upper part is concave corresponding with the convexity of the upper part of the back; at the same time it is desirable that the height of the chair seat from the floor should be equal to the height of the leg up to the knee, the depth of the seat should be equal to the length of the thighs, and the height of the back of the chair should be equal to the length of the back from the seat to the upper part of the shoulders. The width of the seat must correspond to the width across the hips of the sitting person. It is often objected that a person placed in such a comfortable position on a chair, as just described, is not able to write comfortably; but this is not the case, because the top of the writing table or a sloping writing desk is so arranged that it can be moved horizontally towards the body of the writer; the writing desk is such a height that both elbows, or rather the forearms, are placed comfortably on it; the paper or copy book is placed obliquely from the left to the right, so that the diagonal line should be perpendicular to the edge of the table.

Having adopted this position for years for my patients suffering from curvatures and also for perfectly healthy persons, I am able to speak from experience that it is much better to bring the *writing table to the body* than the *body to the writing table*. In the position described the writer remains always in a natural position without twisting or leaning the body on one side, without bending the head forwards and sideways and without straining the eyes. I prefer in cases of short sight to let the writer have well chosen spectacles and thus all the disadvantages of a crooked and stooping position and of straining the eyes are prevented; those who are incredulous are advised to try the arrangement proposed regarding the chair, the desk, and the paper, and they will be soon convinced that there is no more comfortable

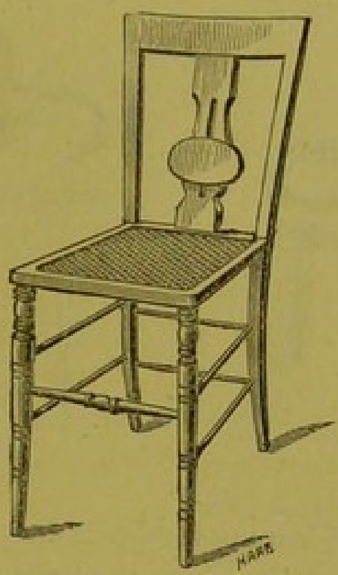


Fig. 1.

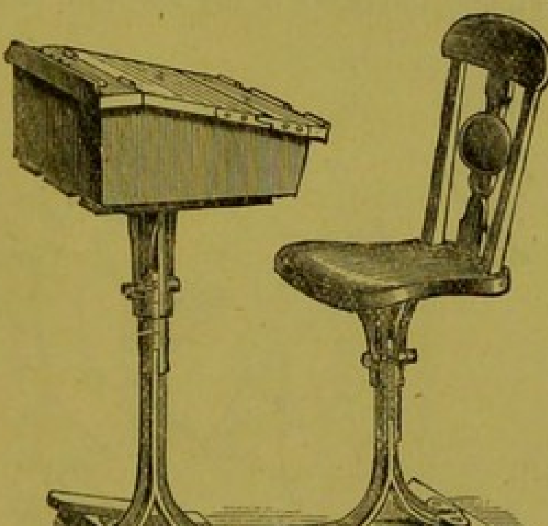


Fig. 2.

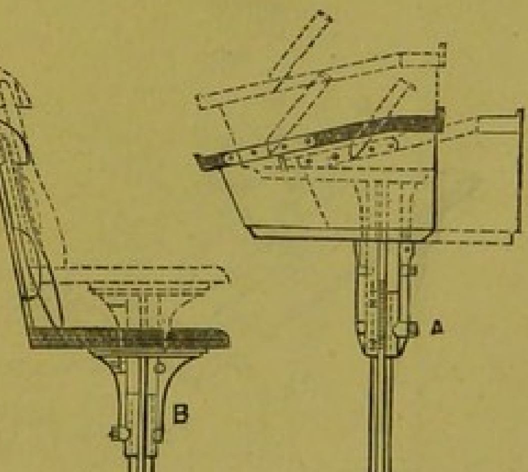


Fig. 3.

position to be found for the writer, and that the mechanical supports for the forehead or clavicles are perfectly unnecessary. The following illustrations will give a correct idea of the manner of carrying out the suggestions which have been just described.*

* Designs of school furniture, &c.

The illustrations 4 to 11 show how bad positions in writing, drawing, etc., can be prevented in public and private schools by encouraging the writer always to lean back in the chair and to draw the writing table or

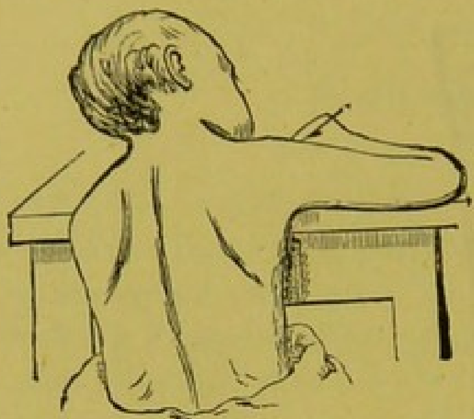


Fig. 4.

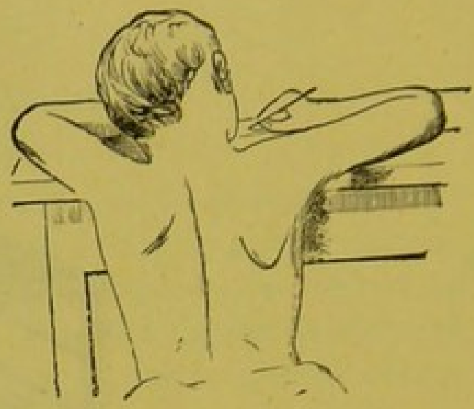


Fig. 5.

desk to the body, instead of leaning forwards and bending the body towards and on the table. In the chair, fig. 1, the height of the seat corresponds with the length of the legs (from foot to knee), the depth of the seat with the

Fig. 6.

Fig. 7.

length of the thighs, and the height of the back of the chair with the length of the body from the seat upwards. There is a moveable convex pad fitting into the lumbar curve, while the concave part of the top of the chair permits the shoulders to rest; the whole body is at rest and no effort is required to sit up; the top of the desk being moveable is brought close to the body, and there is no necessity for stooping or leaning over the table. Figure 2 is a

Fig. 8.

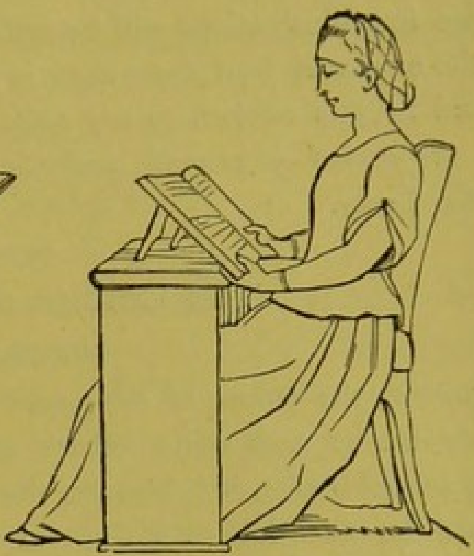


Fig. 9.

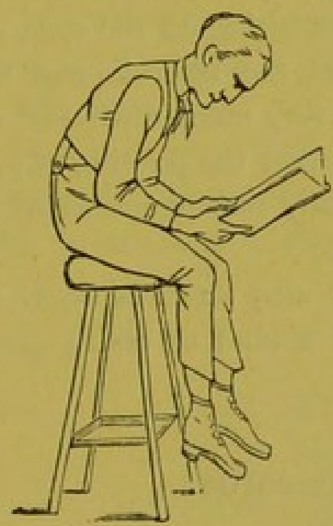


Fig. 10.

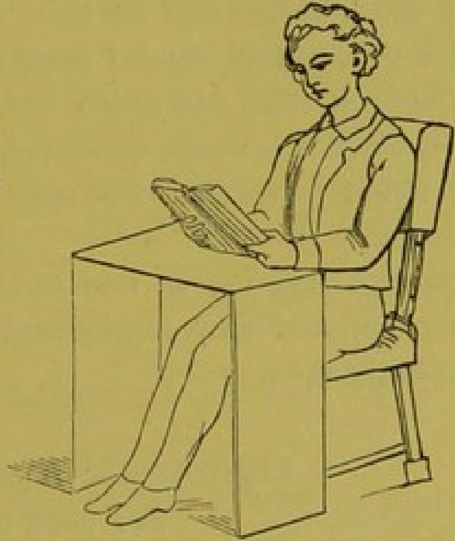


Fig. 11.

school chair and desk. Figure 3 shows how the desk and seat can be raised or lowered also how the desk can be moved horizontally forwards.* Figures 4 and 5 are instances of school boys sitting in bad positions in which the eyes are

* I have given the drawings of my chairs to the North of England School Furnishing Company, who have a depôt in Newgate street, city of London.

unequally directed to the writing because the head is too much turned to one side. Figures 6 and 7 represent bad and good positions of girls while drawing. Figures 8 and 9, 10 and 11 represent bad and good positions while reading.

These few illustrations will be sufficient for proving how bad positions affect the eyes and how short sight is produced; I must refer those more interested in this subject to my *table of injurious positions to be avoided during the period of growth and education*, published by the publishers of this Prize Essay.

The Colour of the Paper.

See page 63.

Regarding the colour of the paper there is still a controversy going on. Professor Fuchs and some others advocate perfectly white paper for printing school books, etc., because the contrast between the perfectly white paper and the black letters is so great that even when the light is not very strong the reading is still easy. According to experiments made by Babbage about forty years ago, it was proved that black print on yellowish tinted paper is the most distinct and the least fatiguing to the eyes, and in consequence of a proposition which I made at the International Congress of Hygiene at Turin in 1880, and which was very much discussed, a resolution was passed, or rather the desire expressed, that the printing of school books on yellowish tinted paper should be specially recommended to the various governments.

The Society of Hygiene at Lausanne also declared itself against the use of white paper, and they recommend a kind of bluish grey paper as less injurious to the eyes.

Gymnastic Apparatus.

See page 66.

Lately there is a fashion prevailing to let school children practise gymnastics on gymnastic apparatus; this is not necessary. The harmonious development of the human body, as far as it is required for a scientific physical education, can be obtained by *free exercises* (that is exercises without the aid of any gymnastic or other apparatus), and by the various out-door *games*, by marching, running, leaping, swimming. This is not the place to enter into the details of the mode of developing harmoniously all the parts of the body, but as long as the teachers themselves are not instructed in the elements of physical education and in the exercises required for that purpose, as well as in the elements of general and of school hygiene, there is no hope of arresting the degeneration of the physique of the population. Gymnastic apparatus is required only for gymnasts, firemen, soldiers, acrobats, etc. The expenses for gymnastic apparatus may be saved in all schools.

School Doctors.

See page 78.

Dr. Fuchs will be surprised to hear that in Great Britain such a being as a school doctor does not exist. Several years ago I called the attention of the school authorities to this subject, and published a short pamphlet on the *obligatory medical inspection of schools* where I gave the outline of the *excellent* system of school inspection and of personal examination of each pupil prevailing in Brussels, which was introduced by Dr. Jansens, the learned chief of the *Bureau d' Hygiène* of the town of Brussels. My proposition was considered utopian, and I remember that one of the hard-working members of the London School Board asked me privately not to speak of medical inspection of schools, as the tax-payers complained already about the high rates for education. We will hope that some intelligent M.P. will bring this subject before Parliament, and will prove that it is better to pay for medical inspection of schools and scholars, than for increased poor rates, hospitals and convalescent homes, and that prevention is cheaper than cure.

Trachoma.

See page 154.

Although Dr. Fuchs twice mentions the frequency of this disease amongst the Dutch Jews, he does not name one of the principal causes of this disease amongst the Jews in Amsterdam, which Professor Snellen, of Utrecht, pointed out to me, viz., the *bathing* of Jewish women and girls in common tanks at the end of their monthly periods ; also of women after their confinement. This is a religious ceremony prescribed for the sake of cleanliness and hygiene. As there are many trachomatous amongst the bathers, and as the head is submerged in the water which contains much vaginal secretion of various kinds, this ceremonial bathing is a frequent cause of infection.

Glossary of Technical Terms.

ACCOMMODATION ... The faculty possessed by the eye to adapt itself to the distinct vision of near and distant objects.

ACUTE DISEASES ... have violent symptoms, often attended with danger, terminating within a few days.

ADULTORUM ... ... Of adults.

AEGIPTIACA ... ... Egyptian.

ALBINISM ... ... A state in which the skin, hair and the iris are destitute of their normal colour.

ALBUMINURIA ... A disease in which albumen (a substance similar to the white of an egg) is carried away with the urine.

AMAUROSIS ... ... Total loss of vision, caused by paralysis of the optic nerve.

AMBLYOPIA ... ... Partial loss of vision.

ANÆMIA ... ... Deficiency of blood.

ANCHYLOSTOMOSIS. A disease accompanied by the presence of a kind of worm.

ANOPTHALMUS ... Without one or both eyes.

AUTOCHTHONOUS... Indigenous.

AQUEOUS HUMOUR. The fluid in the eye between the cornea and crystalline lens (see below diagram of the eye, A.)

ARTHRITIS ... ... Inflammation of a joint—gout, rheumatism.

ASTIGMATISM ... A condition of the eyes, in which there is a want of symmetry in their refractive surfaces.

ATHEROMA ... ... A morbid deposit causing little elevations in the arteries.

ATROPHY ... ... Wasting or emaciation of a part.

AXIS ... ... The straight line, real or imaginary, passing through a body on which it revolves or may revolve.

BLENNORRHŒA ... A discharge of mucus or matter from a mucous membrane.

BLEPHARITIS... ... Inflammation of the eyelids.

CADAVER ... ... Dead body.

CARIES ... ... Disease of bones, analogous to ulceration of the soft parts.

CATARACT ... ... Opacity of the crystalline lens, or its capsule.

CATARRH ... ... Affection of a mucous membrane, causing increased discharge of mucus.

CEREBRO-SPINAL-MENINGITIS. Inflammation of the membranes of the brain and spinal cord.

CHEMOSIS ... ... Inflammation of the conjunctiva of the eye attended by great redness and swelling.

CHOROID ... ... A coloured vascular membrane lying behind the retina (see diag. Ch.)

CHOROIDITIS... ... Inflammation of the choroid membrane of the eye.

CILIARY BODY ... A part of the eye behind the circumference of the iris (see diag. Ci.)

CONGENITAL... ... From birth.

CONJUNCTIVA ... The mucous membrane covering the front of the eye-ball and inner surface of the eyelids (see diag. Cn.)

CONJUNCTIVITIS ... Inflammation of the conjunctiva.

CONJUNCTIVAL ... Belonging to the conjunctiva.

CONSANGUINITY ... Relationship by blood.

CORNEA ... ... A transparent structure resembling a watch glass, forming the anterior fifth of the eye-ball (see diag. Cr.)

CRYSTALLINE LENS OR LENS. The transparent refractive body lying behind the iris which focuses the rays of light on to the retina (see diag. L.)

CYSTICERCUS... ... The germ of the tape worm.

DACRYO-CYSTO-BLENNORRHŒA. A disease attended with discharge affecting the lacrimal sac.

DIABETES ... ... A disease in which a quantity of sugar is discharged by the urine.

DIPHTHERIA ... ... A disease in which the mucous membrane of various parts, chiefly the throat, air passages and conjunctiva becomes covered with a leather-like membrane.

DYSCRASIA ... ... A diseased state of the general organism.

DYSENTERY ... ... A disease of the bowels attended with pain and a discharge of mucus and blood.

ECTROPIUM ... ... A disease in which the eyelid folds on itself, so that the conjunctival surface becomes external.

ECZEMA ... ... A smarting eruption of small pustules without fever and not contagious.

EMBOLISM ... ... A clot of blood stopping up some blood vessel.

EMMETROPIC... ... The normal or perfect state of refraction of the eye.

ENCEPHALITIS ... Inflammation of the brain.

ENDEMIC ... ... Any disease peculiar to a class of persons or to a country.

ENTOZOA ... ... Parasitical animals.

EPIDEMIC ... ... Any disease which attacks many persons at the same time.

EPITHELIUM ... ... A layer of minute cells covering surfaces of the body.

ERYSIPELAS ... ... A spreading inflammation of the skin.

EXANTHEMATA ... Cutaneous diseases.

EYE-CLINICS ... ... Hospitals in which eye diseases are treated.

FEBRIS RECURRENS. Relapsing fever, resembling typhus.

FLUOR ALBUS ...	A whitish mucous secretion from the vagina of women.
FŒTAL	Belonging to the fœtus.
FŒTUS	The unborn or immature child, from the fifth month of pregnancy till birth.
FOLLICLE	A little bag or simple gland.
FOVEA CENTRALIS	A depression in the retina where that organ is most sensitive to the picture focused on it (see diag. F.)
GLAUCOMA	Dimness or defect of vision accompanied by opacity of the vitreous humour and hardness of the eyeball.
GONORRHŒA	A disease of a mucous membrane, originating in the sexual organs.
GONORRHOICA, GONORRHŒAL ...	Belonging to gonorrhœa.
HÆMORRHAGE ...	A flow of blood.
HEMERALOPIA ...	A defect of vision by which objects are only seen in broad daylight.
HYPERÆMIA	Excess of blood in a part.
HYPERMETROPIC ..	The long sight of old age.
HYPOPION	A disease of the eye, attended with the presence of pus in the front chamber of the eye behind the cornea.
HYPOPION-KERATITIS.	Inflammation and abscess of cornea.
INCUBATION	Hatching, applied to the time taken by a disease to be developed after infection.
INTERSTITIALIS ...	Affecting the interstices of a membrane or tissue.
IRIDECTOMY	An operation in which a portion of the iris is removed.
IRIDO-CHOROIDITIS	Inflammation of the iris and choroid.
IRIDOCYCLITIS ..	Inflammation of the iris and ciliary body.
IRIS	The variously coloured membrane, pierced by a round hole (the pupil) which serves as a diaphragm to cut off superfluous rays of light from the retina (see diag. I.)
KERATITIS	Inflammation of the cornea.
KERATOMALACIA ...	Disease, accompanied by softening of the cornea.
LAMELLAR	In layers.
LAZAR-HOUSES ...	Hospitals for quarantine.
LEPROSY...	Disease in which the skin becomes excessively thickened and nodulated ; called also elephantiasis.
LEUCORRHOEA ...	Mucous discharge from female genitals.
LEUCOMA	A milky opacity of the cornea, left by the scar of an ulcer or wound.

LEUKÆMIA	A disease attended by increase of the white corpuscles in the blood.
LIQUOR AMNII ...	The fluid enclosed in the membranes of the pregnant womb.

MALACIA OF THE CORNEA. Softening of the cornea, same as keratomalacia.

MARASMUS	Wasting of the flesh, emaciation.
MENINGITIS	Inflammation of the membranes of the brain or spinal cord.
MENOPAUSE	The period of the cessation of the menstrual discharge.
METASTASIS	Transference of a disease from one place to another.
MICROCOCCUS ...	A small spherical organism.
MICRO-ORGANISM ...	A small living animal or vegetable.
MICROPHTHALMUS	An abnormally small eye.
MYOPIA	Short-sightedness.
MYOPIC	Short-sighted.
NEONATORUM ...	Of new-born infants.
NEURITIS	Inflammation of a nerve.
NICOTINE	A poisonous alkaloid contained in tobacco.
NODES	Hard circumscribed tumours on a bone, arising from a swelling of the bone or periosteum.
NYSTAGMUS	A constant involuntary motion or oscillation of the eyeballs.
OPACITIES	Dimnesses of the transparent parts of the eye obstructing the light.
OPHTHALMIA ...	Inflammation of the eye.
OPTIC NERVE ...	The large nerve that enters the eyeball at its back and spreads over the interior as the retina (see diag. O.)
ORA SERRATA ...	The finely indented border of the ciliary processes of the choroid where the retina ends (see diag. OS.)
PARENCHYMATOSA	Of a fleshy character or appearance.
PHLYCTENA	A small vesicle on the conjunctiva of sclerotic or cornea.
PHLYCTENULAR ...	Belonging to phlyctena.
PHOTOMETER ...	A light-measurer.
PHOTOPHOBIA ...	Intolerance of light.
PHYSICATSEXAMEN	The examination for the office of Physicus.
PIGMENTOSA	With increased deposit of pigment or colouring matter.
PRIMIPARA	A woman in her first accouchement.
PROGLOTTIDES ...	Segments of intestinal worms.
PROPHYLAXIS ...	Preventive treatment.
PUERPERAL	Belonging to, or consequent on child-bearing.
PURULENT	Consisting of pus.
PUS	Matter.

16

PYÆMIA ... ... A disease accompanied by the presence of matter or pus in the blood.

RACHITIS ... ... A disease peculiar to children, characterised by softening and distortion of the bones.

REFRACTION ... ... The angular deviation of an oblique ray of light when it passes from one transparent medium to another of different density.

RETINA ... ... The expansion of the optic nerve over the inside of the eye. (see diag. R.)

RETINITIS ... ... Inflammation of the retina.

SATURNINE POISONING. Poisoning by lead.

SCLERA OR SCLEROTIC. The thick opaque case of the eyeball (see diag. S).

SCOTOMA... ... ... A black or dark spot seen by the patient.

SCROFULA ... ... A dyscrasia or general disease originating in a morbid condition of the lymphatic glands or transmitted hereditarily.

SCURVY ... ... A disease characterized by great debility, a spongy state of the gums and a tendency of the blood to escape from its vessels.

SEQUELÆ ... ... After effects—secondary diseases.

SERPENS... ... ... Of a serpentine form.

SNELLEN ... ... The name for a series of test types, introduced by Dr. Snellen.

SPORADIC ... ... Applied to infectious diseases which seize only a few persons at a time.

STAPHYLOMA... ... A bulging of a part of the eyeball, often attended by the protrusion externally of portions of the interior of the eye.

SYPHILIS... ... ... A disease caused by venereal poison being received into the system.

TÆNIA SOLIUM ... The tape worm.

THROMBOSIS ... ... A clot of blood obstructing a blood vessel.

TRACHOMA ... ... A disease of the eye, attended by a granular condition of the conjunctiva and a discharge.

TRACHOMATOUS ... Belonging to trachoma.

TRAUMATIC ... ... Belonging to a wound.

TRICHIASIS ... ... A disease in which the eyelashes are turned in towards the eyeball.

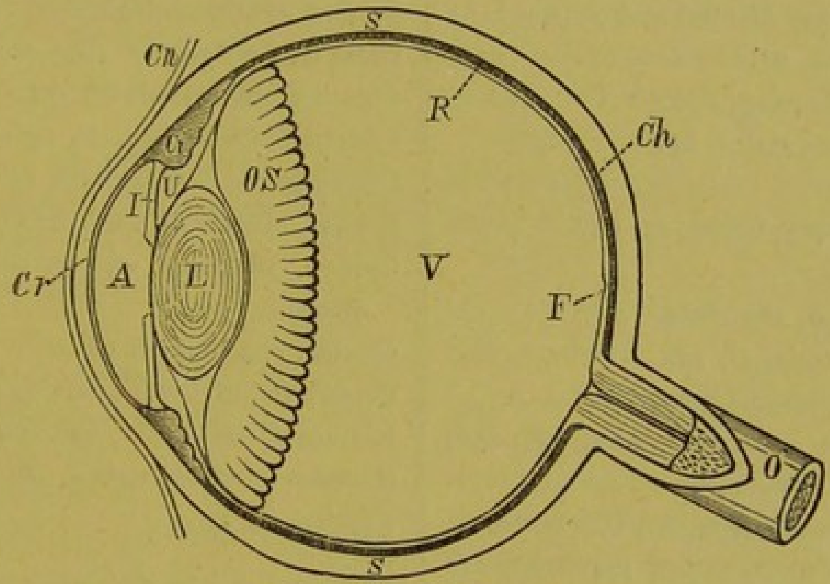
TUBERCULOSIS ... A disease attended by the formation of tubercles.

ULCUS ULCER ... A solution of continuity in any soft part of the body, with a discharge of pus.

UVEA, OR UVEAL TRACT. The dark pigment at the back of the iris (see diag. U).

VARIOLOUS.	Relating to small-pox.
VISCERAL	Relating to the intestines or internal organs.
VITREOUS HUMOUR	A clear fluid enclosed in a transparent membrane filling the eyeball from the crystalline lens to the retina (see diag. V.)

DIAGRAM SHOWING THE PRINCIPAL PARTS OF THE EYE.



Cn. Conjunctiva.
Cr. Cornea.
Ch. Choroid.
Ci. Ciliary body.
A. Aqueous humour.
V. Vitreous humour.
L. Crystalline lens.
I. Iris.
U. Uvea.
S. Sclerotic.
R. Retina.
O. Optic nerve.
F. Fovea centralis.
OS. Ora serrata.

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