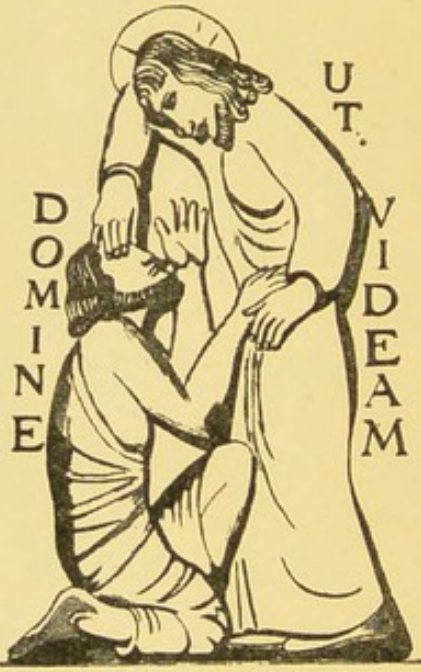
The toxic amblyopias : their symptoms, varieties, pathology and treatment / by Casey A. Wood.

THE

TOXIC AMBLYOPIAS

THEIR SYMPTOMS, PATHOLOGY AND TREATMENT

CASEY A. WOOD, C. M., M. D.



E. Treacher Collins

THE TOXIC AMBLYOPIAS

THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT,

By CASEY A. WOOD, C. M., M. D.

Professor of Ophthalmology in the Chicago Post-Graduate Medical School;
Ophthalmic Surgeon to Cook County Hospital, and to the
Emergency Hospital, Chicago.

Reprinted, for private circulation only, from the ANNALS OF OPHTHALMOLOGY AND OTOLOGY 1892-94.

PREFACE.

While the poisonous agents that produce ocular symptoms are quite numerous, examples of their injurious effects upon the eye are, with some few exceptions, comparatively rare. It must follow from this fact that a monograph upon the subject of Toxic Amblyopia, written by one observer, is likely to be chiefly a compilation of other men's literary efforts. While this is entirely true in my own case, I have for many years had the matter in mind, and I trust, as a consequence, the reader will be able to detect, here and there, an observation to which I may fairly lay claim as all my own.

Among the conclusions thus arrived at I am decidedly of the opinion that the use of certain intoxicants, some of them commonly prescribed drugs and beverages, very often results in minor defects of vision, the true nature of which is unsuspected by the patient or his medical attendant. These symptoms, which are commonly included in the term "asthenopia," show themselves especially as a decrease in the amplitude of accommodation and convergence. I have seen evidence of this muscular weakness follow the every-day employment of quinin, the salicylates, potassic iodid, potassic bromid, alcohol, tobacco, coffee, tea and such forms of decomposed food as "high" game, "strong" cheese, etc.

I feel certain, also, that the asthenopic symptoms observed in some forms of dyspepsia constitute a Toxic Amblyopia due to *ptomaine poisoning*. They properly belong to those milder types of allantiasis where the eye signs are yet sufficiently well marked to be recognized by the unskilled observer.

As an offset to this, many drugs have been wrongly accused of producing eye symptoms. I have, consequently, omitted any

mention of quite a large number of agents put forward, from time to time, as a cause of ocular intoxication. I quite agree with Knies that "if we are to include, for example, every instance where the intoxication is at times accompanied by contraction or dilatation of the pupil or where towards the end of a fatal case irregular movements of the eyeballs, squint, motionless irides, etc., had been noticed, there would be no end to the list of the toxic amblyopias."

While pursuing this study, I was also conscious that I had failed to avail myself of much valuable material, owing to my ignorance of several foreign languages and to my not having access to numerous other sources of information that might have made my work more useful and interesting. On the other hand, I have diligently searched *the originals* of such contributions to the literature of this subject as were accessible to me, (inaugural theses, monographs, text-books and articles in periodicals), as were written in English, French, German, Italian, or Latin.

I have to thank the Editor of the ANNALS OF OPHTHALMOLOGY for giving me so much of his space and wish to explain that, with the exception of the prefatory matter, this monograph is merely a reprint of articles that have, during the past two years, appeared in his journal. It was my intention to have inserted a list of *errata* and to have added an index, both of which would have been of advantage, but the irregular paging of the reprints has made these additions impracticable.

My thanks are also due to Drs. de Schweinitz and Charles A. Oliver, of Philadelphia, to Mr. J. B. Lawford, of London, and to many other friends for assistance in preparing these papers; to the officials of the Newberry Library for their courtesy, and to Prof. Uhthoff, of Marbourg, who first inspired me to investigate this subject.

I cannot refrain from referring here to Mr. Simon Snell's recent experience of six cases of amblyopia (*British Medical Journal*, March 3, 1894,) in workers with di-nitrobenzol, that powerful explosive known in English commerce as "roburite," and in Germany as "Sicherheit." The general symptoms closely resemble those from bisulphid of carbon, and remind one of Neiden's account (*vide* reference No. 212). The conjunctiva and lips were often discolored; the urine was commonly of an inky blackness. The eye signs were well marked and appear to give the poison a place in class I, div. 2, of the nomenclature I have adopted. The F. of V. for white in all the cases showed a con-

centric limitation (30° — 50°), with the center unaffected. In a few instances there were central scotomata for green and red. In all the ophthalmoscope showed changes at the disk, usually pallor. The central acuity was lowered both for distance and near. Mr. Snell is careful to speak of the tobacco habits of his patients, but the experience of others, the peripheral limitation of the field and the fact that one of his best marked cases occurred in a young woman, aged 17, leave little doubt but that the optic nerve lesion resulted from the absorption of the di-nitrobenzol into the system.

I wish, also, to refer to Miss Alice Wakeham's paper on *quinin amaurosis* (*New York Polyclinic* for August, 1893), with history of a case.

Finally, I venture to predict a considerable demand for the forthcoming translation, edited by Dr. H. D. Noyes, of Max Knies' "*Die Beziehungen des Sehorgans und seiner Erkrankungen zu den übrigen Krankheiten des Körpers*," as containing one of the best accounts of the Toxic Amblyopias yet presented to the profession.

C. A. W.

103 East Adams Street, Chicago

TABLE OF CONTENTS.

I.

DEFINITIONS AND CLASSIFICATION.

The terms Amblyopia and Amaurosis.—Their varieties and synonyms. —A definition of Toxic Amblyopia.—Classification.—A symptomatic classification most useful.—Poisons producing chronic retrobulbar neuritis.—Poisons producing other forms of optic nerve and retinal disease.—Agents producing chiefly mydriasis.—Poisons that bring about contraction of the pupil.—Poisonous agents whose eye symptoms are inconstant.

II.

THE ETIOLOGY OF TOXIC AMBLYOPIA.

Tobacco.—Alcohol—Tobacco.—Carbon Disulphid.—Cannabis Indica. —Iodoform.—Lead Salts.—Quinin.—Salicylic Acid and other Salicylates. —Cocain.—Venom of poisonous reptiles.—Mydriatic Alkaloids.—Decomposed food.—Sulphuretted hydrogen.—Carbolic Acid.—Morphia and other opium preparations.

III.

ETIOLOGY OF TOXIC AMBLYOPIA.—*Concluded.*

Aconite.—Chloral and its hydrate.—Pilocarpin and jaborandi extracts. —Eserin and Calabar bean.—Osmic Acid.—Santonin.—Picric Acid.—Digitalis.—Tea. —Chocolate. —Gelsemium. —Anilin. —Emanations from pitch and coal.—Arsenic. —Naphthalin. —Potassic bromid.—Methylated spirits.—Ergot.—Amyl Nitrite.—Nitrous oxid. —Nitrobenzol.—Mercurial compounds.—Silver Salts.

IV.

PREDISPOSING CAUSES, SYMPTOMS, DIAGNOSIS AND TREATMENT.

Idiosyncrasy. —Age.— Sex.— Occupation.— Alcohol and Tobacco.— Quinin.—Iodoform.— Carbon disulphid. —Cannabis Indica.—Arsenic.— Lead Salts.—Salicylic acid and Sodic Salicylate.—Cocain.—Venom of poisonous reptiles.—Salts of Silver.—Mercurial preparations.—Ergot.— Nitrite of Amyl.—Nitrous oxid.—Male Fern.—Pomegranate.—Ptomaines and poisonous leucomaines.—Poisonous fungi.

V.

SYMPTOMS, DIAGNOSIS AND TREATMENT.—*Continued.*

Belladonna and its alkaloids.—Other cycloplegic alkaloids.—Opium and morphia.—Aconite.—Chloral and its hydrate.—Eserin.—Pilocarpin and jaborandi.—Coffee and Caffein.—Anilin and its salts.—Coal gas and its combustion products.—Phosphorus.—Sulphuric Acid.—Ethylen dichlorid.

—Potassic bromid.—Iodin and iodides.—Methylene bichlorid.—Chloroform. — Ether. — Antipyrin. — Nitrobenzol. — Sulphonal.—Chrysosphanic Acid.— Saponin.— Horse Chestnut.— Podophyllum.— Helleborein.— Erythrophlaein, "haya poison," apomorphin, *alpha* kava resin and "toad poison."—Hydrocyanic acid and other cyanides.—Spt. Etheris nitrosi.

VI.

AGENTS OF MINOR IMPORTANCE.

Nitroglycerin.—Chromic Acid.—Hydracetin.—Antifebrin.—Curare.—Marsh Gas.—Oxalic Acid.—Menthol.—Coniin.—Gelsemium Sempervirens.—Cytisin. — Creolin. — Resorcin. — Ether petrolei. — Toluylendiamin.—Strychnia.—Sulphur Ointment.— Piscidium.— Bromoform.—Salicyl.—Oil of Anise.—Leucomaines of hydrophobia.

VII.

PATHOLOGY AND TREATMENT OF THE MORE IMPORTANT TOXIC AMBLYOPIAS. PROPHYLAXIS AND HYGIENE.

Tobacco.—Tobacco and Alcohol,—Arsenic.—Carbon disulphid.—Cocain.—Ergot.—Iodoform.—Lead Salts.—Quinin.—Salicylic Acid and Sodic Salicylate.—Ptomaines.

THE TOXIC AMBLYOPIAS; THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT.

By Casey A. Wood, C. M., M. D.

PATHOLOGIST TO THE ILLINOIS EYE AND EAR INFIRMARY; PROFESSOR OF OPHTHALMOLOGY IN THE CHICAGO POST-GRADUATE SCHOOL; OCULIST AND AURIST TO THE ALEXIAN HOSPITAL, ETC.,
CHICAGO.

The absence of a complete English treatise on the above extremely important subject has tempted the writer to undertake the rather ambitious task of gathering together the scattered observations and records of work done in this department, both at home and abroad, and of presenting them in something like a coherent whole to American readers. He has been partly moved to do this in view of the fact that so far nobody has seen fit to translate either Uhthoff's classical essay [*Untersuchungen über den Einfluss des chronischen Alkoholismus auf das menschliche Sehorgan*,] or Galezowski's earlier monograph [*Des Amblyopies et des Amauroses Toxiques*, 1878.]

THE TERMS AMBLYOPIA AND AMAUROSIS—THEIR VARIETIES AND SYNONYMS. A DEFINITION OF TOXIC AMBLYOPIA.

The employment of the term *amblyopia* (*amblus*, dull, and *ops*, the eye,) dates from the time of Hippocrates and has always been applied to those cases of deficient or weak vision not due to discoverable refractive error or to any sensible change in the ocular structures. In other words, it describes one symptom only of certain so-called functional eye diseases. But just as many "functional" affections of other parts of the body are now explained by the presence of organic alterations and have, in consequence, been removed from the former category, so we find that the discoveries of the ophthalmoscope and microscope especially have greatly reduced the number of the amblyopias. The former instrument has revealed to us many lesions in the background of the eye hidden from the oculists of the "pre-ophthalmoscopic era," while the latter has demonstrated the existence of pathological changes in the visual apparatus that were previously unsuspected or were matters of conjecture only. In spite, however, of these facts and in the face of protests made by even early writers on ophthalmology the retention of the expression "toxic amblyopia" may be defended upon the ground that as yet no other name has been suggested or generally adopted that furnishes a more definite idea of the morbid alterations in the ocular structures brought about by certain toxic agents.

Mackenzie (1) preferred the term *amaurosis* (*amauros*, dark), defining it to be an obscurity of vision due to diseases of some portion of the ocular nervous apparatus, a definition which would include and better describe some of the so-called amblyopias. Since his day, however, a different meaning has been attached to this term by most authorities who, speaking generally, regard amaurosis as an advanced de-

gree of amblyopia—a nearer approach to a condition of complete blindness.

The designation of a diseased condition by one or more of its symptoms is to be deprecated and to be avoided when possible, but inasmuch as the terms toxic amblyopia and toxic amaurosis, not only describe the causation of the trouble, but also indicate their most prominent symptoms, they have something to recommend them. Certain French writers have attempted to avoid the difficulty by dividing this class of affections into two categories: one they term *névrite rétro-bulbaire* and the other *amblyopie toxique*, but as, in the opinion of the writer, many of the cases included in the former division probably belong to the latter, and as some of the latter are undoubtedly examples of the first class, the advantages of this nomenclature are not very apparent. Nor does the term *Intoxicationsamplyopie* used by German writers, tell us any more about the causation of this important division of disease. No doubt that rule in semeiology which reminds us that diseased processes should bear a name indicative of their pathology will finally prevail in this department of medicine, but as long as the precise structural changes in many or most cases of toxic amblyopia and amaurosis remain unknown, or are in doubt, these terms may be conveniently and consistently employed.

Toxic amblyopia; then, *may be defined as that interference with vision produced by the use, in poisonous doses, of certain drugs.* In toxic amaurosis, blindness, temporary or permanent, is the principal symptom.

At the outset, also, the writer would state his decided preference for prefixing the particular form of poison amblyopia or amaurosis with the name of the drug or drugs which have produced the disease in question, and in this monograph he proposes to speak of "tobacco amblyopia," "alcohol-tobacco amblyopia," "quinine amaurosis," etc., whenever these expressions can properly be employed.

CLASSIFICATION.

A SYMPTOMATIC CLASSIFICATION MOST USEFUL.—POISONS PRODUCING CHRONIC RETRO-BULBAR NEURITIS.—POISONS PRODUCING OTHER FORMS OF OPTIC NERVE AND RETINAL DISEASE.—AGENTS PRODUCING CHIEFLY MYDRIASIS.—POISONS THAT BRING ABOUT CONTRACTION OF THE PUPIL.—POISONOUS AGENTS WHOSE EYE SYMPTOMS ARE INCONSTANT.

To any one acquainted with the subject of poison amblyopia (and this term will hereafter be understood to include amaurosis where the two conditions are not contrasted,) it will be evident that the agents which produce deterioration of vision may be roughly divided into two classes. The first comprises those whose toxic affects are generally known to present certain constant factors and to be associated with in-

jury, more or less demonstrable, to the optic nerve and retina. The second group will be made up of those substances that produce a weakening of sight for the most part of an acute and transitory character, unaccompanied by physical signs of tissue change in the optic nerve which entitle them to be included in the first class. The following classification is in some respects empirical, but for our purposes, it is a useful and necessary one. The more important agents are italicised.

CLASS I.—*Poisons that directly affect the Optic Nerve.*

Division 1. Poisons that produce a chronic retro-bulbar neuritis—*alcohol; tobacco; alcohol-tobacco; carbon disulphide;* haschisch; iodoform; arsenic (?)

Division 2. Poisons producing other forms of optic nerve and retinal diseases—*lead; quinine;* salicylic acid and sodic salicylate; cocaine; venom of poisonous reptiles; salts of silver; mercurical preparations; ergot; nitrite of amyl; nitrous oxide gas; male fern and pomegranate.

CLASS II.—*Poisons whose Amblyopic Symptoms are Unaccompanied by Retinal or Optic Nerve Lesions.*

Division 1. Agents that produce chiefly mydriasis—*belladonna* and its products; alkaloids from the *datura stramonium*; hyoscyamus niger; *decomposed food*; poisonous fungi; poisonous fish (ptomaines; leucomaines, etc,); sulphuretted hydrogen; carbolic acid.

Division 2. Agents that bring about a toxic state whose chief ocular sign is a contracted pupil. These are morphia and other preparations of *opium*; aconite (?); chloral and its hydrate; pilocarpine and *jaborandi extracts*; eserine and *calabar bean.*

Division 3. Poisons producing various or irregular eye symptoms—osmic acid; picric acid; *santonin;* digitalis; tea; chocolate; gelsemium; *aniline dyes;* nitro-benzol; *emanations from pitch and coal;* preparations of iron (?); iodine (?); arsenic; naphthaline; coffee (?); methylated spirits; ethylene chloride; sulphuric acid; *potassic bromide.*

The list of agents whose use, local or general, is said to have produced visual disturbances is, thus, a long one, but in some instances the accounts given of the alleged amblyopia are very meager or very indefinite, or they come to us in the shape of physiological experiments made upon the lower animals. In some other cases the amblyopia was plainly due to local, mechanical irritation of the conjunctiva and cornea, or, like the ordinary myotics, to mere contraction of the pupil with or without interference with accommodation. Lastly, I have in several instances found isolated references to ocular symptoms supposed to be produced by toxic agents which could not be traced, or when traced turned out to be entirely misleading.

ETIOLOGY OF TOXIC AMBLYOPIA.

ALCOHOL.—TOBACCO.—ALCOHOL-TOBACCO.—CARBON DISULPHIDE.—CANNABIS INDICA.—IODOFORM.—LEAD.—QUININE.—SALICYLIC ACID AND OTHER SALICYLATES.—COCAINE.—VENOM OF POISONOUS REPTILES.—MYDRIATIC ALKALOIDS.—DECOMPOSED FOOD.—SULPHURETTED HYDROGEN.—CARBOLIC ACID.—MORPHIA AND OTHER OPIUM PREPARATIONS.

ALCOHOL.—Notwithstanding the assertions of some authorities, there can be no doubt but that the drinking of this poison is one of the most frequent causes of toxic amblyopia. Deficient vision from abuse of alcohol has been recognized by the earliest writers on this subject. For example Plenck, (2) among the cases of amaurosis gives prominence to *abusus spirituosorum*. Not to mention the exhaustive treaties of Uhthoff (3) in late years, the reader will find the case for alcohol argued at length in Doebbelin's (4) thesis, published in 1850.

It is probable that the more dilute forms of alcoholic beverages taken in moderation (two or three glasses of beer or wine daily) alone rarely or never produce chronic amblyopia. Hutchinson (5) thinks that the impurities in and additions to spirituous liquors may be held accountable for a large part of the damage to sight, but it has yet to be established that such adulterations as amylic alcohol (fusel oil, potato spirit) and the empyreumatic oils or such ingredients as are commonly added to alcoholic liquids to form the liqueurs (wormwood in absinthe, hydrocyanic acid in maraschino, oil of juniper in gin, and so on,) as well as the elaborate concoctions know as "fancy drinks" are, *per se*, capable of producing the characteristic symptoms af this disease. It is well established that long continued and frequent indulgence in small quantities of spirits is more deleterious to eyesight than occasional "sprees." The persistent morning nausea, anorexia, muscular tremors, sleeplessness, and dull headaches that plague the chronic drinker are more likely to be associated with degeneration of the optic nerve tissues than are the more acute troubles of the deep but occasional drunkard. Of a 1000 cases of decided alcoholism, Uhthoff found that 6 per cent. of them were sufferers from amblyopia; in 6.5 per cent. more he found optic nerve changes without amblyopia; in 5.3 per cent. pathological states of the optic nerve and retina, and in 12.2 per cent. other diseases of the ocular apparatus. So that 300 of these 1000 chronic alcoholics had eye affections of one kind or another.

TOBACCO.—As in the case of alcohol, the more concentrated the form and the more constantly the indulgence in the tobacco poison, the greater the likelihood that the vision of the *habitué* will suffer.

I have not been able to find the report of a case where amblyopic symptoms were developed by snuff taking. Prepared snuff, it must be remembered, is much poorer in nicotine than the natural leaf tobacco. This is due to the process of manufacture during which a large pro-

portion of its alkaloids is decomposed or escapes. According to Johnstone (6) the stronger varieties—the rappees—made of tobacco having from five to six per cent. of nicotine retain only two per cent. when fully manufactured, thus reducing their strength to that of the mildest Havana and Turkish leaf.

"Dipping" (the habit of rubbing snuff upon the gums with a brush or carrying it to the mouth upon a chewed stick previously dipped in snuff,) is mostly confined to the female sex and said to be prevalent in the Southern States, and, so far as I can learn, is not a frequent cause of toxic amblyopia.[1] A few cases are, however, on record. Among them is an interesting instance given by Blitz (7).

> The patient, a woman, thirty-five years old, from the Tennessee Mountains, became so blind that she could barely distinguish light from darkness. She "dipped" a large quantity of snuff daily, but on desisting from the practice and undergoing treatment, vision was entirely restored in six weeks.

De Schweinitz (8) also mentions the case of a young woman, not otherwise a tobacco user, who got toxic amblyopia from working in a tobacco factory. It must not be forgotten that the sneezing and the use of the handkerchief that accompany snuff taking, as well as the small quantity of nicotine commonly absorbed in "dipping" probably account for the rarity of toxic symptoms among those who indulge in these habits.

I am inclined to believe that chewing is more harmful to sight than smoking. However that may be, all that we know about tobacco amblyopia seems to indicate that *it is the nicotine that causes loss of vision*. Although in the combustion of the weed a volatile, acrid, and exceedingly poisonous empyreumatic oil—nicotianine—is produced, there is probably very little nicotine in the smoke, the latter alkaloid being partly destroyed and partly retained in the pipe, cigar stump or cigarette end.

The usual combination of a well seasoned pipe with strong ("shag") tobacco has rendered nicotine poison common in England notwithstanding the comparative infrequency there of tobacco "eating." In America, on the other hand, where pipe smoking of the short and strong kind is uncommon and the use of cigars and cigarettes almost universal, the prevalence of the chewing habit quite makes up for that comparative freedom from tobacco amblyopia which we might enjoy if we were to refrain from the latter vice. An exemplification of this truth can be seen in Germany where the preference for mild cigars and tobacco smoked in long, easily cleaned pipes, as well as the entire absence of

---

[1] Dr. Minor, of Memphis, Tenn., informs me that he has not had a case of amblyopia from "dipping" and, he adds, has never known any one addicted to that habit.

the chewing habit largely account for the rarity of tobacco amblyopia in the Vaterland. Again, in Turkey, where cigarette smoking is almost the only form in which the weed is used by both sexes and among all classes, tobacco amblyopia is, according to Van Milligen (9), Hübsch, (10), and other competent observers, almost unknown, and yet the annual consumption of tobacco by the Turks is enormous. Van Milligen says that for many years the Nargileh and pipe have been quite out of fashion. The smoke from the cigarette tobacco (containing three to four per cent. of nicotine) is drawn into the lungs, but the mouth end is so prepared that none of the tobacco touches the lips; consequently no nicotine is directly absorbed.

In estimating the probable effect of the tobacco used in a given case Cohn (11) very properly insists that we ought to consider not only the kind but the weight of cigars when the tobacco is used in that form. He quotes a case of nicotine amblyopia where in the early stage of the disease the patient smoked first Havanas and later the same number of Dutch cigars. The Cuban cigars contain 2.02 per cent. and the Dutch 1.8 per cent. of nicotine, but as the former weighed only 4.7 grms. and the Dutch 9 grms. the latter must be held responsible for the disease.

Alcohol-Tobacco.—This mixed cause is what one finds quite frequently in most countries. The steady drinker is almost always a tobacco devotee and, as will hereafter be seen, it is difficult to say which poison is, in such cases, responsible for the amblyopic symptoms. It may, however, be assumed that when the disease is found in a patient who drinks beer or light wines, but who smokes or chews some form of strong tobacco, the latter is probably the cause of his troubles. On the other hand, the infrequent smoker of mild tobacco (cigars and cigarettes especially) who regularly take spirits of any kind may be set down, even in the absence of other proof, as amblyopic from the drink habit. Hutchinson and other English writers claim that moderate drinkers of mild alcoholic beverages are less likely to be the subjects of tobacco amblyopia than total abstainers.

To give an idea of the frequency (in America) of these cases as compared with other causes of anaemic and atrophic states of the optic nerve the tables of Alt (12) may be quoted. Of 120 such cases he found that tobacco alone was the cause in nine instances, alcohol alone in three cases, alcohol-tobacco in 39 cases. That is to say, in more than 42 per cent. of the whole number of cases, tobacco and alcohol played the chief etiological role. Uhthoff's (3) figures, (30,000 patients), of course, refer to Germany. Of 204 cases of retrobulbar neuritic affections he puts down abuse of alcohol as producing the disease in 64 cases or 31 per cent., alcohol-tobacco in 45 cases or 22 per cent., tobacco alone in 23 cases or 11 per cent. Thus alcohol and to-

bacco, alone and together, were the cause of the neuritis in 132 instances—64 per cent. of the whole. In France Galezowski (13) has given some very interesting statistics based upon his observation of more than 20,000 patients suffering from diseases of the eye—statistics which fuller and later experience has confirmed. Of 151 cases of toxic amblyopia (tobacco and alcohol) only 21, fourteen per cent., were due entirely to tobacco. These were all heavy smokers, using from 20—80 grammes of tobacco daily or smoking 8—26 cigars. One-half per cent. of all the cases in the Hirschberg (14) klinic had toxic amblyopia.

After a thoughtful consideration of the foregoing facts and figures one must come, it appears to me, to these conclusions: 1. Both tobacco and alcohol, alone and combined, may produce toxic amblyopia. 2. It is probable that it is the nicotine in tobacco that produces the toxic effect. If this be true, chewing is more injurious to sight than smoking, short pipes than long ones, old or unclean ones than new or easily cleaned pipes, mild cigars and cigarettes than strong cigars, and strong tobacco than mild. 3. The form in which alcohol is taken into the system has much to do with the amblyopic effects. The lighter forms of alcoholic beverages unless indulged in to great excess do not permanently affect vision. The same quantity of alcohol which when diluted (as beer or light wine) would be harmless, might be injurious to the eye sight if taken in the concentrated forms of whiskey, brandy or gin. This is especially true when the latter are drunk between meals or when the stomach is empty.

Carbon Disulphide.—Less than fifty cases of toxic amblyopia from this cause have been published since Delpech's (15) article appeared in 1856. This agent is a colorless liquid of a peculiarly pungent and disagreeable odor. It is almost as volatile as "sulphuric" ether and its fumes soon diffuse themselves through an apartment and vitiate the respired air. It exerts a powerful solvents effect upon fats and is used in large quantities for extracting oily matters from fabrics and other materials. It is also used in electro-plating. But its chief value in the art depends upon its power of vulcanizing or "sulphurizing" rubber. Mixed with a small percentage of monochloride of sulphur (SCl) it is extensively employed in the manufacture of rubber articles. It has not been yet established what part, if any, is played by the sulphur chloride in producing intoxication. This latter agent is a deep orange colored, non-volatile liquid and is now much used in the production of "artificial rubber," but so far, no cases of amblyopia have been reported from its separate employment.

Cannabis Indica.—Indian hemp in the form of "haschisch," "bang," "gunjah," etc., is indulged in as a narcotic stimulant by East-

ern nations almost as extensively as tobacco is by us. It is known to cause, among its other toxic effects, an amblyopia closely resembling that due to nicotine and alcohol. The dried flowers are smoked, an electuary (prepared from the resin, essence of roses, musk and other aromatic substances) is eaten, while an oleaginous extract made of melted butter or oil is sipped until intoxication occurs. The active ingredients are a volatile oil and a resin. I do not know of a single case of amblyopia from this drug reported as occurring in American or European countries, but Ali, (16), who has seen many cases in Persia, speaks of it as being quite common in that country.

Iodoform.—The only case on record is the following from Hirschberg's (17) klinik.

A sixteen-year old girl was operated upon by Prof. Küster for hip-joint disease which was dressed with iodoform. During the after treatment severe disturbances of vision set in. VR=$\frac{1}{20}$, VL=$\frac{1}{30}$. There was a central scotoma of from 4° to 8° radius, otherwise the field of vision was undisturbed. Fundus entirely normal. Pupils widely dilated. Hirschberg diagnosed iodoform amblyopia. In eight days vision was again normal. Nothing is said in this report about the patient's smoking or drinking habits.

Lead.—Amblyopia among workers in lead has long been recognized, and next to alcohol and tobacco is the commonest cause of amblyopia; although the occurrence of optic nerve atrophy from this poison was not described until 1886 by Hirschler (18). The salts of this metal find their way into the system by absorption through the skin in the case of painters (who mostly deal with white lead already mixed with boiled oil), while in the case of workers in factories where plumbic ores are reduced or where they are subsequently prepared for the market, the respiratory tract furnishes an additional means of conveying the poison to the brain, kidneys and other organs. Oliver (19) mentions among other sources of lead poisoning, lead smelting, plumbing, working in type foundries, water polluted with lead salts, food (canned meats, fruits and vegetables), paint mixers, etc. Cosmetics containing lead are also thought to be capable of producing lead amblyopia. Atkinson (20) records a fatal case where in the brain and meninges alone an amount equal to five grains of the metal was discovered.

Quinine.—When one considers the large doses and the enormous quantity of this drug that are constantly prescribed and when one remembers how common is the occurrence of cinchonism it is remarkable that there are not more than forty or fifty cases of quinine amaurosis on record and that ocular disturbances are so rarely produced. The first of these was described by Graefe (21). The very characteristic signs and symptoms of quinine amaurosis have been developed by as little as eighty grains taken during thirty hours but it has also required doses aggregating 1300 grains extending over three days (Voorhies

22) before blindness set in. These symptoms have usually been produced by quinine taken in its pure form, but in a few instances, as in that recorded by Roosa, (23), where a strong mixture of cinchona caused the mischief—preparations of the bark have produced blindness. There is no evidence that the associated alkaloids (cinchonine, cinchinoidine, etc.,) are capable of causing a toxic amblyopia or amaurosis, but as their action in other respects resembles that of quinine, it may for the present be assumed that they may produce similar effects upon the eyes.

Salicylic Acid and Sodic Salicylate.—Several cases of poisoning are recorded from the use of these drugs now so extensively employed in rheumatic and other affections. The first and most important case reported in literature is that of Gatti (24).

Eight grammes, divided into ten doses—one every hour—were given to a perfectly healthy sixteen year old girl for acute articular rheumatism. She slept several hours after the last dose and when she awoke was absolutely blind, or had only qualitative perception of light, marked mydriasis, clear media, light gray reflex, papilla normal, edges well defined. Retinal veins filled with blood. No phosphenes. Deafness, weak cardiac impulse, small pulse, slight perspiration; pains in joints entirely gone. Urine normal. In it no trace of salicylic acid. Dullness in head, sleepiness, memory unclouded. Ten hours later patient awoke from sleep and was able to count fingers, but the deafness and mydriasis lasted until the next day. Vision finally became normal.

Cocaine.—This drug has been shown to be responsible, among its other toxic effects, for a decided though transitory amblyopia. In Bock's (25) case six minims of a twenty per cent. solution, used as a sub-mucous injection for teeth extracting, was sufficient to produce distinct fundus changes.

Venom of Poisonous Reptiles.—This agent has been known to bring about serious results (so far as vision is concerned) in those who survive the action of the poison. In the case of poisonous serpents we have Amaral's assertion that in South America blindness as the result of snake bites is common enough. de Magalhaes (26) of Rio reports the following case:

A twenty-four year old negro was bitten by a snake. This was soon followed by great weakness, loss of consciousness, rupture of blood vessels and bleeding from the nose. After twenty-four hours consciousness returned, but headache and sleeplessness set in and lasted a month. Then failure of sight was noticed. In another month all symptoms disappeared except the visual disturbance which got worse, and then remained stationary for a year. Finally it went on to blindness. The eyes are now in constant motion (nystagmus) so that an ophthalmascopic examination is difficult, but the optic nerve is not atrophic; on the contrary the veins are hyperaemic. On a later examination de M. found a round black spot on the outer-upper side of the left papilla which looked like an old hemorrhage. Patient died shortly afterwards of small pox.

The active agent in all these cases is an albuminoid substance. Weir Mitchell has named the poison of our rattlesnake *crotaline* and says that its virulent qualities resist the influence of temperatures between 0° and 212° F., as well as most antiseptic agents. The poison of the cobra applied to the eyes of fowls acts as a powerful cycloplegic. In a case of amblyopia following "toad" poison getting into a woman's eye, Staderini and Addario (27) found that a one per cent. collyrium of the poison produced anœsthesia of the cornea and conjunctiva lasting four to five hours.

Mydriatic Alkaloids.—The local effects of these agents upon the eye are too well known to require an extended introduction. They are chiefly atropine, homatropine, daturine, duboisine, and hyoscyamine, as well as preparations of the plants from which they are derived, The amblyopia which they produce is almost altogether the result of dilatation of the pupil and paresis of accommodation. Similar effects are also produced by digitalis and aconite. Certain of these drugs are purely local mydriatics and in all of them the mydriasis and cycloplegia may be a part of the general poisoning that results from their introduction into the system by accident or design. Galezowski (28) mentions a case where the eye symptoms were traced to the wearing of a belladonna plaster!

Decomposed Food.—*Ptomaines and leucomaines affect the eye in much the same way as the mydriatic poisons.* Almost every description of decomposed or partially cooked food has produced amblyopic symptoms, especially dilatation of the pupil and accommodative paresis. It is, however, chiefly in those countries where "high" game and half cooked food are most popular that these accidents occur. As examples of this may be mentioned "high" hare (29), uncooked meat (30), decomposed sausage (31), rotten fish (32), poisonous fungi, (33), and shellfish, (34), especially mussels are on record as causes of amblyopia. The active agent in the latter case is a diseased liver producing *mytilotoxine*—similar to curare in action.

Sulphuretted Hydrogen.—This is one of the very rare causes of amblopia. Although a violent poison in its undiluted form, it does not seem to exhibit its poisonous qualities upon the eye when breathed in its dilute state, as in illuminating gas, emanations from sewers, springs, etc. In a case reported by P. & L. Brouardel (35) this poison produced mydriasis, exophthalmos, loss of pupillary reflex, anœsthesia of the cornea, etc.

Carbolic Acid.—A very few well authenticated cases are on record from this agent.

In Nieden's (36) case 100 grms. of a three per cent. solution injected into the pleural cavity produced, among other poisonous symptoms, decided visual

failure which lasted twenty hours. A merchant, æt 37, had an *empyema pleurae* for which was done exsection of the sixth and seventh ribs of right side. The cavity was daily washed out with a two per cent. carbolized solution after which patient had a sweetish taste in his mouth with some headache. Treatment continued four months without further symptoms. To hurry up matters he increased solution to three per cent and used it twice a day with greater force. Before end of second injection patient cried out and fell to the ground in convulsions, unconscious, weak pulse. Both pupils were widely dilated and did not react to light. Ether and other remedies brought him to consciousness in two hours; after which severe headache and desire to vomit. Both eyes were completely blind. Fundi (examined twelve hours after) normal except a slight haze of papillæ. Next morning patient was free of all bad symptoms and could make out the form of large objects. Following evening read large type and on the second morning, for a short time, ordinary print, On the fourth day visual power was normal.

Morphia and other Opium preparations. The opium habit (contrary to what one would expect from the dreadful inroads it makes upon the nervous energy) is not to any great degree the cause of true amblyopia. Every body is familiar with the dull cornea, the leaden iris, the injected conjunctiva and the contracted pupil of the opium slave, but visual disturbances apart from these, due to opiates, are quite uncommon when one remembers how wide spread the use of opium is. Galezowski[1] quotes Ali as saying that he had met in Teheran among the opium smokers there several cases which resembled tobacco amblyopics, but as he does not exclude the possibility of their being also haschisch users the etiology of the affection is somewhat obscure. And Galezowski's[2] own case was successfully treated by stopping immoderate doses of opium *and* tobacco. The following is the history of Wagner's (37) well known case:

Man, 32 years old, suffered from periodical vomiting which he treated with hypodermic injections of morphine. On a journey old symptoms set in and in five days used 1.92 grms. (30 grs.) morph. acet., although from insecure hand may not have injected it all. Patient was found somnolent and with very slow, small pulse. Both pupils small and sluggish. The retinanl arteries were extremely narrow, the papilla hazy, and the veins normal. The light of a half turned down lamp was not perceived. Same conditions for two days. Patient was then removed and no further history could be obtained.

ACONITE—CHLORAL AND ITS HYDRATE—PILOCARPINE AND JABORANDI EXTRACTS—ESERINE AND CALABAR BEAN—OSMIC ACID—SANTONIN—PICRIC ACID—DIGITALIS—TEA—CHOCOLATE—GELSEMIUM—ANILINE—EMANATIONS FROM PITCH AND COAL—ARSENIC—NAPTHALINE—POTASSIC BROMIDE—METHYLATED SPIRITS—ERGOT, AMYL NITRITE NITROUS OXIDE—NITROBENZOL—MERCURIAL COMPOUNDS—SILVER SALTS.

Aconite.—This drug is rarely the cause of amblyopia. The best example of it is that recorded by O'Brien (38) where mydriasis and twitching of the lids followed a poisonous dose.

[1] l. c., p. 48. [2] l. c., p. 51.

CHLORAL and its HYDRATE, indulged in as a habit apart from its legitimate use in medicine, is capable of rendering the eye amblyopic. Some difference of opinion exists as to the exact symptoms, produced a discrepancy which will receive attention later on.

PILOCARPINE and JABORANDI extracts. These drugs as well as ESERINE and CALABAR BEAN produce myosis and spasm of accommodation when employed locally, but I have been unable to find the record of any case where these symptoms resulted from their general use.

OSMIC ACID.—The only account I have been able to find of this agent producing amblyopia is that given by Noyes (39) of New York. It is premised that the metal osmium "heated in air is burned to an oxide and exhales poisonous fumes, having an odor something like chlorine."

Dr. P., an assistant in a chemical laboratory, was heating osmium and iridum in a crucible. Although aware of the poisonous properties of the fumes he took out a bit of the former metal with his forceps and put it near the left eye for inspection. Immediately he was struck with a sharp pain and ten minutes afterwards saw Dr. Noyes. There was great blepharospasm, photophobia and bulbar pain. Conjunctiva and sclera injected; lachrymation profuse. Pupil of normal size and activity. Vision reduced to one third and patient reads only Jäger 3. All objects looked dim. No paresis of accommodation. Fundus normal (except perhaps a pink papilla) and media clear. The symptoms remained for one day, after which the eye resumed its normal function. Dr. P., as well as Dr. Noyes, thinks that the toxic influence was mainly exerted upon the retina.

SANTONIN.—This drug, together with *picric acid*, *amyl nitrite* and occasionally *digitalis*, might be grouped together as good examples of poisons producing colored vision—generally xanthopsia or yellow vision. Various theories have been put forward to account for these color disturbances. Helmholtz thinks they are the result of the direct action of the drugs on the nervous elements of the retina; these are first excited and then exhausted and the eye becomes violet-blind. On the other hand it has been claimed that they are due to the optic media being tinged yellow or green, as the urine is in such cases. The aberration of the color sense was first observed by Hufeland (40) in 1806 and is probably the most marked subjective symptom in santonin poisoning. It has been observed that the usual xanthopsia is often preceded by a violet hue over all objects.

De Martigny (41) in a few cases found the yellow sight intermit and pass into other colors. A dose of 0.3 grm. was followed by xanthopsia; an additional 0.6 grm. dose brought on erythopsia or red vision which became orange and finally yellow. In another patient there was green vision and in one case, blue. We are consequently inclined to believe that the color symptoms are the result of nervous irritation and are not due to light passing through colored media. Dunoyer (42) men-

tions a case where the patient took .05 grm. santonin. This was immediately followed by aphasia, and yellow vision, both of which disappeared after four hours. This and many other examples show the transitory character of the colored vision.

Picric Acid.—There are very few instances of amblyopia due to this cause. Hilbert's (43) experiments upon himself furnish symptoms similar to those resulting from santonin poisoning. Two hours after taking 0.3 grm. of picric acid he had slight yellow vision which lasted two hours, after which blue and violet were not distinguished. This was not, he thinks, due to a yellow coloration of the optic media, but to the irritant effects of the poison on the cerebral centers.

Digitalis.—A single example of this rare cause of amblyopia will suffice. The case is recorded by Jeanton (44). A patient took 90 grms. of tinct. digitalis. Nausea and vomiting followed with mydriasis and cloudy vision. For two days there was also xanthopsia.

Tea.—Theoretically one would expect that the abuse of this stimulant-narcotic would result in a toxic amblyopia of the alcohol type, but although suspected by some authorities, there are not many well defined instances of its amblyopic influences. Very contradictory amblyopic symptoms are assigned by various observers to this agent. Wolfe (45) mentions a case in which there was fluidity of the vitreous and floating pigment particles, due, he thinks, to over indulgence in tea. Berry (46) also thinks that excessive tea drinking causes ocular symptoms. Visual disturbances from protracted tea-tasting, in a Russian, is reported in the London *Lancet* for 1887.

Chocolate.—It is doubtful whether this agent is capable of producing a true amblyopia, although such an early writer as Hocken[1] claims that it is.

Gelsemium.—This is an extremely rare cause of amblyopia. Parckinson (47) relates a case in which ptosis and diplopia resulted from the administration of *liquor gelsemii*.

Aniline.—This thin, colorless, oily fluid of an agreeable odor is the base of the many beautiful dyes of commerce which bears its name. Pure aniline is probably more poisonous than its colored salts, (*e. g.*, fuchsine), and the workmen in dye factories often complain of temporary headache, photophobia, *muscae* and prostration as well as of occasionally amblyopic symptoms. Galezowski (48) attributes most of these symptoms to accommodation paresis.

Emanations from Pitch and Coal.—These contain a number of toxic agents which may seriously impair the vision of those employed in mining, preparing and distributing such commercial products. The fine powder fills their lungs, chokes their sweat ducts, is ground into their hair and clothing and impregnates every cavity of the body

[1] l. c. p. 15.

having direct communication with the outside air. The poisonous emanations are mainly *phenol, aniline* and its products, as well as *volatile resinoids* and traces of essential oil.

Arsenic.—Makers of paris green, painters, wall paper hangers, as well as those persons who take the drug for medicinal or cosmetic purposes, are liable to suffer visual disturbances apart from the conjunctival hyperæmia, and eczema of the lids which often result from long continued exposure to its influence. Hutchinson (49) thinks that vitreous opacities may follow a too-long course of arsenic. It is also asserted (50) that a medicinal course of arsenic has caused retrobulbar neuritis.

Naphthaline.—This is a white, shining, crystalline substance that fuses at 176 degrees F. and is one of the products of coal tar distillation. The question whether its internal exhibition can result in the formation of cataract, as it certainly does in the rabbit and other lower animals, has formed a subject for a good deal of discussion. The latest and one of the best of these papers is by Prof. H. Magnus (51) to which I would refer the reader.

During the past year the House Surgeon at the Alexian Hospital, Dr. Burton, has carefully examined a large number of typhoid patients (treated with maximum daily doses of naphthaline for several weeks) but in none of them did the lens, with a fully dilated pupil, show the least trace of cataract.

Potassic Bromide is very seldom a cause of visual disturbances, although epileptics and others take the drug in large quantities and for long periods.

Notwithstanding the assertion of Laborde (52) that conjunctival hyperæmia is the only ocular symptom caused by this drug, several recorded cases prove the contrary.

Perhaps the best marked instance is that related by Rubel (53) whose patient took 10–15 grms. (150–235 grains) daily. He was an epileptic, twenty-three years old and a spirit drinker. One day he noticed that he was blind. The ophthalmoscope showed pallor of both discs and contraction of the retinal arteries. The bromide was stopped and in five weeks vision returned. Subsequent doses brought back the visual disturbance.

Gifford (54) relates the following case:

H. T., æt. 15, strong boy, had for five years convulsions. Took daily 40—70 grs. of KBr., for a long period and developed in L. E. a central keratitis not controlled by ordinary remedies. Healed with opacity on stopping KBr. Shortly after convulsions returned and the bromide was again given. The R. E. became again affected by a branching keratitis similar to that of the other eye and of the same obstinate character.

Methylated Spirits. There are at least several well authenticat-

ed cases where the vision has been affected by indulgence in this strong smelling liquid. Although the admixture of ordinary ethylic with methyl alcohol, to produce the "methylated spirits" of the arts, was expected to prevent its use as a beverage it is well known that the thirst for alcohol has often overcome the repugnance which even the well-seasoned nose and stomach of the drunkard must have for this nauseous mixture. The poisonous effects were, in the published cases, due to the methylic alcohol. In D. Mengin's case there was complete blindness in twenty-four hours after intoxication from this drug.

Nitrobenzol. This is an indirect coal tar product—an oily, yellowish, volatile and intensely sweet liquid with an odor like that of bitter almonds. Under the name "artificial oil of bitter almonds," it is the common source of aniline and is also employed for scenting soaps and even for flavoring confectionery and articles of diet. In factories where it is made workmen often suffer from toxic symptoms. Nitrobenzol is partly converted into aniline in the system and has been found in the blood after death. Litten (55) gives the following interesting description of a case of poisoning from it:

Patient comatose. The skin and as much of the mucous membrane as could be seen were colored from blue to gray blue. The expired air and vomited matters had an intense smell like bitter almonds. The urine had the same smell and was of a deep violet color. Antidote, ether *sub cutem* and numerous mustard plasters. Fundus an intense violet. Not only the retina, but the papilla, arteries and veins were colored the same tint and looked as if stained with ink. The only difference between the vessels was in their caliber; the veins looked fuller than normal. There were some small hemorrhages in the neighborhood of the latter. Later it was found vision was normal. There were no color disturbances; white had no admixture of other colors. The above appearances persisted for three days after the poisoning.

Mercurial Compounds. Workers in mercury, especially calomel makers and those using amalgams of tin and mercury for "silvering" mirrors, are liable to have ocular troubles which probably result from the absorption of the metal or its salts through the skin and lungs. The extensive employment in medicine of mercurial preparations would furnish a long list of amblyopic patients if these agents had a special predilection for the ocular structures. That mercurial amblyopia is very rare proves the contrary. In former years when mercury was usually

pushed so as to produce its toxic effects, the optic nerve did certainly suffer to a much greater extent than it does in more modern times. Himly, (56), for instance, gives a place in his work to *amaurosis mercurialis*. Leber (57) does not think that the case for mercury is well grounded. Galezowski[1] reports an example of optic atrophy and Square (58) one of optic neuritis, ascribed to the toxic action of mercurial salts.

Silver Salts. These produce, among the other symptoms of argyria, an amblyopia closely resembling that of lead (Gowers) but cases are rare, and since the internal administration of silver compounds is nowadays extremely uncommon, cases of weakened vision from these drugs are practically unknown. Bresgen (59) describes a case of visual disturbance caused by nitrate of silver, but Uhthoff does not think that it was a genuine case of toxic amblyopia. Rumer (60) found deposited in the sclerotic sheath of the optic nerve small, round globules of metallic silver.

Ergot, Amyl Nitrite and Nitrous Oxide. It has been proved to a demonstration that the exhibition of these drugs may produce decided effects upon vision. This is due to alterations in the nutrition of the retina and is dependant upon the varying amount of blood admitted into the central artery. In the case of ergot, as might be expected, the caliber of the arteries is reduced, the capillary tint becomes lighter and the veins are not so large. Amyl nitrite, on the other hand, produces an active hyperæmia —the arteries being notably enlarged—an effect lasting only while the flushing of the neck and face continues. Nitrous oxide, when inhaled, produces upon the retinal circulation effects similar to those brought about by amyl nitrite, but they are of longer duration.

BIBLIOGRAPHY.

1. Mackenzie. Diseases of the eye. 1832, p. 767.
2. Plenck. Doctrina de Morbis Oculorum. p. 175, Anno 1777.
3. W. Uhthoff. Untersuchungen über den Einfluss des chronischen alkoholismus auf das menschliche Sehorgan. *Graefe's Archiv. für Ophthalm.* Bd. xxxii. Abth. 4; and Bd. xxxiii, Abth. I.
4. Eduardus Doebbelin. De Amblyopia et Amaurosi Alcoholica. Diss. Inaug. Berolini.
5. J. Hutchinson. *Ophthalmic Hosp. Reports* 8, p. 1-8.
6. Johnstone. Chemistry of Common Life, Vol. ii., p. 34.
7. Blitz. *Journal Am. Med. Assoc.*, Feb. 15, 1890.
8 De Schweinitz. *Medical and Surgical Reporter*, 1887.
9. Van Milligen. *Trans. Oph. Soc. U. K.*, Vol. viii., p. 242.
10. Hubsch. Quoted by Albutt, "On the Ophthalmoscope," p. 262.

[1] l. c. p. 141.

11. Cohn. Notiz zur Tabaksamblyopie. *Centralbl. für pkt. Augenheilk*, 1879, S. 300.
12. Alt. One Hundred and Twenty Cases of Anæmia and Atrophy of Optic Nerve and Retina. *Am. Journal of Ophthalmology*, Aug. and Sept., 1886.
13. Galezowski. Des troubles visuels consecutives á l'abus du tabac. *Recueil d'ophtalmologie*, 1883, p. 677.
14. Hirschberg. Uber Tabaksamblyopie, etc. *Deutsche Zeitschrift f. pkt. Med.*, 1888, 17.
15. Delpech. Recherches sur l'intoxication speciale que détermine le sulphure de carbone, 1856.
16. Ali. Des Amblyopies Toxiques. *Recueil d'ophtalmologie*, 1876, 258.
17. Hirschberg. Iodoform Amblyopie. *Berlin klin. Wochenschrift*, 1882, p. 636.
18. Hirschler. Graefe's *Archiv. für Ophthalmologie*, Bd. xvii., Abt. I.
19. T. Oliver. Lead poisoning in its acute and chronic manifestations. Goulstonian Lectures, 1891.
20. Atkinson. *The London Lancet*, Vol. i., 1878, 784.
21. Von Graefe. *Graefe's Archiv.*, iii., 2, S. 376.
22. Voorhies. *Trans. Am. Oph. Soc'y.*, 1879, 411.
23. Roosa. Knapp's *Archives of Ophthalmology*, Vol. viii., p. 392.
24. Gatti. Amaurose passagére consécutive á l'administration de salicylate de soude. *Courriere Medicale*, 1881.
25. Bock. Ein Fall von Cocainintoxication. *Centralb. für prak. Augenheilkunde*, Jan., 1886.
26. de Magalhaes. De l'amaurose déterminée par le venin d'un serpent. *Recueil d'ophtalmologie*, 1875, p. 10-15.
27. Staderini and Addario quoted in *Annual Univ. Med. Sc.*, 1890, iv., p. 117.
28. Galezowski. Des Amblyopies Toxiques, p. 65.
29. Cohn. Sehstörungen bei Vergiftungen durch Wildpastete, *Archiv. für Augenheilkunde*, ix., 2, S. 144.
30. Groenouw. Fünf Fälle von Accomodationslähmung bei Fleischvergiftung. *Klin. Monatsbl. für Augenh.* 1890, p. 167.
31. Federschmidt. Uber Wurtsvergiftung. In Nagel's Jahresbericht, 1883, 305.
32. Hirschfeld. Fünf Fälle von Fischvergiftung. *Vierjahrsch. für gericht. Med.*, 1885, ii., S. 283.
33. Rovini. Storia di un avvelenamento per funghi. *Lo Sperimentale*, p. 286.
34. Duterte. *Recueuil d'ophtalmologie*, 1897.
35. P. and L. Brouardel. Recherches sur l'empoisonment par l'hydrogen sulfure. *Comptes rendues*, CI., 5, 401.
36. Nieden. Fall von transitorischer Amaurose durch Carbolintoxication. *Berlin klin. Wochsch*, 1882, xix., 49.
37. Wagner. Amaurose in Folge von Vergiftung mit Morphium. *Monatsbl. für Augenh.* 1872, S. 335.
38. F. H. O'Brien. A case of poisoning from aconite. *New York Med. Record*, p. 128, 1887.

39. Noyes. Amblyopia produced by osmic acid. *Trans. Am. Oph. Soc.*, 1866, p. 34.
40. Blyth. On poisons, 1884, p. 423.
41. De Martigny. *Gazette des Hopitaux*, 1860.
42. Dunoyer. Aphasie transitoire toxique. *Gazette Medicale de Paris*, No. 39, 1885.
43. R. Hilbert. Uber Xanthopie verursacht durch Pikrinsäure, *Centralb. für pkt. Augenheilkunde.* März, 1885, S. 70.
44. Jeanton. Empoisonement avec teinture de digitale. *Gazette des Hopitaux.* Nr. 56, p. 441, 1883.
45. Wolfe. Injurious effects of tea-drinking upon the nutrition of the eye. *Br. Medical Journal*, August, 1879.
46. Berry. *Trans. Oph. Soc'y. United Kingdom*, vii., 91.
47. C. H. W. Parckinson. Ptosis and diplopia from liquor gelsemii. *Br. Medical Journal*, ii., 1883, p. 323.
48. Galezowski. Des amblyopies et des amauroses toxiques, p. 101.
49. *Vide Sajous' Annual*, 1890, iv., B. 116.
50. Neuritis retrobulbaris nach Arsenikgebrauch. Zehnder's *Monatsbl. für Augenheilkunde*, Mai, 1891, p. 181.
51. Magnus. *Graefe's Archiv für Ophthalmologie*, Bd. 36, 4.
52. Laborde. *Archives de Physiologie*, Mai, 1868.
53 Rubel. Bromkaliomaurose. *Centralbl. für pkt. Augenheilk.* October, 1884.
54. H. Gifford. Affections of the cornea following administration of the bromides. *Am. Journal of Ophthalmology*, 1890, p. 245.
55. M. Litten. Vergiftung durch Anilin verunreinigtes Nitrobenzol. *Centralbl. für pkt. Augenheilk*, April, 1891, p. 118.
56. Himly. Krankheiten und Misbildungen des Auges, Bd. 2, S. 422, 1843.
57. Leber. Graefe und Saemisch Handbuch, Bd. v., 889, 54.
58. Square. *London Oph. Hospital Reports*, Vol. vi., p. 54.
59. Bresgen. Vergiftung durch Argent. nitricum. *Berlin klin. Wochenschrift*, 1872, p. 72.
60. Rumer; quoted in Gower's *Medical Ophthalmoscopy*, p. 279.

(*To be Continued.*)

THE TOXIC AMBLYOPIAS; THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT.

By Casey A. Wood, C. M., M. D.,

PROFESSOR OF OPHTHALMOLOGY IN THE CHICAGO POST-GRADUATE MEDICAL SCHOOL; OCULIST AND AURIST TO THE ALEXIAN HOSPITAL. OCULIST TO COOK COUNTY HOSPITAL AND TO THE EMERGENCY HOSPITAL, CHICAGO.

(*Continued from Vol. 1, Page 258.*)

Predisposing Causes, Symptoms, Diagnosis and Prognosis. Tobacco, Alcohol and Alcohol-Tobacco.

WHILE we must regard the toxic agent as the direct or exciting cause of the visual failure, it must not be forgotten that there is a number of well recognized indirect or predisposing causes which favor the development of the disease. These we shall proceed to consider.

Idiosyncrasy. In almost all instances of impaired vision where the exciting of cause the amblyopia is a drug in common use, whether as a medical remedy or not, there exists an idiosyncrasy on the part of the sufferer against the agent in question. This also holds true, but to a less degree, in those cases where the poisonous agent is infrequently employed. How comparatively few persons suffer from impaired vision due to alcohol, tea, chloral or tobacco, and yet how universally are these agents employed. Nor is there any necessary relation between the amount of the poison absorbed and the amblyopia. Frequently one finds that the eyesight entirely escapes in persons living most of the time on the borderland of insanity from drink or who are continually reeking with the stale odor of chewed and smoked tobacco. On the other hand, a well marked amblyopia may be met with in persons smoking a couple of ounces of mild tobacco or two or three cigars a week. The exceptions to this rule are such drugs as the mydriatic poisons—belladonna, hyoscyamus, and the like—which when taken in full doses almost invariably produce a temporary amblyopia.

Age. One rarely sees a case of tobacco, tobacco-alcohol or alcohol amblyopia in a patient under forty, notwithstanding the free

use of these stimulants by persons under that age. The *vis resistentiae* of youth protects the nervous system from the degeneration which in old and middle-aged persons results as well from these as well as from other causes. In Uhthoff's cases the alcohol and tobacco amblyopics were of the following ages:

28-30	years	of	age	4
30-40	"	"	"	30
40-50	"	"	"	46
30-60	"	"	"	39
60-70	"	"	"	18

According to T. des Planches lead amblyopia occurs most frequently between the ages of thirty and forty.

Sex. The male sex has a practical monopoly of amblyopic symptoms from these toxic agents. In Uhthoff's 135 cases every one were men. An exception to this rule is found in the case of lead amblyopia. Oliver (*61) feels certain that women exhibit a greater susceptibility to lead poisoning than men. Of 135 cases noted by him in the Newcastle infirmary 91 were women and 44 men. In my opinion the influence of sex is, *per se*, very slight in the production of amblyopic symptoms from toxic agents. If women were to use intoxicants or were exposed to the influence of toxic agents to the same extent as men, visual disturbances would be as common from that cause with them as they are with the sterner sex. Of the cases of quinine amblyopia reported to date (about 60) nearly one-half are females. The meaning of this is that the drug is used almost as extensively by women as by men. I am also inclined to believe that if strict inquiry were made slight disturbances of vision from toxic agents would be found to be more common among women than they are generally thought to be. Chisholm (*62) relates an interesting case of tobacco amblyopia in a refined lady which emphasizes this assertion. The following history is a further illustration of this contention:

Amelia F., aet. 56, presented herself at the clinic of the Post-Graduate Medical School desiring presbyopic glasses. She gave the usual history of failing vision for near work and said that no glasses seemed to help her. She also stated that her distant vision had been "misty" for some time past. To drown domestic sorrows she drinks a pint of whiskey before breakfast and smokes 6 to 10 pipes of "Tip-top" tobacco daily; has typical central scotomata for red and green. Pupils contract well to light and acc. No fundus changes. VR and L = 6-60; with plus 1. D = 6-18. Can read Jaeger VI with near correction. Promised to give up alcohol and tobacco, but has not since returned.

Occupation has something to do with the liability to toxic amblyopia from tobacco and alcohol. As Berry points out, in the

case of workmen, farm laborers and others who rise very early and work a few hours before breakfast the temptation to smoke and drink on an empty stomach is great. This is also true of bartenders and saloon keepers, who, in the course of business, feel obliged to consume at all hours numerous samples of their own wares.

The action of all forms of exhausting disease—especially those that affect the nutrition of the body—in predisposing to the toxic action of nicotine and alcohol is too well known to need discussion here. They act just as poor and insufficient food does and for the same reasons.

Symptoms.—Attempts have often been made to separate the signs and symptoms of tobacco amblyopia from those due to alcohol alone or to alcohol and tobacco combined. Poetscka, Foster and Hirschberg (*63) assert that such a differentation can be made. These contentions will be afterwards considered under another heading, but since, in my opinion, there are no reliable signs or symptoms whereby nicotine amblyopia can be distinguished from that due to alcohol, the symptomology of the three forms of amblyopia will be considered under one heading.

Symptoms.—The first symptom of which the patient usually complains is dim or "misty" vision. It is not to him so much a failure of sight as the sensation of looking through smoke or mist at distant objects. The visual failure grows gradually worse; it almost invariably affects both eyes and to the same extent. Monocular amblyopia from toxic agents is exceedingly rare, although Lawford and others have recorded such cases. The noticeable thing about the failure of vision from these intoxicants is that it never becomes absolute. One may state with certainty that complete loss of sight never happens in pure alcohol or tobacco amblyopia. In the Uhthoff cases (135) it never sank below $\frac{6}{200}$.

Pseudo-presbyopia.—I have also noticed that an early indication of trouble is the inquiry for stronger glasses with which to do near work. The sufferer finds, for example, that it is impossible for him to read as well as he previously did, even before he notices any marked defect in his distant vision, and naturally concludes that he requires a change of spectacles. And, for a time at least, strong convex lenses may assist his failing vision by producing larger images, especially if they are very strong and the print is held near the eye. As the disease progresses he discovers that he can not read ordinary print with any glasses; indeed with the best glasses he may be able to read only Jaeger 6 or 8.

The amblyope rarely suspects the cause of his trouble, as he has probably not made any recent change in his habits, *i. e.* drinks about the same amount of alcohol and smokes the same number of cigars or the same quantity of tobacco. The worry and anxiety attendant upon his impaired vision may indeed induce him to smoke or drink the more, but as that occurs after the amblyopia has declared itself, he does not think of the circumstance as likely to increase his troubles.

Color Blindness.—This symptom is a very common one and is confined, as a rule, to inability to distinguish green and red. The sufferer may not find it out until he has handed over a five-dollar gold piece or a two-cent piece for a nickel, or (in England) given a sovereign for a sixpence. An amblyopic patient of mine, with fair visual acuity, used to complain that he was no longer able to delight his eyes with the sight of certain scarlet berry clusters on the mountain-ash trees near his home. Connor (*64) relates the case of a florist who found himself mistaking colors in making decorations with plants. The color of his red roses became dirty and he could no longer see to pick the worms off the bushes. Noyes (*65) speaks of an artist who complained that he was not able to produce upon canvas the brilliant reds that he once did.

This color defect is confined to the center of the field of vision. It is a negative scotoma so that the patient is not conscious of the defect as such. A red surface to him is all red.

Variable Vision.—Not infrequently these amblyopic patients see better in dim than in bright light. One of my patients complained most bitterly of a shimmering before his eyes like "heat rays rising from the ground in summer."

Most observers speak of a patient's better vision towards evening, but I am inclined to believe that this is especially true of the early morning hours when the patient has been refreshed by a good night's rest and the light is not strong enough to contract the pupils. A patient of mine, suffering from tobacco-alcohol amblyopia (with vision of $\frac{6}{60}$), was obliged to arise before dawn. He told me, without suggestion on my part, that he could see remarkably well when he first got up, that his sight became obscured as the day advanced and then it partially recovered towards evening. Since toxic amblyopes see better with the perimacular parts of the retina than with the insensitive yellow spot, it is easy to understand that a dilated pupil will be of some advantage to them. The occasional use of very weak (gr. one-eighth to one ounce)

atropine drops, as well as the wearing of tinted glasses, subserve the same purpose; the former keep the pupil in a state of dilatation by paralyzing the contractor fibers of the iris, while the latter gain the same result by cutting off the bright rays of the sun.

Signs.—The use of the ophthalmoscope sometimes reveals certain changes in the optic nerve and sometimes the disc is absolutely normal. In the latter case we may suspect from what we know of the morbid anatomy of the disease that the atrophic changes have not advanced as far forward as the disc. The most constant sign is an abnormal pallor (sometimes exactly triangular in shape, singling out the macular bundles) of the temporal side of the papilla. Uhthoff (*66) observed this in sixty-three out of one hundred cases of central toxic amblyopia. In eight the neighboring retina was affected without decoloration of the disc, while the fundus was normal in twenty-eight cases.

In a patient suffering from alcohol-tobacco amblyopia, which I had an opportunity of observing in Mr. Lang's klinik at Moorfields, there was on the temporal side of the disc a well-marked atrophic crescent extending quite to the edge of the papilla, and resembling in form the extra-papillary crescent of myopia.

Alcoholic Retinitis has been observed in a few instances. Edmunds and Lawford (*67) relate the following case: A man, æt. 49, suffering from alcoholic paralysis, but without complaint of defective sight, relative scotomata, diabetes, albuminuria or history of syphilis, was found during life to present most of the appearances of syphilitic retinitis. Death in six months. Microscopical examination showed widespread disease of the retina with absolutely no affection of the optic nerve bundles or of the trebeculæ. No œdema or infiltration in nerve sheath. E. and L. quote Sharkey's (*68) case as the only other one where retinitis, due to chronic alcoholism, has been reported. They think the disease should be termed alcoholic retinitis, and the fundi of all chronic alcoholics should be observed for retinal changes. In this connection it might be noted that Uhthoff (*66) distinctly refers to alterations in the retina as examined ophthalmoscopically in a thousand cases of chronic alcoholism examined by him. The appearances were those of a very slight neuro-retinitis, but without retinal hæmorrhages, papillary swelling, etc.

Loss of pupillary reflex to light was noticed in one per cent of Uhthoff's cases, and has also been remarked by others and shown to be due to one or other of these toxic causes alone.

Optic Atrophy.—It is at least questionable whether these toxic agents are capable of producing atrophy of the optic nerve, although such a claim has been made by various observers. It is highly probable, however, that where a central amblyopia of toxic origin goes on to true atrophy of the nervous tissue the latter condition is an association merely and not a later stage of the former. A fair example of such a case is published by Hinde (*69), of Chicago. See also an admirable paper by Groenouw (*70). There were of Uhthoff's 1,000 patients only two doubtful cases with absolute central scotomata and peripheral limitation of the field.

Lawford (*71) relates nine cases which were diagnosed by him as tobacco amblyopia, but later on he found that either they did not get well under treatment or got worse. It may be remarked in this connection that Nos. 3, 6 and 7 are certainly typical cases of tobacco amblyopia, and it seems impossible that they could be otherwise; but in Nos. 1, 2, 4, 5 and 9 the peripheral F. of V. was contracted and the scotomata were unusually large, while in No. 7 nothing was said about the periphery of the visual field.

Much has been written about the relations existing between the optic atrophy associated with *diabetes* and that produced by toxic agents, and it has sometimes been claimed that the former is sometimes a later stage of the latter. In my opinion this has never been proved. From all that we know of both processes it would seem as if the glycosuria did sometimes predispose to toxic amblyopia, but true destruction of the nerve is the work of the diabetes alone.

Lippincott (*72) has published an interesting case where, after an attack of delirium tremens atrophy of both nerves with deterioration of central vision, concentric limitation of the F. of V. and incomplete color perception were present. Later, complete recovery.

Relative Scotomata.—Central color scotomata form an almost invariable sign of the diseases belonging to Class I. In uncomplicated cases of tobacco and alcoholic amblyopia the colors affected are red and green; blue and white are probably not entirely affected. Quite otherwise is it with carbon bisulphide where an absolute scotoma for white may occur.

The typical scotoma for red in the former instance is that of a small oval including the fixation point and extending almost or quite to the blind spot. Much difference of opinion exists both as to the shape assumed by these scotomata and as to the conclusions

to be drawn from it. Pœtschka, Hirschberg and others, affirm that when the amblyopia is due to tobacco alone, the relative defect has a paracentral position, while that due to alcohol is more or less pericentral. Uhthoff, having this contention in view, found that in eleven cases of well-marked pericentral scotoma alcohol was the cause of the disease in seven cases, tobacco in one case and tobacco-alcohol in three cases. Of nine cases of paracentral scotomata he found two to be due to tobacco, three to alcohol and four mixed. In one case ($V=\frac{15}{200}$) the scotoma was sometimes pericentral, sometimes paracentral, and Uhthoff hence concludes, truly I think, that when the patient continued to fix the central spot with his fovea, a pericentral scotoma was pictured, but when he chose an extra macular portion of his retina for the purpose it was paracentral. If this be true, very little reliance can be placed upon the shape or relative position of these scotomata so far as the diagnosis between tobacco and alcohol is concerned.

Disease of the macular region may sometimes be mistaken for central toxic amblyopia, as the following case will show: C. T. H., æt. 40, has always been healthy, but for twenty years has been a hard smoker and lately consumed as much as a pound a month of "Lone Jack," (a medium tobacco), with a daily use of five or ten cigars a day. Limited use of alcohol. In April '90 had an attack of the grippe, from which he laid in bed for six weeks and was confined to the house for nearly three months. Ten days after the attack began he noticed that he was blind, and for sometime could not see the bowl of his pipe while smoking. Then he got gradually better and as his strength returned, vision improved. When he got well enough to go out he could see large objects; could, for instance, distinguish men from women, but nothing more. There was additional improvement until August last. On December 6th, $VR=\frac{20}{50}$; $VL=\frac{20}{100}$. At this stage his case was diagnosed as one of A-T amblyopia, and his smoking and drinking were stopped. He was given hypodermic injections of strychnia every morning until he was taking one-third of a grain. I then had an opportunity of examining him and found in the RE a central scotoma for red, green, blue and yellow. White was seen as gray. There was the same condition in the left eye, the colors being clearer five degrees from the center and especially on the nasal side of the field. He had been using the strychnia for a month, but careful examination showed that there had been no improvement in vision. With + 1. LE. J iv; RE. J II, both very deliberately. A fundus examination revealed a whitish discoloration

about the fovea centralis of both eyes and although the treatment with strychnia and abstinence from stimulants was kept up for another six weeks, no improvement in either distance or near vision occurred. A year afterwards the condition of the patient was unchanged. I regard this case as one of double macular hemorrhage.

Powers' Test.—If a toxic amblyope be made to inhale a few drops of amyl nitrite and his vision be examined as soon as flushing of the face sets in, a temporary increase of visual acuity will be observed. This amounts upon occasions to as much as a rise from $\frac{20}{200}$ to $\frac{20}{50}$ or $\frac{20}{40}$ and alone forms the most positive proof that the patient suffers from an affection whose visual defect is due to an anæmic state of the optic nerve. Moreover, this affords a test of some prognostic value for it has been noticed that in those cases where the visual increase is marked that a cure can be safely predicted in the near future. In one case (VR=$\frac{20}{100}$, VL=$\frac{20}{200}$), under my care the effect of amyl nitrite was so lasting and gave so much relief that I administered the drug at regular intervals in addition to other remedies.

Contracted Pupil.—It has been shown both by Schur (*73) and Rogow (*74) that the local application of nicotine acts like eserine in producing miosis, that is to say a paralysis of the sympathetic nerve endings of the iris which allow the *sphincter pupillæ* fibres to act. This fact probably explains the contracted pupil so common in tobacco and tobacco-alcohol amblyopia. The blood and other nutrient fluids continually charged with nicotine, in quite the same way, exerts a specific but quite local action. This is the opinion of Hirschler (75), who, however, attributes the contracted pupil, which he has noticed in pure alcohol amblyopes, to disease, (probably fatty metamorphosis) of the medulla oblongata.

When all the symptoms of central amblyopia, due to intoxicants are considered, it ought to be, and as a matter of fact is, easy to detect and differentiate these forms of ocular disease. Uhthoff, (66), thus summarizes the points of *diagnosis between the retrobulbar neuritis of tobacco and alcohol and that due to other causes* as syphilis, disorders of menstruation, "cold," diabetes, etc. 1. The central scotomata are almost invariably confined to red and green; it is rare to find even blue affected and almost never yellow or white. 2. The scotomata and visual disturbances are bilateral. 3. Vision does not fall below $\frac{6}{200}$. 4. The form of the scotoma is that of an oval which usually include and stretches from the fixation point to the blind spot and lies above the horizontal meridian. 5. The vision becomes *gradually* less. 6. The disease

affects almost always men. 7. Of more than 40 years of age. 8. *Pain is noticed on extreme ocular movements in the essential retrobulbar neuritis of women, but is invariably absent in the toxic form.*

61. Oliver. *Gulstonian Lectures*, I. 1891.
62. Chisholm. Tobacco amblyopia in a woman. *American Journal of Ophthalmology*. March, 1887.
63. Hirschberg. Ueber Tabaksamplyopie und Verwandte Zustande. *Deutsche Zeitschrift f. pkt. Med.*, 1878, 17.
64. Connor. Tobacco amblyopia. *Journal American Medical Association*. 1890.
65. Noyes. Diseases of the eye, 1890, page 619.
66. Uhthoff. Second part of the Monograph. *Untersuchungen Ueber den Einfluss des Chronischen Alkoholismus, etc.*
67. Edmunds and Lawford. Retinal changes in a fatal case of Alcoholism. *Trans. Br. Oph. Socy*, 1889, page 137.
68. Sharkey. *British Medical Journal*, Dec. 22, 1888.
69. Hinde. Case of Toxic Amblyopia ending in Optic Atrophy. *New York Medical Record*, July 16, 1892.
70. Groenouw. Ueber die Intoxications Amblyopie. *Graefe's Archiv f. Ophthalmologie*, Bd. xxxviii., I. 1.
71. Lawford. *Trans. Oph. Socy. United Kingd.*, 1890, 167.
72. Lippincott. A case of Atrophy of the Optic nerves. *Medical and Surgical Reporter*, XLI., page 137.
73. Schur. *Zeitschrift f. Rational Medizin*, xxxi., S. 402.
74. Rogow. *Zeitsch f. rat. Medizin*, xxix., S. 1.
75. Hirschler. *Graefe's Archiv f. Ophth.*, xvii., 1. S. 227.

(To be Continued.)

THE TOXIC AMBLYOPIAS; THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT.

By Casey A. Wood, C. M., M. D.,
of Chicago.

(*Continued from Vol. II, page 237.*)

Symptoms, Diagnosis and Prognosis. Tobacco. Alcohol. Tobacco and Alcohol. Quinine. Iodoform. Carbon Disulphide.

Brauchli (76) from 39,428 patients of Prof. Haab's klinik in Zurich, gives the following interesting facts: One hundred and forty-four cases (0.365%) were certainly due to tobacco and alcohol, alone and combined. Ninety-five were due to alcohol and tobacco; in only two of sixteen cases attributed to alcohol was the use of tobacco excluded; in no instance were the so-called pure tobacco cases free from suspicion of indulgence in alcohol. As predisposing causes of the amblyopic symptoms, were mentioned typhoid fever, malaria, loss of blood, syphilis, toothache, and irregular habits of life. Most of the patients were between 36 and 55. Visual disturbances were generally the same in both eyes. In eighty cases there were central color scotomata, and in ten complete red blindness. In the majority of instances there was distinct decoloration of the temporal half of the papilla. Only eighteen per cent were cured; thirty-seven per cent improved; and unsatisfactory, the large amount of forty-four per cent.

J. Hutchinson, Jr., (77) in reporting certain exceptions to the usual symptoms in A. T. amblyopia, gives the following example of a rare form of the disease, a unilateral affection of sight:

G. W., aged 42, came in April, 1884, regarding his right eye. V., R. = $\frac{20}{70}$, and J. x. V., L. = $\frac{20}{20}$ and J. i. Smoked one-half ounce "shag" daily, but no suspicion was held at the time that his amaurosis was due to this cause. His vision deteriorated, until in September, 1884, his left eye also failed. January, 1885, V., R. = $\frac{20}{100}$, J. xix at 7″. V., L. = $\frac{20}{200}$, J. xvi at 7″. Fundi both normal and fields for white good. There were the usual scotomata for red and green, none for blue or yellow. No sugar or albumin in urine. Avoided "shag" but continued to smoke lighter tobacco, and under treatment improved, and finally recovered good vision in both eyes.

This writer also notes the following exceptional points about some cases of A. T. amblyopia he has met with: 1. Not uncommonly a central scotoma for yellow, with or without some limitation of the color field. 2. Very rarely blue shows a central scotoma, *i. e.*, red, green, yellow, and blue are all confused or mistaken in the central part of the field. 3. The amaurosis may for a considerable time be confined to one eye only. 4. With the central scotomata and great defect of distant vision, good near vision may be retained. 5. The color scotoma, may, at any rate for a time, be wholly absent. 6. Even mild kinds of tobacco may produce amblyopia.

Before leaving this subject, I would direct the reader to an article by Coursserant (78) on the employment of injections of pilocarpine in the diagnosis of the amblyopia from tobacco-alcohol. Speaking of the value of the drug in diagnosis, he claims that immediately after the sweating, salivation, and other signs of increased secretion and excretion had set in, a decided increase of the visual acuity, lasting at least twenty-four hours, will be noticed in cases of toxic amblyopia. Furthermore, where optic pallor is present, the sight does not improve after injections if the decoloration be symptomatic of a true atrophy; indeed, Coursserant has witnessed a continuous and oftimes a rapid deterioration of vision when the pilocarpine treatment is employed in the non-toxic cases. This test, which resembles that with amyl nitrite, does not, like it, depend for its action upon the temporary flushing of the opticus capillaries, but upon the powerful, if transitory, elimination of the poisonous alcohol and tobacco from the system.

It is as if the circulation in, and nutrition of, the central centers so improved that the poisonous load could be temporarily lifted, and the visual act, while the bettered condition lasted, be performed with greater ease. Such an improvement could not, of course, be expected when the visual centers or opticus elements themselves had been destroyed by disease.

The case for the retro-bulbar neuritis of A. T. amblyopia, as opposed to other forms of optic nerve atrophy, rests upon its distinctive signs and symptoms just related. These form such a constant, such a classic series, that when an unusual condition presents itself it must be regarded *as probably of foreign origin*. To this category, I would consign the inequality of the pupils (2.5%); Argyle-Robertson pupil (1%); dilatation of the pupils (6%); reported by Uhthoff. As for the cases of conjunctival xerosis, uniform pallor of the disc, hyperemia of the papilla, and nystag-

mus, mentioned by Uhthoff and others, they may be classed with the "toxic hysteria" of Gilbert (79) as, at least, of doubtful origin. In this list it would not, perhaps, be fair to include paresis of the ocular muscles. These may set in as the result of an atrophy of their nerve supply. Such cases are merely examples of the peripheral neuritis of advanced alcoholism that may effect the peripheral nerves in *any* part of the body. Among the thousand cases of chronic alcoholism, examined by Uhthoff, muscular anomalies were not uncommon, about 2 per cent, omitting two cases of nystagmus.

Thomsen (80) has described three cases of acute alcoholic paresis affecting the ocular muscles, one of whom recovered.

Suckling (81) reports such a case, of a male patient, aged 50, who had an oculo-motor paresis. He was first attacked with painful cramps in both legs, followed by bilateral paralysis of the rectus inferior and internus, associated with ptosis on both sides. The pupils were contracted and barely reacted to light. No patellar tender reflex, plantar reflex exaggerated. The posterior tibial nerve was tender on pressure. Patient's intellect weakened. Abstinence from alcohol brought about a cure of the ocular paresis.

The *prognosis* is very favorable, especially in those cases where abstinence from the toxic agent is insisted upon and persistently practiced, where the general health is not impaired beyond restoration, where there is no other optic nerve trouble, where the visual field for white is not contracted either peripherally or centrally, where (with all manifest refractive errors corrected) vision does not fall below $\frac{6}{200}$, and where the media are clear, sight can, in the great majority of cases, be restored by judicious treatment in from four to ten weeks.

Caeteris paribus, the length of time occupied in successfully treating a case of tobacco or alcohol amblyopia will depend upon the time his bad vision has lasted, *i. e.*, upon the extent of the ravages which the interstitial neuritis has made among the sensitive macular fibers of the opticus.

But a patient may be practically blind for years, and yet recover.

Over two years ago, a farmer, aged 53, presented himself to me for treatment. He had not been able to read a newspaper for six years. Much of his time had been consumed in going about the country in search of glasses, and although each optician that saw him advised him to consult an oculist, he doggedly refused to do so, having in mind some friend whose eyes had been "ruined by having them tampered with by eye doctors." His was a well marked tobacco amblyopia. He returned home the day I

saw him armed with a large bottle of syrup of hypophosphites, having given me a conditional promise to reform his habits, and to return in the near future. A year afterwards he sent me a note by a neighbor, who also came to consult me, saying that he was all right now, could read as well as he ever did, and thought of beginning to smoke again in moderation.

QUININE.—To the collection made by Atkinson (82) in 1889, most of the published cases of quinine amaurosis, and to the remarks accompanying the report, there is very little to add so far as the diagnosis and prognosis of this form of toxemia is concerned. The first published case of quinine amaurosis, by Giacomini (83) in 1841, as well as of thirteen other cases recorded by Lewis (84), McLean (85), Baldwin (86), Trousseau (87), Guersant (88), and Briquet (89), are anterior to (26) Von Graefe's cases (1857), previously referred to by me as the first on record. I have taken the liberty of quoting extensively from Atkinson's admirable compilation, and am indebted to him for several references.

The original investigations of DeSchweinitz (90), (to be afterwards considered), regarding the pathology of ocular cinchonism were published at a later date, and with Atkinson's review, comprise, practically, all that we know about that affection. From these two sources the English reader may obtain a complete knowledge of the subject as it stands to-day.

The signs and symptoms of quinine amaurosis do not vary greatly. Knapp (91) addressing the Heidelberg Ophthalmological Society, 1881, stated them as follows: "Marked pallor, general weakness, twitching of the mouth and extremities, *total blindness*, and deafness associated with loud *tinnitus aurium*. The pupils are widely dilated and do not react to light, but may to accommodation. The patient often loses consciousness to a greater or less degree, and it may be that the blindness and deafness are not noticed for several days because of the mental condition present. The ophthalmoscope shows *an absolute anemia of the optic nerve and retina. The papilla is chalky-white and no trace of a blood vessel in that or the retina is to be seen.* This state of things is to be seen in *every* case."

Atkinson thinks the eye signs of quinine amaurosis constitute a symptom-complex, as follows: "1. Transitory blindness, complete or incomplete, usually developing suddenly. This blindness may be more complete than in any other recoverable condition, and is comparable to the blindness of atrophy. 2. Color blindness. As sight begins to return, most cases will be found to be color blind, completely or partially. The color sense gradually returns and may ultimately become restored. In some cases the

diminution of light sense is permanent. 3. Wide dilation of the pupils. The pupils are irresponsive to light, but are said to respond to accommodation effort. It is to be inferred that the dilation is due to the blindness, and that there is no implication of the third or sympathetic nerves. 4. There is pallor of the optic discs and extreme diminution of the retina vessels, both veins and arteries. In many cases this is permanent. In cases examined early by the ophthalmoscope, a whitish haze, with cherry-colored spots, has been observed at the macula, as in cases of embolism. [Browne (92), Buller (93), Gruening (94)]. 5. There is contraction of the visual field. This is extreme and expands slowly. There is no reliable evidence that it ever regains its normal extent. "The contraction is concentrical or elliptical with the longest axis in the horizontal direction." Knapp (95). *Impairment of hearing (at times to total deafness), with tinnitus, appears to be present almost invariably.* It is rarely complete more than twenty-four hours and gradually disappears. Some variations from this type have been noted. Voorhies' (22) patient had anesthesia of the cornea. Diez (96), Knapp, and Browne observed divergent strabismus. One of Roosa's cases (97) had marked nystagmus; likewise one of Knapp's. Dickinson (98) noted in his patient "marked congestion of the retinal and choroidal vessels, together with a remarkable tumefaction of the optic disc, it appearing swollen and pushed forward prominently into the vitreous. Its condition was very similar to that denominated '*stauungs-papille*,' (choked disc), the usual concomitant or resultant of neuro-retinitis." This is a striking variation from the otherwise universal experience, and it may not be impossible that the symptoms in this case were expressions of malarial intoxication, such as are occasionally observed.

"Taken altogether, the symptoms of quinine amaurosis are strikingly definite and constant. Knapp's first case appears to show that relapse may be excited by quite small doses. One of Nettleship's patients (99) exhibited the predisposing idiosyncrasy in its extremest degree, his sight being seriously damaged by twenty-three grains of quinine administered during three days, two years after he had been similarly affected by quinine."

Rogers (100) thinks that *incomplete ocular cinchonism* is not rare, and asserts that an hour after twenty grains of quinine have been taken some accommodative paresis may be noticed in a goodly percentage of the cases; that at the end of the second hour it is complete, so that a No. 10 convex glass (+ 4. D?) is required to enable the patient to read at the usual near point.

This paresis lasts eight to ten hours. The greater number of incomplete ocular cinchonism escapes observation or record.

"Briquet (89) who saw four such cases, thus describes the evolution of the symptoms. Says this writer, the patient begins to complain of the light, and the effort to fix the eye upon objects is painful. There is a sensation like that produced by using strong glasses. The eye is brilliant. The pupils are usually normal and the conjunctiva not injected. There is then a slight degree of excitation of the optic nerve, analogous to that so often seen in the beginning of paralysis of the nerve. In a more advanced degree, patients see as through a mist. Objects seem small or double, or are not perceived at a distance of two or three meters. Finally, incomplete amaurosis may occur when the pupils become dilated and insensible to light."

Briquet quotes Monneret as also having seen four cases of this incomplete amaurosis.

"In most cases the blindness develops suddenly. More than once it has been described as occurring 'just as if a lamp had been blown out.' In many cases, however, vision fails much more gradually. Blindness generally becomes complete within twenty-four hours, though in some cases several days may elapse before this occurs. The duration of total blindness, the absence of all perception of light, varies within wide limits from a few hours [Peschl (101), Webster (102), et. al.] to a day or more; [Briquet, Baldwin (86), Buller, Gruening, et. al.] to several weeks. even many; three, Greuning; five, Michel (103); ten, Voorhies, nearly three months, Dewey (104). In most cases, perception of light returns within a few days. There is no case recorded where blindness remained absolute. In all sight was recovered, though often slowly, and nearly always imperfectly. Six months after the beginning of blindness, one of Greuning's cases was still partially color-blind, and the fields of vision remained contracted. During the greater part of the first year, one of McLean's patients could look steadily at the sun without seeing it or even without any painful sensation being produced. In one of Roosa's cases the visual fields remained contracted, the optic discs pale, and the arteries small. In another, the patient whose vision was said to have been perfectly normal previously, felt, after two years, as if there had been a veil over the eyes, and she could not tell if her linen was clean as it came from the wash. She was also unable to distinguish certain shades of dark blue. In Voorhies' patient the optic discs remained perfectly white after nearly a year, and there was

no trace of the central artery, except a small twig. The visual field was greatly contracted after an interval of twenty-two months. Buller found in his patient a total abolition of all sense of color, except by central perception. Central vision was perfect. The nerves were both pale, but not white. The arteries and veins were not one-third as large as normal. Webster reported a case, where, seven years after the beginning of blindness, which was total only a few hours, the sight remained impaired. Browne states that in one case the visual field remained contracted after fifteen years. In nearly every case where the condition of the sight was accurately determined, some damage to vision remained when the patient was last observed. As regards peripheral vision, the blindness remains permanent. Central vision gradually returns to the normal after some days, weeks, or months. (Gruening)."

As rare exceptions to the very definite symptom-complex of quinine amaurosis, is a case reported by Jodko,[1] in which there were central scotomata, but no fundus changes. H. C. Coe (105) records a case in which internal strabismus, with slight ptosis, was produced by five grains of qtiinine taken four times a day for five days. Patient recovered.

Some unusual eye symptoms are noticed by Mellinger (106), and by Emile Roger (107), but they may be regarded—like the above—as quite exceptional, if not accidental.

The *prognosis*, so far as sight is spoken of in the sense of central vision, is very favorable. Where an embolic process is the pathological condition present, damage to peripheral vision is, in the nature of things, likely to persist. But there are few ocular conditions, and certainly no other toxic states in which a patient is so certain, after a total blindness, to recover in so short a space of time such good and useful vision as can confidently be looked for in quinine amaurosis.

Iodoform. In addition to the case of iodoform amblyopia, published by Hirschberg (17), and detailed in a former chapter, E. Hutchinson (108) and Priestly Smith (109), have more recently furnished us with interesting histories of two others. The latter writer confirms the propriety of placing this drug in Class I, Division 1, and gives us the following history:

H. B., aged 31, was admitted to Queen's Hospital with a disease diagnosed as tubercular pleurisy and peritonitis. For forty-one days he was given two grains of iodoform three times a day, the dose being increased

[1] Quoted by Uhthoff, *loc. cit.*

during the last ten days of treatment to four grains eight times, or thirty-two grains per diem. After thus taking 1,000 grains, he experienced the general poisonous effects of the drug—faintness, diarrhœa, twitching of hands, constant taste and smell of iodoform, etc. On the third day, after stopping the remedy, there was great drowsiness and ptosis; the latter symptom disappearing the next day. On the fourth day, refraction was found to be normal, and the media clear; haziness of the disc, but no papillitis; vision greatly impaired, and an absolute central scotoma, Red scotoma as in tobacco A., but larger. Loss of vision began two days before stopping the drug and rapidly increased. Three days afterwards the papilla more hazy. Four weeks later patient had still a central color scotoma in both eyes; absolute just below the fixation point. V., R. $= \frac{6}{36}$, V., L. $= \frac{6}{24}$. Vision rapidly improved, and in three months was $\frac{6}{8}$ *n. o.*, and no scotomata. The patient did not smoke during his stay in the hospital, but began in moderation while undergoing outside treatment.

Nothing is said about this man's habits as to indulgence in alcohol.

E. Hutchinson reports his case as follows: E. G., merchant, age not stated, non-smoker and temperate user of wine, consulted Dr. Hutchinson in February, 1885, for visual failure beginning at previous Christmas holidays. He got rapidly worse, and at time of examination V. $= \frac{1}{100}$ in either eye. Color perception and visual field normal. No pain in eyes. Fundus normal, except that discs were gray. He had been taking six grains of cresote and nine grains of iodoform in pill form since January, 1884, more than a year. The iodoform in the pills were stopped, and hypodermic injections of strychnine gr. $\frac{1}{10}$ daily given. Improvement rapidly followed, and on April 26, V., R. $= \frac{20}{30}$ and V., L. $= \frac{20}{40}$, and could read easily with his hyperopic correction.

The *prognosis* is very favorable. Hirschberg's patient was well and the eye entirely normal in eight days. Hutchinson's in two months, and Priestly Smith's in six months after beginning treatment.

Carbon Disulphide. The principal difficulty in setting forth the symptoms of carbon disulphide poisoning, resides in the fact that many of the patients were either smokers or drinkers, or both, and it is a question whether the central scotomata in some of the published instances may not have been due to these agents. When, however, vision was good previous to the bisulphide poisoning, we may properly attribute the amblyopia to the latter chemical.

As in quinine amblyopia, there are doubtless many cases of transitory amblyopia and partial poisoning unrecognized and unpublished. Of the cases investigated by the British Ophthalmological Society (110) in 1885, twenty-four in all, many were smokers. As typical examples of the eye symptoms in carbon bisulphide poisoning, I have abstracted the following cases. The first was published by Mr. Gunn (111) in 1886; the next two are from Hirschberg's (112) (113), Klinik while the fourth was reported by Becker (114):

CASE I. Thomas W., aged 33, worked continually with bisulphide of carbon as stillman in oil works for fourteen years, and was exposed to

bisulphide of carbon fumes for the last five or six years. The chloride of sulphur is also employed in the works. His general health has failed for the last year; has suffered from aching in the ankles and arms, and pain in the muscles, particularly after walking; loss of appetite, pain in the temples, "a feeling of having had a blow on the top of the head." On two or three occasions, some months ago, he completely lost power over his lower limbs. About four months ago his sight began to fail. He has been married for ten years; within the last eight or nine months has noticed a failure of sexual power. He is a moderate drinker, his average being not more than two pints of beer daily. He smokes one and one-half ounces of strong tobacco weekly, his first morning pipe often making him feel sick. *Present condition:* He is nervous, indeed almost hysterical. His gait is normal, and his knee jerks moderate. Pupils wide, act fairly to light. Tn. He can decipher J. xix c. each eye. Red and green blindness completely, detects blue and yellow moderately well. Field of vision for a while good, very slight peripheral contraction. *Ophthe.* R. O. D. very pale, large vessels of good size. L. O. D. opaque looking, and somewhat pale, large vessels normal.

CASE II. Worker in rubber factory, aged 16, came January 18, 1886. Had worked a year with CS_2 and SCl. At Christmas, vomiting, sulphur eructations, headache, restlessness at night, wandering in mind. Then visual disturbances; R = fingers at twelve feet, L = seven feet. Field of vision normal at the periphery, but there is a large absolute central scotoma with a radius of twenty degrees. Colors are seen outside. Normal fundus. On February 11, the scotoma is ring-shaped, small, and paracentral. On February 22, V., R. = fingers at fifteen feet; V., L. = fingers at seven feet.

CASE III. A girl, aged 26; worked in a rubber factory, and was exposed from two to three hours daily to the fumes of CS_2 and SCl. V. = $\frac{22}{100}$ U. O. Central scotoma for colors, white doubtful. The fundus was normal, but both maculae were stippled and had the peculiar look noticed in the anemic fundi of animals poisoned by naphthaline. Recovery was slow. In six weeks V. = $\frac{20}{30}$.

CASE IV. Reported by F. Becker: A. G., aged 66, worked in a rubber factory on articles which he was obliged to immerse in a solution of chloride of sulphur in CS_2. First had sweet taste in mouth, loss of appetite, and cramps in the calves of his legs. Then gradual affection of sight. A moderate smoker and drinker. V. = fingers at three meters. Periphery of field uncontracted, but large central scotomata for red, green, blue, and yellow. Temporal half of papilla very pale. In a month V. = $\frac{1}{5}$, but a small scotoma for white remains, and Dr. Becker does not think vision will further improve.

The investigations of the committee (110) appointed by the British Ophthalmological Society, to report upon the subject of bisulphide of carbon amblyopia, led them to believe that it is the inhalation of the vapor, and not the contact of the hands with the chemical that produces the poisonous effects. The earliest symptom, and the most constant one, according to Delpech (15), is severe frontal and temporal pain, as if the head were squeezed in a vise. The workmen attributed this to the smell of the sulphuriz-

ing fluid, and in support of this belief is the significant fact that the only patient of Depech's who had no severe headache was the subject of anosmia. Patient's clothes, breath, skin, and hair have a "rubbery" odor. The *stage of exaltation* (Delpech) presents the following features: Loquacity, vertigo, and a feeling of drunkenness in going into the outside air. Variable spirits and an irritable temper. His appetite is often increased, and he becomes sexually excited. Vision now suffers, he sees objects as through a mist. Hearing is even more frequently affected. Often there is general hyperesthesia. These symptoms are followed by a *stage of depression* when there is anorexia, disturbed sleep, and mental failure. Now there is an anesthesia of the skin, especially of the limbs; cramps, great muscular weakness, impairment of sexual desire, or complete anaphrodisia. Fingers became stiff and numb. Vision is now greatly impaired, fog or mist appearing before the eyes even in broad daylight. Pupils are dilated. The peripheral field is uncontracted, but central negative (and sometimes positive) scotomata are invariably present. Pallor of the disc with indistinctness of its margin often noted.

These symptoms increase in severity as long as the patient is exposed to the poisonous fumes, and finally he loses his menory entirely, and is unable to stand upright.

Of the twenty-four cases reported upon, twenty-two were in men. Their ages varied from 15 to 52, ten being under 25. The *prognosis* is, so far as concerns sight, very fair if the sufferer can entirely give up his deleterious occupation. Of twenty-four cases, eight recorded very good or perfect vision; seven others improved more or less; in five, there was little or no improvement.

A full report by Gallemaerts (115) of a case of amblyopia from carbon disulphide, illustrated by charts of the visual fields, with remarks upon the pathology of the disease, may be found in the *Annales d' Oculistique* for 1890.

76. Brauchli. Ueber die durch Tabac und Alcohol, verursachte Intoxications amblyopie. *Inaug Dissert*, Zurich, 1889.

77. J. Hutchinson, Jr. Report on Toxic Amblyopia. *Trans. Oph. Socy. U. K.*, vii., page 63.

78. Coursserant. Du traitement et du diagnostic des amblyopies toxiques (alcoolo-nicotiennes) par les injections sons-cutanées de chlorhydrate de pilocarpine. *Bulletins et Memoires de la Société francaise d'ophtalmologie*, 1885, page 266.

79. Gilbert. [Title mislaid]. *Société med. des hopitaux*, Oct. 25, 1889.

80. Thomsen. [Title mislaid]. *Berlin klin. Wochenschr.*, No. 2, 1888,

81. C. W. Suckling. Ophthalmoplegia externa due to Alcohol. *Br. Medical Journal*, December 18, 1886.
82. I. E. Atkinson. Some of the Graver and Rarer forms of Cinchonism. *Journal Am. Medical Assocn.*, September 28, 1880.
83. G. Giacomini. Effeti del solfato di chinina sugli animali, ed avvelenamento pel solfato di chinina nell' uomo sano. *Annali univ. di med.*, Milano, xcvii, 1841, 325.
84. H. C. Lewis. A case of total blindness occurring during the administration of large doses of the sulphate of quinine. *Western Jour. Med. and Surg.*, Louisville, iv (1845) page 396.
85. J. McLean. Blindness caused by the use of sulphate of quinine. *Ill. and Ind. Med. and Surg. Journal*, i, 1846, 385.
86. W. O. Baldwin. Observations on the poisonous properties of the sulphate of quinine. *Am. Journal Med. Sc.*, ap. 1847, n. s. xiii, 292.
87. Trousseau. *Dictionnaire de Médicine.* 2 me Edition, Art. Quinine, page 567. [Quoted from Atkinson].
88. Guersant. Same as 87.
89. P. Briquet. (*a*) *Traite' therapeutique du quinquina et de ses preparations*, Paris, 1853. (*b*) Reflexions sur l'emploi du sulfate de quinine à hautes doses. *Bulletins de l'acad. de méd*, 1842-3.
90. G. de Schweinitz. Some experiments to determine the lesion in quinine blindness. *Ophthalmic Review*, February, 1891.
91. H. Knapp. Ueber Chinin—Amaurose. *Bericht der ophthal. Gesellschaft, Heidelberg*, 1881, S. 100.
92. A. B. Browne. A case of quinine amaurosis, with remarks. *Trans. Oph. Socy. U. K.*, Vol. vii, page 193.
93. F. Buller. A case of sudden and complete loss of vision after large doses of quinine. *Trans. Am. Oph. Society.* 1881, page 262.
94. A. Gruening. On quinine amaurosis, with a case. *Archives of Oph.*, x, 1881, page 81.
95. H. Knapp. On quinine amaurosis, with three cases. *Archives of Oph.*, x, page 223.
96. F. Diez. Cas o de ambliopia toxica producida por el sulfato de quinina. *Oftal. practica*, Madrid, 1883, ii, 13.
97. D. B. St. John Roosa. A case of probable quinine amaurosis. *Trans. Am. Oph. Society*, 2887, page 431.
98. Wm. Dickinson. Quinine amaurosis. *St. Louis Med. and Surg. Journal*, October, 1881, page 352.
99. E. Nettleship. Acute temporary amblyopia whilst taking small doses of quinine; patient intolerant of quinine. *Trans. Oph. Socy.* U. K., vii, 218.
100. Jos. G. Rogers. Some peculiar affects of cinchonia. *Alienist and Neurologist*, 1882, iii, 445.
101. Peschl. [Quoted from Atkinson]. *Annal di Ottalmologia*, xvi, 421.
102. D. Webster. Two cases of quinine amaurosis, etc. *Archives of Med.*, N. Y., 1883, Vol. x, page 338.
103. C. E. Michel. A case of quinine amaurosis. *Archives of Oph.*, 1881, page 214.

104. G. M. Dewey. Sulphate of quinine—its use and abuse. *Trans. Med. Assoc., Missouri*, 1882, page 161.
105. H. C. Coe. Paralysis after quinine. *Chicago Med. Standard*, 1889, Vol. v, page 72.
106. Mellinger. Ein Fall von amblyopie nach Chinin-intoxication. *Zehender's klin. Monatsbl.*, February, 1887.
107. E. Berger. *Les Maladies des Yeux, etc.*, page 410.
108. E. Hutchinson. Toxic amblyopia from the prolonged use of iodoform and creosote. *N. Y. Med. Journal*, January 2, 1886.
109. Priestley Smith. Toxic amblyopia from iodoform. *Ophthalmic Review*, April, 1893.
110. Report on Toxic Amblyopia. *Trans. Oph. Society* U. Kgdom, Vol. vii, page 35-100.
111. R. Marcus Gunn. Toxic amblyopia from bisulphide of carbon (tobacco?) with typical general symptoms of poisoning by this agent. *Trans. Oph. Socy. U. K.*, vi., 372.
112. Hirschberg. *Centralbl. für pkt. Augenheilkunde*, February, 1886. Note on page 49.
113. Hirschberg. Schwefelkohlenstoff Vergiftung. *Centralbl. f. pkt. Augenh.*, August, 1889, S. 268.
114. F. Becker. Ein Fall von Schwefelkohlenstoff—amblyopie. *Centralbl. f. pkt. Augenh.*, 1889, 138.
115. E. Gallemaerts. Amblyopie par le sulfure de carbon. *Annales d'Oculistique*, Tome civ, 1890, page 154.

[*To be Continued.*]

THE TOXIC AMBLYOPIAS; THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT.

By Casey A. Wood, C. M., M. D.,
of Chicago.

[*Continued from Vol. III, page 88.*]

Cannabis Indica. Arsenic. Lead Salts. Salicylic Acid and Sodic Salicylate. Cocain. Venom of Poisonous Reptiles. Salts of Silver. Mercurial Preparations. Ergot. Nitrite of Amyl. Nitrous Oxide Gas. Male Fern. Pomegranate. Ptomaines. Poisonous Fungi. Symptoms, Diagnosis and Prognosis.

CANNABIS INDICA. Although, according to Ali (16), chronic indulgence in "haschisch" produces an amblyopia of the nicotine-alcohol type, the eye symptoms accompanying acute poisoning are by no means constant or characteristic. James Oliver (116) noticed dimness of vision and weakness of accommodation, the pupil being contracted, or of normal size. On the other hand Casiccia's (117) case developed mydriasias accompanied by hallucinations of vision, "lights and sparks of fire before the eyes." Susskind (118) also reports dilated pupils, while in Seifert's (119) case the pupils were of medium size and reacted slightly to light. Finally, Werner (120) reports an instance of cloudy *violet vision* in a small nervous woman, developed by $\frac{2}{3}$ grm. of the extract taken in nine divided doses. We may accept all this as evidencing the truth that the symptoms of chronic and acute poisoning produced by drugs are often widely different.

Arsenic. The lids, conjunctiva, cornea and sclera of patients are often affected and the majority of the cases reported by ophthalmologists are merely descriptions of the hyperemia, odema and pigmentation of the external ocular apparatus that in chronic arsenical poisoning or during long continued medication also affect the skin and mucous membranes elsewhere.

The claim of arsenic to a place in Class I, Div. 1, of our classification is, however, supported by the evidence of more than one witness. Liebrecht (50) reports the following case from Schöler's klinik in Berlin:

A man, aged 30, examined on account of misty vision of four weeks standing. V., L. = $\frac{20}{200}$ Sn. vii; V., R. = fingers at eight feet and Sn. xvi. Pupillary reaction normal. Ophthalmoscope shows temporal pallor of disk. F. of V. normal at periphery, but they show an ill defined paracental scotoma for green and red. On the right side (near the fixation point), a very small absolute scotoma. Patient drinks no spirits and only a small amount of beer. Formerly smoked four or five cigars daily—for four weeks none. Doubtful luetic history.

During the previous three years and a half the patient had taken arsenic in pill form (dose unknown) for *psoriasis fere universalis*, the amount having been greatly increased during the past six weeks until within eight days when he was obliged to intermit it owing to the production of vomiting with pains in head and stomach. The outcome of this case is not recorded but the absolute scotoma, in the absence of other causes, would lead us to agree with the reporter in his assertion that the optic nerve lesion present was the result of the chronic arsenical poisoning and was not due to tobacco.

That cases of simple optic nerve neuritis occur is abundantly proven. Dana (121) in giving a full account of arsenical paralysis records such an instance in an American, aged 48, who was ordered Fowler's solution in increasing doses until at last he took ozss, *t. i. d.* After a month of treatment he had peripheral motor and sensory paresis as well as optic neuritis, with normal pupillary reflexes. The medicine was discontinued and in five months the patient was better.

In a second case the vision was impaired without optic inflammation.

H. Derby's (122) case is of great interest as the trouble was ultimately traced to the arsenical wall paper in the patient's library. The latter, a man of regular habits and previous good vision became so blind that V. R. = $\frac{1}{20}$; V. L. = $\frac{2}{10}$; bilateral optic neuritis with slight hemorrhage near r. o. d. *The urine was found to contain arsenic.* After removal of the probable cause patient gradually improved. Krehl (123) records a case of medicinal poisoning (Fowler's solution); a man, aged 23, who, formerly healthy, acquired a horizontal nystagmus of slight degree, with flashes before his eyes on gazing steadily at objects.

Lead Salts. The symptoms of this form of amblyopia are by no means constant because plumbism does not always affect the same parts of the eye. Among the earliest and most interesting contributions to this subject is the account given by Mr. Hutchinson (124) of five cases.

The commonest symptoms are those due to *optic nerve atrophy* which may come on slowly or be chronic from the beginning. The picture is usually that of a pale, well-defined disc with the arteries greatly reduced in caliber, even when the veins are distended. Sometimes there is slight congestion of the papilla, but this is accompanied by little swelling and the disc eventually becomes of a dirty gray tint with lines running along the narrowed vessels. Sight is always greatly affected, and the visual field may present both central and peripheral defects. This commonly goes on to total blindness. In five cases published by Landesberg (125), two had optic nerve atrophy and treatment was of no avail. Vision was reduced to $\frac{20}{100}$ and less in both eyes.

In a case described by Uhthoff: a color-mixer, aged 18, seen nine months after symptoms set in, not complicated by tobacco, alcohol, or renal affection, there appeared to be an extensive *retro-bulbar neuritis*. The vision in the right eye was only $\frac{7}{200}$ and in the left eye $\frac{8}{200}$. The F. of V. showed an absolute central scotoma with uncontracted periphery. There was a distinct pallor of the outer half of the disc. Very little improvement took place. DeWecker and Masselon (126) speak of true retro-bulbar neuritis as common in cases of lead poisoning, but say that if the poisoning persists the relative scotomata becomes absolute and increase in size.

In another and important class of cases the local manifestations are those of a decided *optic neuritis* with retinal and papillary hemorrhages, swelling of the disc, tortuous and obscured vessels. Gowers (127) figures such fundus in the case of a man, aged 45, who had marked cerebral symptoms such as headache, delirum, convulsions, etc. The disc is concealed by a swelling of moderate prominence bordered by a fringe of striated hemorrhage and of a color nearly that of the fundus. The veins a little larger than normal. Arteries concealed by the swelling and most of them very narrow. Vision was considerably impaired but could not be accurately tested, owing to his mental state.

Last, but by no means least, there may exist a state of *transient visual disturbance* without fundus changes, which is probably the most frequent of all. The amblyopia may last but a few hours, and many patients who finally exhibit signs of optic atrophy or neuritis give a history of antecedent "attacks" of dim vision. Gowers thinks this is analogous to the temporary amaurosis of diabetes, and is due to the direct effect of the lead upon the visual centers.

Stricker (128) records a well-marked example of temporary amblyopia in which, however, the attacks lasted much longer than they usually do. The patient, a woman, had intermittent epilepti form attacks due to lead poisoning. These were accompanied by a slight bilateral optic neuritis, giving rise to a sensation of fog before the eyes. For varying periods the vision sank so low that she could not see her hand. In the intervals of rest from the fits the cloudiness cleared up and the patient had normal acuity of vision. At one time the foggy sight lasted nine weeks, but eventually the attacks of saturnine epilepsy became less frequent and less severe, and with this improvement the optic disc again resumed its normal aspect. In the same way Günsburg (129) relates a case of temporary blindness (in which the lead poisoning had produced renal disease) associated with uremic symptoms. The loss of sight lasted several hours. The fundi were normal, but the pupils did not react to light. Next day V. was normal and the uremic symptoms had disappeared. Michel has observed in several cases of lead colic that the visual acuity temporarily diminished to mere perception of light although there were no fundus changes discernible. This state of things he considers a purely reflex amblyopia, and does not think it is due directly to the lead poisoning.

In chronic lead poisoning the general symptoms (characteristic dark line along the gums, colic, muscular paresis, arthralgiæ, etc.) usually persist for a long time before vision is affected. Samelsohn (130) has pointed out, as a rare exception to this rule, the appearance of ocular affections before other signs of plumbism show themselves, and states that in such cases the former rapidly disappear when the poisonous influence is removed. In any event the eye is involved (seriously at least), in a very small percentage of cases of plumbism.

In Günsburg's (129) case the patient was unaffected until after he had been employed continuously for 27 years in the lead works. If the injurious habit or occupation of the patient is persisted in, organic lesions commonly show themselves with a permanent reduction of vision.

Although the above forms include the great majority of cases of lead amblyopia, many other ocular manifestations are on record, especially *paralysis of one or more of the extrinsic ocular muscles*. One of Landesberg's (125) cases had a bilateral paresis of the rectus externus; another had complete paralysis of all branches of the oculo-motorius. Von Schroeder (131) also reports a case of

typical neuro-retinitis with bilateral abducens paralysis. Landolt (132) describes a most interesting case of left-sided hemianesthesia with gray-red discs and irregular scotomata in both fields.

Wadsworth (133) gives a very instructive account of a boy aged 9, with marked optic neuritis and paralysis of several ocular muscles; lead was found in the urine for many months and vision was entirely lost from optic atrophy. The source of the lead was not ascertained.

The state of the pupils, to which importance is attached by some in the diagnosis of the ocular disturbance of plumbism, is not of much importance. They are often dilated during attacks of colic, but may, according to T. Oliver (19), be unequally affected. Their condition at other times will depend upon the amount and kind of the fundus changes.

The *diagnosis* of lead amblyopia rests upon the presence of the accompanying plumbism, although when nephritic or cerebral disease is present it may indeed be difficult to say whether the ocular disease be due to the direct or the indirect influence of the lead poisoning. There is no reason why the presence of lead salts in the body should not be demonstrated, and in all doubtful cases the urine should always be examined from time to time. C. A. Oliver (134) relates a case of progressive blindness in a male adult where the urine, saliva and nasal mucus revealed the presence of lead.

The *prognosis* is favorable when vision is not reduced and the fundus changes are slight or are recent, but very unfavorable in chronic atrophy, in the retinitis accompanying nephritis and in the neuritis following or accompanying cerebral disease.

Salicylic Acid and the Salicylates. There is not much to add to Gatti's (24) case. Knapp (135) says that the visual disturbance observed in three cases of poisoning by this drug *were about the same as in the milder attacks of quinine amaurosis.* They all got well quickly and left behind them no noticeable traces. As suggested, in speaking of the eye signs of quinine poisoning, it is very likely that a slight and temporary decrease of the visual acuity is not uncommon in persons taking large doses of the salicylates and that this symptom is likely to be overlooked or attributed to other causes. I have made diligent inquiry among a number of my confreres in general practice and have reason to believe that several such cases have been observed in Chicago.

Gibson and Telkin (136) relate a case of a middle-aged woman, where after two drams had been given (divided into 30-grain doses every two hours), the patient showed extreme contraction of the

pupils which were insensitive to light. Thirty hours afterwards there was complete recovery. In Schiffer's (137) case there were hallucinations of vision for twenty-four hours after an enema of seventy-five grains sodic salicylate.

Cocaine. There are no distinctive ocular symptoms resulting from either acute or chronic poisoning from cocaine. In a fatal case seen by me (resulting from the spraying of the naso-pharynx with a small quantity of a 20 per cent solution), that occurred while I was clinical assistant at the London Throat Hospital the pupils were fully dilated, but other observers have noticed contracted or even normal pupils during acute poisoning. Bettelheim (138) found a sensitive cornea in a similar case. Marckwort (139) reports a case where its long continued application to the nose probably produced an acute glaucoma; Chisholm, Javal and others believe that its application to the conjunctival sac may induce glaucomatous outbreaks. Hallucinations of vision, chromatopsia, diplopia, micropsia with dancing of objects before the eyes have all, as temporary symptoms of chronic cocaine poisoning and in persons addicted to the cocaine habit, been noticed by several observers, especially by Saury (140). In Bock's (25) case, ten minutes after the usual symptoms of poisoning set in, the patient complained of misty vision and became unconscious. Ophthalmoscopic examination showed, during and after the attack, no pallor of the nerve but diminution in size of the retinal arterioles. Vision the same as before the poisoning.

Venom of Poisonous Reptiles. In my introduction of the subject I have already sufficiently spoken of the symptoms and course of the eye troubles in these forms of intoxication.

Silver Salts, Mercury and its Salts. I have nothing to add to the introductory notes.

Ergot. Knies, as well as Albutt, speaks of the contractile effects of ergot upon the retinal and nutrient opticus blood vessels, and as a result, marked pallor of the disc. A transitory amblyopia is produced by this vascular contraction and papillary anemia. The pupil is usually dilated and inactive. All these symptoms were well shown in a case of ergotism recorded by Hume (141) where an enema of an ounce of the fluid extract had been administered. Menche (142) observed these same symptoms during an epidemic of ergotism in Ober Hesse twenty-five years ago, but he is probably wrong in claiming a case of *iritis* as due to the effects of the poison.

But by far the most important ocular result of ergotism is the

production of *cataract*. The earliest account is given by Ignaz Meier (143) of twenty-three cases, victims of the epidemic of 1857, in the Siebenbürger district of South Germany. The wet summer produced disease of the rye and in spite of warnings to avoid the tainted bread the ignorant and half-starved peasantry ate it in large numbers; 283 were affected by ergotism of whom ninety-eight died. In the following year Meier saw fifteen women and eight men affected with slowly progressive (several months to a year in forming) cataract of the senile type. Both lenses were affected and the ocular disease seemed to confine itself to the crystalline; the retina, vitreous and opticus were healthy, and the extraction of the cataract was uniformly successful. Kortnew (144), during the widespread 1889-90 epidemic in the Russian Njatka government (caused by diseased rye meal, which affected 2,000 persons), had an excellent opportunity of studying the eye symptoms of this formidable disease. These set in about two months after the beginning of the epidemic and are divided by him into two groups; the first complained of intermittent failure of vision coming on in some instances several times a day, sometimes only once a week, and in others at longer intervals. The average number of attacks during the whole illness was from three to five. None of these patients complained of total or permanent loss of vision.

With the second class of cases it was quite different. The loss of vision not only persisted but got gradually worse as the convulsive seizures, due to the poison, continued. In every such instance opacities were found in the crystalline, which presented the smoky gray appearance of senile cataract. In all the instances of this kind, thirty-seven, the opacity spread from the center towards the periphery, and in from three months to a year became complete. Little children were blind in from two to three months; adults over forty took longer, from eight to twelve months. The extraction of such cataracts was ordinarily successful except that there was an unusual loss of vitreous.

Tepljaschin (145) examined twenty-seven cases of this form of cataract in Russians affected by the disease and found the same conditions reported by Kortnew.

Nitrous Oxide Gas. Observations of Aldridge (146) confirm what one would naturally expect to discover with the ophthalmoscope—dilatation of the retinal arteries and hyperemia of the papilla. This condition is essentially a transitory one and disappears with the elimination from the blood of the toxic agent that gave rise to it.

Amyl Nitrite acts on the optic and retinal vessels in much the same way as laughing gas. Chromatopsia of the parti-colored (mixtures of yellow, violet, black, white and red) variety, as well as hallucinations of vision have often been observed, but, so far as I know, no permanent changes in the ocular apparatus have resulted from its employment in medicine or in poisoning by it.

Male Fern. There are several well authenticated instances of *amaurosis* and amblyopia from acute poisoning by this drug. In a fatal case reported by Eich (147) the symptoms were those of strychnia poisoning with contracted pupils. In some severe cases of poisoning when the patients survived, blindness, the result of optic nerve atrophy has been several times recorded. Schlier (148) reports a case of temporary amaurosis complicated with albuminuria, but the history of several other cases reads like quinine amaurosis. Zimmermann (149) records an instance of bilateral opticus atrophy from a dose of ten grams of the extract, and Fritz (150) of a unilateral atrophy following the acute blindness. Fritz's case is worth recording in full:

A well nourished girl, servant, aged 18, suffering from taenia, bought at a drug store ten capsules of extr. fil. maris, each containing one gram, and took a capsule every hour. As soon as she had taken six she was attacked by convulsions and coma, and when she recovered from these was blind in both eyes and her pupils were widely dilated. In the course of a week the sight in the right eye began to improve, but very slowly, until after several months the visual acuity again became normal. The left eye remained amaurotic and in it atrophy of the optic nerve was plainly made out. The papilla became very white and the eye was finally affected by strabismus.

Pomegranate. Jacobson (128) records an instance of poisoning by the extract where the effects resembled those of the cycloplegic intoxicants—paresis of accommodation and dullness of distant vision from the development of latent hypermetropia. According to Dujardin-Beaumetz hypodermic injections of sulphate of pelletierine and isopelletierine (alkaloids from the root-bark) produced marked dilatation of the retinal vessels, contracted pupils and scleral injection.

Extract of Pomegranate and Male Fern. Bayer (151) describes a case in which after a dose of 17.5 grms. of extract granati, mixed with the same quantity of male fern extract (divided into seven hourly doses of 2.5 grms. each), vomiting, faintness and unconsciousness lasting thirty hours were observed. The patient became blind in the left eye and visual acuity was dull in the right. The blindness was, in the light of other cases, probably due to the poisonous action of the male fern.

Ptomaine Poisoning. Botulismus. Allantiasis. In a properly constructed review of the amblyopias resulting from this form of intoxication and following the rule laid down by me in the beginning of these studies, each ptomaine should be considered under separate headings, but as neither these putrefactive alkaloids, nor the poisonous leucomaines have all been isolated, and as it is very probable that the ocular symptoms in many instances arise from the combined action of two or more poisons, no such satisfactory arrangement of them can be had.

In the same way the leucomaines have been treated of under such headings as *venom of snakes*, *toad poison*, *poisonous fungi*, etc.

There is a close family resemblance to certain alkaloids, notably *atropia*, *eserin*, curare and strychnia, in the action of ptomaines upon the eye and general system. As an example of this, *muscarin and neurin* produce miosis and spasm of accommodation; *tyrotoxin* paresis of accommodation and mydriasis.

In most of the recorded instances of toxalbumin poisoning, where life was saved, the visual acuity shortly returned; there were no fundus changes and no injury to optic nerve or retina.

Paresis or *paralysis of accommodation* (bilateral and usually accompanied by widely dilated pupils) is the most common eye symptom of poisoning by decomposed *meat*.

Partial and transitory visual failure has frequently been noticed and is likely to be, and probably often has been overlooked or misinterpreted. M. Knies (152) relates a case where two persons who ate of the same fish (which was apparently above suspicion), had as a result a paresis of accommodation that lasted twenty-four hours.

All the extrinsic ocular muscles have been affected, from bilateral and nearly complete ophthalmoplegia externa to paresis of a single muscle. Of these *ptosis* is the commonest of the oculo-motor pareses and has been noticed by many observers *e. g.*, by Kaatzer (153), Hirschfeld (32), Flury (154), Federschmidt (31) and Pürkhauser (155).

These symptoms do not, as a rule, show themselves for several days after the poisoning. Boehm (155) cites a case where the paralysis was first noticed nine days after the ingestion of the food.

Groenouw (30) gives the following account of a few cases:

W. G., aged 29, the next day after eating a full meal of raw ham found that his throat was dry, that he could hardly swallow his food (especially dry bread), and that he was unable to read ordinary print. He was slightly

myopic, and it was estimated that he had lost through the cycloplegia present 5 D. left, and 6 D. right, of accommodative power. Under treatment the symptoms slowly disappeared.

Two other cases occurred in the same family and presented about the same symptoms. The ocular signs declared themselves in from two to five days and lasted for nine weeks. The remains of the ham were fed to mice whom it killed in twenty-four hours. Parts of the dead mice were fed to other mice who remained perfectly healthy, from which it was concluded that the poison was a ptomaine or ptomaines and that death did not result from bacteria, none of which could be detected in the ham or dead mice.

Eichenberg (157) noticed in a case of sausage poisoning, which ended fatally, not only a third nerve paralysis, but a unilateral abducens paresis. Federschmidt (31) saw twenty-two cases of "Wurstgift," the ocular symptoms being in addition to accommodative failure, dilated pupils, cloudy vision, diplopia (three cases), and in one instance paresis of the *lev. palp. sup.*

The differential *diagnosis* of these cases may not always be easy, especially from diphtheria and poisoning by the mydriatic alkaloids. The presence or absence of *paralysis* of the extrinsic ocular muscles, the course of the accommodative paresis, as well as the nature of the general symptoms must, of course, be considered. Quite recently an American practitioner wrote a short article for a well-known medical journal in which he described several cases of atropine poisoning from eating *turkey*. He explained the symptoms by assuming that the bird, in question had, just before his death, fed on belladonna berries or some other plant possessing cycloplegic properties, and that when served at the table his flesh, being impregnated with the poison, had acted like an overdose of belladonna extract. This error was quite pardonable and doubtless many physicians, unaware of the cycloplegic action of tyrotoxin (tyrotoxicon) and other ptomaines, have made similar mistakes.

The *prognosis* is generally good and recovery is usually rapid. When death does not occur and the muscular paralyses persist it is likely that central changes (basilar neuritis or meningitis or nuclear hemorrhages) have been produced by the intoxication. Some of these last cases present symptoms closely resembling typhoid fever (even to changes in Peyer's patches, intestinal ulcerations, etc.), and may easily be mistaken for it.

Fungus Poisoning. Manifestations of this form of intoxication naturally depend upon the kind of fungus, since the active agents in the various mushrooms, toadstools, etc., vary greatly. Some of them when eaten in poisonous doses produce accommodative

spasm and contraction of the pupil, only, as Knies points out, these symptoms occur in order the reverse of those brought about by eserine, the spasm coming on first. Such a fungus is the *agaricus muscarius* whose active principle—*muscarin*—closely resembles the ptomaine named *neurin*. The *agaricus phalloides* on the other hand, does not affect the pupil, although, as Handford (158) has shown, disturbances of vision result from poisoning by it. In Maurer's (159) case the pupils were dilated *ad maximum*.

116. Jas. Oliver. On the Action of Cannabis Indica. *British Medical Journal*, May 12, 1883.

117. Cassiccia. Un caso di avvelenamento per canapi indiana. *Rivista di chim. e farm.*, 1883, p. 326.

118. Susskind. *Würtemberg. artzl. Correspondenzbl.*, 1887, S. 31.

119. Otto Seifert. Ein Fall von Vergiftung mit Balsamum Cannabis Indicae. *Münch. Med. Wochenschrift*, 18ten Mai, 1886, S. 347.

120. Werner. Vergiftung mit Ext. Cannabis Indicae. *Würtem. artzl. Correspondenzbl.*, 1886, No. 33.

121. C. L. Dana. On pseudo-tabes from arsenical poisoning, etc. *Brain*, 1887, p. 457.

122. H. Derby. A case of double optic neuritis accompanied by considerable amblyopia, possibly caused by arsenical poisoning. *Boston Med. and Surg. Journal*, June 18, 1891, p. 603.

123. L. Krehl. Ueber Arsenlähmungen. *Deutsch. Archiv. für rl. Med.*, 1889, Bd. 44, S. 325.

124. J. Hutchinson. *Oph. Hosp. Reports*, Vol. vii, pt. I, p. 6, as well as Vol. vi, pt. I, p. 55.

125. Landesberg. Affections of the eye consequent upon lead poisoning. *Med. Bulletin of Phila.*, 1880, II, 108.

126. deWecker et Masselon. Manuel d'ophthalmologie, p. 688.

127. Gowers. Medical Ophthalmocopy, p. 269.

128. E. Berger. (Stricker). Les Maladies des Yeux, etc., p. 415.

129. Gunsberg. Zur Kentniss der transitor. Amaurose bei Blei-intoxication. *Graefe's Archiv. für Ophthalmol.*, xx, 3.

130. J. Samelsohn. Zur Casiustik der Amblyopia saturnina. *Klin. Monatsbl. für Augenh.*, 1873, S. 246.

131. VonSchroeder. Beitrag zur Kasuistik und Literatur der Amblyopia saturnina. *Graefe's Archiv. für Ophth.*, xxxi, I, 229.

132. Landolt. Troubles de la vision observés dans un cas d' hémiplégie saturnine. *Annales d'Oculistique*, Tome 83, p. 165.

133. O. F. Wadsworth. Double optic neuritis and ophthalmoplégia from lead poisoning, etc. *Boston Med. and Surg. Journal*, Oct., 1885, p. 340.

134. C. A. Oliver. Keating's Cyclopedia of the Diseases of Children. Art. Ophthalmoscopy, iv, 233.

135. Knapp. *Bericht der 13ten oph. Gesellschaft zu Heidelberg*, 1881.

136. Gibson and Telkin. A hitherto unobserved effect of the Salicylates. *The Practitioner*, January, 1889, p. 17.

137. Schiffer. *Archives mensuelles de med. et chir.*, 1888.
138. J. Bettelheim. Akute Cocainvergiftung. *Wiener Med. Presse*, 1889, No. 12.
139. Marckwort. *Archiv. für Augenheilkunde*, 1887, p. 452.
140. Saury. Le cocainisme. Contributions a l'étude des folies toxiques. *Ann. Méd—psych.*, 1880, p. 439.
141. L. Hulme. Case of acute ergotism, etc. *The Medical News*, Nov. 5, 1887, p. 538.
142. H. Menche. Die Ergotismus—Epidemie in Oberhesse im Herbste 1879. *Deutsche Archiv. für klin. Med.*, xxxiii. 1883, S. 246.
143. Ignaz Meier. Ueber die Enwickelung des grauen Staars in Folge der Kriebelkrankeit (Raphania). *Graefe's Archiv. für Ophthal.*, 1862, viii, 2; S. 120.
144. A. Kortnew. Ueber Cataracta raphanica. Trans. by Adelheim from the *Wjestnik Ophth.*, ix, 2, 114. Nagel's Jahresbericht, 1892, S. 519. See also an English translation by Casey A. Wood, of Hirschmann's abstract in Knapp's *Archives*, January, 1893, p. 173.
145. Tepljaschin. Cataracte consécutive á l'intoxication chronique par l'ergot de siegle. *Congrés des Medicins russes*, 1889, St. Petersbourg.
146. C. Aldridge. The Ophthalmoscope in Mental and Cerebral Diseases. *West Riding Lunatic Hospital Reports*, 1871, vol. I, p. 71.
147. Eich. Ueber Vergiftung des Extractum filicis maris aethereum. *Deutsch med. Wochensch.*, 1891, Nr. 32, S. 956.
148. Schlier. Ein Fall von Vergiftung mit Filix mas. *Münch. med. Wochensch.*, No. 32, 1890.
149. Immermann. *Correspondenzblaetter für Schweizer Aertze*, 1ten Juli, 1887, and *Berlin klin. Wochenschr.*, 1887, S. 540.
150. Fritz. From a letter to the *Centralbl. für pkt. Augenheilk.*, 1887, p. 278.
151. Bayer. Vergiftung durch extractum filicis. *Prager med. Wochenschrift*, No. 41, p. 540.
152. Knies. Die Beziehungen des Sehorgans und seiner Erkrankungen zu den uebrigen Krankheiten, p. 371.
153. Kaatzer. Ueber Vergiftung durch Wurstgift. *Deutsche med. Wochenschrift*, 1881, S. 73.
154. Flury. Zur Kasuistik der Fleischvergiftung. *Correspondenzbl. für Schweizer Aerzte*, 1885, pp. 184 and 205.
155. H. Purkhauser. Zur Casuistik der Allantiasis. *Bayr. Arztl. Intellig.—Bl.*, 1877, 24.
156. Boehm. Handbuch der Intoxicationen, p. 240.
157. F. Eichenberg. Ueber die Vergiftung durch Wurstgift im Anschlusse an einige beobachtete Fälle. Gottingen, 1880, S. 31.
158. Handford. A fatal case of mushroom poisoning. *The London Lancet*, 1887, 1048.
159. A. Maurer. Beitrag zur Toxikologie der Morcheln. *Bayer Arztl. Intelligens—Bl.*, 1881, No. 1.

[*To be Continued.*]

THE TOXIC AMBLYOPIAS; THEIR SYMPTOMS, VARIETIES, PATHOLOGY AND TREATMENT.

By Casey A. Wood, C. M., M. D.,
of Chicago.

[*Continued from Vol. III, page 287.*]

BELLADONNA AND ITS ALKALOIDS. In addition to the symptoms detailed on page 176 there are several instances recorded where *glaucoma* has resulted from the external application of mydriatics. In two instances, also, optic nerve atrophy with contractions of the visual field are said to have been caused by their use, but these cases are not well authenticated.

The ocular symptoms occasioned by cycloplegic derivatives from the *solanaceæ* order are probably of peripheral origin. The poison acts by paralyzing the ends of the third nerve distributed to the ciliary muscle and sphincter iridis as well as, *perhaps*, by stimulating the sympathetic dilator fibers.

General as well as local symptoms from the use of other cycloplegic agents are too well known to spend much time upon them.

Kollock (160), in common with many others, the author included, has observed serious symptoms after the instillation of such a small amount as $\frac{1}{60}$ gr. of *duboisin*.

Ziem (161) as well as de Schweinitz and Hare (162) report cardiac weakness after the local use of *homatropin*. Harlan (163) has seen the same drug bring on slight attacks of glaucoma, while Cheney (164) witnessed what he terms "hysterical" mydriasis and blindness following the use of the hydrobromate.

Testi (165) saw well marked cycloplegia and mydrasis in a family poisoned by *hyoscyamus albus*.

Treatment. Owing to its stimulating action upon the third nerve center, opium, and especially hypodermic injections of morphia, in full doses is the most appropriate and most useful form of treatment in cases of poisoning from the cycloplegic alkaloids. McGowan (166), in a case of typical intoxication following a teaspoonful of belladonna liniment, used hypodermic injections of pilocarpin with gratifying results.

Although *nicotine* and *eserine* stimulate the nerve endings of the oculomotorius, their miotic action is feeble, and even large doses do not neutralize the ordinary paretic effects of belladonna or hyoscyamus. The statement of Loring (167), that no visible changes in the retinal vessels are produced by poisoning, agrees entirely with the results of my investigation (page 177) of opium amblyopia.

Opium and Morphia. The experiments of Picard (168) on dogs, and the observations of Laborde (169), in a case of chronic poisoning from morphia, would appear to prove that these agents do occasionally affect the optic nerve and retina and so produce visual disturbances. In addition to Wagner's case (37) previously quoted, Schreiber (170) observed agraphia and alexia after acute poisoning. Schiess-Gemuseus (quoted by Knies), reports a case of a man, aged 65, who, after taking a morphia sleeping powder and having slept thirty hours, became almost blind and deaf. He not only had, after an interval of three weeks, a right-sided hemianopia but a persistent contraction of the visual field on the left side. The right papilla presented the appearance of a tobacco disc, *i. e.*, hyperemia of the nasal half with palor of the temporal side.

Aconite. Many other observers besides O'Brien (38) and Hooper (171) have recorded *mydriasis* without cycloplegia as the chief ocular symptom of aconite and aconitia poisoning, although Haakmar, and a few others, in a case (172) from aconitia nitrate mention this sign as alternating with miosis. In a fatal case from the nitrogallate of aconitia, Buscher (173) noticed that the patient had attacks of complete blindness. Woodburg's case (174) exhibited misty vision and diplopia.

Chloral and Its Hydrate. Most authors agree with Griffith (175) that after the continued use of chloral, the pupil almost invariably becomes contracted, but later on psychic alterations set in and then the pupillary contraction gives place to dilatation. The *miosis*, which is the symptom most commonly observed, is associated with loss of the normal pupil-dilatation-reflex from irritation of the sensory nerves in the ocular neighborhood. This contraction of the pupil is the result of paresis of the sympathetic nerves supplied to the iris.

Usually there are no fundus changes, although Berger speaks of a congestion of the papilla, when *mydrasis* is present, due to congestion of the retinal veins. Ulrich (176) says that in the later stages slight pressure upon the globe is sufficient to force the blood out of the papillary vessels and that the intraocular tension

is lessened. There is then an anemia of the retinal vessels. Cheatham (177) has had two cases of photophobia and conjunctival hyperemia, which he ascribes to chloral, having seen them follow a single dose of 15 grains. Visual disturbances, due to organic alterations, are very rare.

Mittendorf (178) had a patient who had been taking 2.5 to 3 grms. of chloral hydrate daily. There were greatly impaired vision and small central scotomata for red and green, while the papillæ were muddy. Chloral stopped and strychnia administered. Improvement began in four days; in three weeks vision was two-thirds with no scotoma. Kirkpatrick Murphy (180) observed in a woman, 58 years of age, who took 150 grains daily, dimness of sight, eyes bloodshot and constantly watering, pupils dilated and temporary amaurosis lasting two days.

Treatment. Very little is known about it. C. J. G. Sinclair Coghill (179) is an advocate of amyl nitrite, and in a case of complete miosis from chloral used the former remedy with success.

Eserine. Although this agent, as well as extracts of Calabar bean, are well known miotics when used locally, yet systemic intoxication generally causes *dilatation of the pupil.* C. Aragô (181) has seen complete, though temporary, blindness follow general eserine poisoning in a 10-year old child, which, by the way, most commonly results from its instillation into the conjunctival sac.

Pilocarpin and Jaborandi. Locally always powerful miotics, the chief eye symptom in *general* poisoning is, as with physostigmine, mostly *mydriasis.* Fuhrmann (182) relates a case of luetic papillo-retinitis in which a hypodermic injection of 0.01 grm. of pilocarpin was given. Alarming symptoms set in accompanied by an amblyopia lasting two hours and a half. The patient could not recognize a person at 20 centimeters, although his left eye before the poisoning had normal vision. In an article on the subject Landesberg (183) gives his experience of five cases treated with pilocarpin and jaborandi in which he observed sooner or later a quickly developed *cataract.*

Says Berger, "although exceptional cases of transient amblyopia or of cloudy vision are commonly explained by the hypothesis of a disturbed intraocular circulation, it is more probable that pilocarpin, in poisonous doses, temporarily paralyzes the peripheral fibers of the optic nerve."

Coffee and Caffein. Strong solutions of caffein and its salts applied to the cornea act as a weak mydriatic and anesthetic.

Hutchinson (184) refers to a case of caffein amblyopia, the symptoms of which resemble those of the amblyopia of quinin intoxication.

Aniline and Its Salts. Almost every observer has noticed *mydriasis* and *accommodative paresis* as the chief signs of chronic poisoning. In Leboir's case (185) the dilatation was extreme. Müller (186), on the other hand, observed bilateral miosis. There was defective vision, Jaeger XIX, in each eye, (which improved when the patient abandoned his injurious work) in a case reported by MacKinlay (187).

Coal Gas and Its Combustion Products. Intoxication from poisonous combustion products, especially from carbon monoxid and *carbon dioxid*, as well as from the *hydrocarbons* and other compounds in *illuminating gas*, is occasionally accompanied by ocular symptoms. This is not to be wondered at when one remembers the widespread organic alterations, particularly capillary hemorrhages and fatty metamorphoses found after death in brain, nerves, muscles, kidneys, etc. *Where recovery occurs the eye symptoms are usually due to similar changes in various parts of the visual apparatus.* The minute hemorrhages, that also occur in phosphorus poisoning, are the results of fatty degeneration of the capillary vessels.

A most interesting history is given by Knapp (198). The patient, exposed to the fumes of an imperfectly covered stove, suffered from loss of consciousness after which he had paralysis of several ocular muscles. In the course of two months there was partial recovery, the paralysis being then confined to the ciliary muscle and sphincter pupillæ.

Illing (189) reports a case of homonymous hemiopia due to cerebral disease, while Emmert (190) more recently records a paresis of the third nerve (left eye only) associated with a partial trigeminus and facial paralysis. Recovery in this case was almost perfect.

Retinal hemorrhages have been observed by Becker (191) and others. In Becker's case there was marked congestion of the retinal veins.

Pure carbon dioxid poisoning presents no constant eye symptoms. A mechanical congestion of the retinal veins, as a part of a general venous stasis partly due to asphyxia, has been noticed in association with fundus hemorrhages. Sometimes the pupil is dilated; sometimes contracted. Ball (192) records a curious fact: while the patient was suffering from the effects of the poisonous inhalation the pupils dilated when light was allowed to fall upon the eyes and they contracted in the dark!

Herpes zoster affecting the eye through alterations in the ocular branches of the trigeminus has been observed by Sattler (193).

Phosphorus. There is a close resemblance between the morbid changes in the tissues of persons affected by this intoxicant and those of persons poisoned by one or both of the oxides of carbon. The ocular symptoms and tissue alterations are for that reason much the same in both instances. In chronic intoxication, [Michel (194)] affecting workers in match factories, for example, hemorrhages and patches of degeneration in the retina are sometimes seen. The latter are composed of the altered (fatty) external granular layer, mixed with crystals of tyrosin. The process begins with a fatty degeneration of the retinal capillaries in the same way that phosphorus poisoning affects the smaller vessels elsewhere; an ophthalmoscopic picture that resembles the retinitis of albuminuria.

Sulphuric Acid. This is a rare cause of visual disturbance. Salomonsohn (195) reports a case of acute polioencephalitis superior (produced by poisoning from this acid) which in its turn caused progressive paralysis of the eye muscles, ending in complete ophthalmoplegia. The patient recovered and the eye symptoms disappeared. Georges Martin (196) also publishes an instance of blindness, the result of sulphuric acid poisoning.

Ethylene Dichlorid. Dutch liquid. This colorless, inflammable fluid has been used as an anesthetic, especially under the modified form of *ether anestheticus aranü*. Raphael Dubois (197) noticed that after inhalations of it, dogs and rabbits acquired persistent opacities of the cornea. Panas (198) believes these to be due to serous infiltration of the true substance of the cornea dependant upon a destruction of portions of Descemet's membrane by the ethylene chlorid. In this way the parenchyma is exposed to the action of the aqueous humor.

Potassic Bromid. In addition to the case already detailed (*vide ante*) Schweig (199) reports a case in which slight *mydriasis*, lasting several days, and conjunctival catarrh were the principle ocular signs of the bromism. Berger attributes the dilation of the pupil either to the paretic action of the bromid on the sphincter pupillæ or to a contraction of the vessels of the iris. The amblyopia is probably due to the mydriasis, as no fundus changes have been reported.

Iodin and Iodids. Edema of the lids, as in Hewkley's case (200), accompanied by lachrymation and pains in the eyes, as seen in the case of Lorenz (201), constitute the ordinary symptoms of ocular iodism, as part of a general intoxication.

The following histories must be regarded with suspicion, as the alleged ocular poisoning occured in patients with syphilis. Ehrmann (202), in a case of acute iodism, observed not only the usual symptoms just mentioned, but in four instances severe trigeminus neuralgia with tender "pressure" points. These disappeared when treated by quinin.

I present the following case: "Mrs. M., 36 years of age, in November, 1893, observed failing vision. It seemed as if a cloud were floating before the eyes. She applied for treatment to a well known ophthalmologist, who prescribed potassic iodid in increasing doses, combined with 'mixed treatment.' Has taken 200 grains of K. I. at a dose. After being under treatment for several months it was noticed that when the iodid was stopped vision improved, and invariably got worse when full doses were resumed. Finally, the surgeon was obliged to return to very small doses and at last to stop the drug altogether, owing to its untoward effect. Patient afterwards consulted me and I had a similar experience with her. The lesion was a *hyalitis* (V., R. = $\frac{20}{200}$; V., L. = $\frac{15}{200}$) which eventually greatly improved."

Methylen Bichlorid. This anesthetic fluid, allied to chloroform and said to be a mixture of it and methylic alcohol, produces eye symptoms the direct opposite of the former (*q. v.*) viz: *miosis* in the first stage of the narcosis, but *dilated pupils* in the later stages.

Chloroform. Aside from the condition of the pupil in the various stages of chloroform narcosis there are no ocular symptoms, properly so called, pathognomonic of this intoxicant. Niemann (203) records a case of acute poisoning from drinking chloroform: the man first presented contracted and, later on, dilated pupils.

Schlaeger (204), Vogel (205) and Budin (206) have made elaborate studies of the pupillary reflexes in persons under the influence of chloroform, investigations that add very little to the everyday experience of the surgeon.

During the period of excitement the pupil is dilated, but as the inhalation proceeds and the medulla and cerebral centers become paralyzed the pupil contracts—a well marked miosis indicating that the anesthesia is complete.

Ether. The pupillary signs are much the same as with chloroform, but Jacob (207) noticed, six times, mydriasis instead of miosis in the stage of deep narcosis out of 1200 etherizations. As a result of a study of these signs Warner (208) reports a disassociation of the usual binocular movements under chloroform which is not exhibited by ether.

Detachment of the retina, probably as the result of efforts at vomiting, has been recorded by several observers, *e. g.*, by Schirmer (209).

Antipyrin. Wicherkiewiez (210) claims that this drug produces an amblyopia similar to that of sodic salicylat. Guttman (211) observed in a debilitated woman, 25 years of age, a complete though evanescent blindness, which came on after a dose of 15 grains.

Nitrobenzol. Another case described by Nieden (212), should be added to Litten's (55) report. A workman in a "roburite" factory suffered for two weeks from general poisoning, difficult respiration, cardiac palpitation, vertigo, nausea, weak pulse, etc., before the eye symptoms set in. These were failing sight (the visual acuity being reduced in either eye to $\frac{1}{20}$) and gradual but marked contraction of the F. of V. After an interval of four weeks improvement set in. The ophthalmoscope showed a decided hyperemia of the veins with (in one eye) a large retinal hemorrhage.

Sulphonal. Two histories are of interest. Knaggs (213) publishes the earlier case in which, in addition to general anesthesia, loss of sensation in the conjunctiva was noticed. Dillingham (214) reports a case of intoxication where a temporary ptosis lasting two weeks, formed a principal symptom of the poisoning.

Chrysophanic Acid. A. Trousseau (215) has recorded a case where alleged eye symptoms followed the application to the skin of a 10 per cent ointment. The inunction produced an acute hyperemia of the conjunction that disappeared in a few hours. This, the writer found, differed entirely from the conjunctivitis caused by the direct application of the ointment to the conjunctiva itself, the latter affection persisting for eight days.

Saponin. So far as I know there is on record but one case of intoxication from this agent, (a white, inodorous, sweetish-acid, glucoside, derived from *saponaria officinalis*) where a claim of eye symptoms has been set up. These followed the use of the drug upon the person of Fr. Keppler (216) who was at the time experimenting with saponin for the purpose of determining its value as a local anesthetic, and consisted of very severe pains, strabismus and exopthalmus of his left eye.

Esculus Hippocastanum, Horse Chestnut. *Esculin*, a white, bitter, crystalline glucoside, obtained from the bark; dose, 15 grs. in malaria.

Salomon (217) describes the eye symptoms produced in a boy, 3 1/2 years of age, from eating the green rind of the fruit. They resemble those of atropia poisoning—widely dilated pupils, staring vision, scarlet face, bounding pulse, etc.

Podophyllum. Chemists' assistants, who grind certain irritant drugs, are prone to acquire conjuctival hyperemia, as well as acute inflammation and even corneal ulcers, unless the eyes are protected by a mask from the dust. Such is the case with podophyllum, as with many others that it is not within the province of this study to mention. For example, Dr. Cheatham, of Louisville, informs me that in preparing *jequirity* powder, which he uses extensively, he has known the irritating dust set up the most violent and serious inflammation of the anterior portion of the eye, threatening the destruction of the whole organ.

Helleborein. This alkaloid belongs to a rather large class, of which cocain is the chief representative, the local anesthetics.

Erythrophlaein, (from *E. judiciale*); "*haya poison*," (from E. guineense); apomorphin; alpha kava resin (from *piper methysticum*) and "toad poison" (27) also produce anesthesia of the cornea and conjunction, but, owing to the pain and inflammation they produce, are not employed in surgery,

Hydrocyanic Acid and other Cyanids. Either the eye signs of poisoning from the cyanids are various and inconstant or else the amblyopia assumed to follow this form of intoxication is partly or wholly due in the three published cases to other causes. The symptoms of each differ from those of the other two and they represent every case I could find in literature. H. de Tatham (218) reports, as the result of exposure to the vapor of dilute hydrocyanic acid, a temporary hemianopia, that disappeared in a few hours. G. F. Souwers (219), in a photographer poisoned by potassic cyanid, remarks swelling of the upper lids and sluggish pupils. Müller-Warneck (220) saw completely dilated pupils, with absent irritation reflex and proptosis, in a case of intoxication from cyanid of potassium; the patient recovered.

Spt. Etheris Nitrosi. Hill (221), while describing a case of acute poisoning from 3 ounces, in a boy 3 years of age, mentions dilatation and immobility of the pupils. The post mortem examination showed highly congested cerebral veins.

The following list of drugs and poisons receive briefer mention, either because the original article describing the toxic amblyopia in question is not accessible to me, or because the eye symptom or symptoms have a doubtful connection with the intoxication, or because the alleged amblyopia is the only recorded instance of the untoward effect of the agent upon the eye or is the result of physiological experiments upon the lower animals only. I do not doubt, however, that a number of the cases are genuine examples of toxic amblyopia.

Nitroglycerin; ophthalmoplegia as a late sympton, Nieden.[1]

Chromic acid; a 5 per cent solution applied as a remedy for perspiring feet has produced temporary *yellow vision.*

Hydracetin; in one eye small retinal hemorrhages, attributed by Grünthal (222) to inunction of salve containing the drug; the urine contained much albumen.

Antifebrin; Simpson[2] reports contracted and motionless pupils after 105 grains in two and a half hours.

Curare poisoning also produces, as a late ocular symptom, miosis.

Marsh gas, "choke damp," believed by Von Reuss (223) to be the cause of "miners' nystagmus."

Oxalic acid; Koch (224) experiments on rabbits; mydriasis at first, followed by contraction of pupils.

Menthol; Charrin and Rogers' experiments (225) on rabbits ($^5/_7$ gram. caused death in five to ten minutes) showed post mortem opacities in the lens.

Coniine, from *conium maculatum;* inhalations of solution caused [H. Schulz (226)] lachrymation, burning of conjunctiva and inability to hold the lids open.

Gelsemium sempervirens, according to Ringer, causes contraction of the pupil taken internally, but mydriasis when applied locally.

Cytisin, from *cytisus laburnum.* Albutt records dilated pupils, pallor of the nerve and small retinal vessels.

Creolin; three cases of "black vision" by Bitter (227).

Resorcin; Hirschberg (228), *conjunctivitis* after application of ointment to the face.

Ether petrolei; case reported by Leidy (229) of bilateral mydriasis, motionless pupils and nystagmus followed by recovery.

Nitrous oxide; an additional observation of Bordier (230), a temporary though very marked *miosis* an hour after the extraction of a tooth.

Toluylendiamine; Stadelmann (231), intense yellow discoloration of sclera in animals.

Strychnia poisoning rarely produces eye symptoms, except possibly dilated pupils and engorged retinal vessels during the convulsions.

Sulphur ointment, (vaseline 100, wax 5, sulphur 10); applied for eighteen years, said by Eichbaum (232) to have produced, with other symptoms, an amblyopia of the atropine type.

---

[1] Quoted by E. Berger, *loco cit.*, p. 408.

[2] Knies, *loco cit.*, p. 345.

Piscidium; from the extract, *mydriasis*, Seifert (233).

Bromoform; pupils dilated *ad maximum* and unaffected by light, Sachs (234).

Salicyl; Rosenberg (235) reports *exanthema bullosum* affecting the anterior parts of the eye.

Oil of anise; Cadiac and Menuier (236), locally, conjunctivitis and keratitis; internally, lachrymation.

Leucomaines of hydrophobia; Penzoldt (237), severe pains in eye from infection of conjunctiva.

PATHOLOGY AND TREATMENT OF THE MOST IMPORTANT OF THE TOXIC AMBLYOPIAS.

Tobacco—Alcohol.. The discovery was made in 1882 by Samelsohn (238), of Cologne, from an examination of the optic nerve of an amblyopic patient and confirmed in the same way by Lawford and Edmunds (239), Nettleship and Edmunds (240), Uhthoff, Sachs (241) and others, that the essential lesion in this disease is an axial interstitial neuritis, beginning somewhere betweeen the papilla and the brain and probably extending thence towards both the center and the periphery. As was suspected by the earlier authorities it is the fibers that supply the macular region (one-fourth or one-third of the whole) that are affected: the others generally escape. Although such a conclusion might with almost perfect certainty be prophesied from the fact that central negative scotomata are nearly always constant factors in the disease, yet the confirmatory evidence of autopsies was needed. From these post-mortem observations (thirteen to the date of writing) we may conclude that the fibers supplying the fovea centralis and surrounding macular region, when they appear at the papilla, form a wedge-shaped sectar and lie on the temporal side of the optic disc.[1] After reading the descriptions of the various autopsies referred to, which are given with elaborate preciseness by the various writers, one is forced to the conclusion that the course of the papillo-macular fibers is not an invariable one in every individual, Nor do I think it likely, from what we know of the variations in size of the negative scotomata, that the nervous degeneration is strictly limited to this or that particular bundle supplied to the macular region. In Uhthoff's work, reproductions of the microscopical sections are given showing the relation of the

[1] For example, see Paul Bunge's *Ueber Gesichtsfeld und Faserverlauf im optischen Leitungsapparat*, Halle, 1884, and H. Wilbrand's *Die hemianopischen Gesichtsformen und das optische Wahrnehmungscentrum*, Wiesbaden, 1890, both with beautifully colored plates and diagrams.

diseased (papillo-macular) bundles to the healthy nerve fibers in their course from the tractus opticus to the disc. This course corresponds very closely to that found by Uhthoff in a case of absolute central scotoma, the result of tabes dorsalis.

As to the *form of the neuritis* it must be remembered that the axis cylinder and the true nervous elements of the opticus escape; the resulting atrophy of them is a simple and not a numerical one. Indeed, one of the strongest arguments that is urged in favor of an alcoholic origin for many of these cases of central amblyopia is that we find in the optic nerve almost a typical picture of the havoc which alcohol plays in the tissues of other organs, namely, a morbid increase in the connective tissue element of the organ. The trebecular fibers, increasing as to number and size, press upon the true nervous structures and cause their atrophy, just as they effect the atrophy of organic elements elsewhere.

In Stiltzing's case (242) there were marked new vascular and connective tissue formations with abundant increase of nuclei in the interstices. The meshes were diminished in size, a portion of the nerve fibers being atrophic, the nuclei present being closer together than normal, but not numerically hypertrophied.

In much the same way, allowing for differences in structure, are brought about the cirrhosed liver, the fibroid phthisis and the peripheral multiple neuritis of drunkards. If multiple peripheral degenerative neuritis occur in other nerves from alcohol, why not also in the optic nerve? Many instances might be quoted where degenerative changes in peripheral mixed nerves have occurred as a result of chronic alcohol poisoning. Lilienfeld has described a case of alcoholic paralysis of both nervi abducentes and of other peripheral nerves. Hadden found, post mortem, in a very intemperate man, 56 years of age, afflicted with alcoholic paralysis and dead of an intercurrent disease, "most advanced changes in the musculo-cutaneous nerves of the legs, wherein numerous empty and collapsed nerve tubes were seen, the granular material having disappeared."

Oppenheim (244) gives five cases of alcoholic paralysis, but none with affections of vision.

Lancereaux (245) found, post mortem, in a chronic alcoholic female, 48 years of age, with paralysis of the extremities, normal nerve centers, but lesions of the peripheral nerves. These consisted of an advanced granulo-fatty degeneration of the nerve fibers.

One of the most instructive cases yet published, where atrophy of the opticus occurred with peripheral neuritis elsewhere, is recorded by Myles Standish (246). I abstract the history, as follows:

Man. seen by writer in September, 1884, a well marked A.-T. amblyope, 52 years of age. Vision grew slowly worse, until he could barely distinguish people on the street. Finally V. = perception of light, and there was pronounced gray atrophy of the discs. He then passed through all the phases of multiple peripheral neuritis affecting the lower extremities, with pronounced mental symptoms, atrophy of leg muscles, etc. In September, 1886, he had improved so that he could walk up and down stairs. V. = $\frac{1}{10}$, but memory impaired and absent knee jerks. F. of V. nearly normal and no color scotomata. Blue-gray atrophy and small vessels.

Dr. Standish has collected forty-four cases of alcohol paralysis with reference to the eye symptoms and finds that in seven there were no fundus changes; ten had congested discs; four white discs and two had discs white on the temporal side; three had large pupils that reacted slowly to light, *i. e.*, 43-per cent, at least, had definite eye symptoms. The writer thus ends his interesting article: "the association of a multiple peripheric neuritis, the pathology of which is known, with a toxic amblyopia, the pathology of which is unknown, is particularly interesting and it does not seem improbable that the morbid processes may be identical. In both diseases the tendency of the disease is to recovery if the use of the toxic agent can be prohibited."

Sachs (247), in a recent and exhaustive study of this whole subject, emphasizes the resemblance, first pointed out by Samelsohn, between the ravages produced in the optic nerve by poisons of Class 1, Div. 1, and those changes that mark the cirrhotic liver. "In both diseases," says he, "the process affects the interstitial connective tissue and in both the essential tissues of the organ (nerve fibers and hepatic cells) suffer secondarily from pressure upon them. The analogy may, I think, be carried still farther. The areolar hyperplasia and cellular infiltration, characteristic of interstitial hepatitis, do not bear any constant relation to one another and are not dependent upon one another. In the same way, as shown in the microscopical examination of my patient's optic nerves, the areolar hypertrophy and the cell proliferation appear to be entirely independent of each other, the latter being generally conspicuous by its absence. Nor do I believe that a widespread cellular infiltration could have preceded the connective tissue hypertrophy without showing unmistakable evidence of its

existence, when one recollects that the optic nerve disease lasted until the death of the patient, only a year and a quarter.

The remarkable increase in the number of the neuroglia cells within the diseased bundles is also noticed by Samelsohn. If one accepts the latest theory of the epithelial origin of the neuroglia[1] it would not be improper to compare this process with the commonly observed proliferation of epithelium within the bile ducts. At any rate one effect of this tissue change is to compress and injure the nerve fiber bundles themselves.

The parallel between hepatic cirrhosis and neuritis interstitialis is still more striking when the vascular changes in our case are noted. These frequently occur in the first mentioned affection and consist of endothelial proliferation resulting in thrombotic closure of some vessels, occuring side by side with new vascular formations."

Sachs believes that the process, in his case at least, began not simply in the usual situation (the distal part of the nerve near the chiasma) but as a proliferating endophlebitis of the *vena centralis postica*, occasioning its obliteration and the formation of new capillary blood vessels in its neighborhood.

He thinks, with the English school, that in the mixed cases alcohol merely predisposes to the amblyopia by producing dyspepsia—in the form, usually, of a chronic gastric catarrh—and so interfering not only with the digestion but also with the assimilation of the food. He further believes that the normal gastric juices, undergoing secondary changes of the fatty acid variety, form complex chemical combinations with the nicotine which are either more readily absorbed into the system or are with greater difficulty eliminated from it. The evidence of such abnormal changes occurring in the stomach he finds in the *acetone odor* with which the breath of patients is laden and compares the condition to that of diabetic-tobacco amblyopes whose urine contains butyric acid. In answer to the argument in favor of alcohol as against tobacco (in bringing about the optic neuritis of toxic amblyopia) that while the former is known to produce changes (peripheral neuritis, atrophy, paralysis, etc.,) in other portions of the nervous system these effects have never been shown to result from the abuse of tobacco, Sachs adduces the clinical evidence, the rarity of pure alcoholic amblyopia and the fact that the changes in the nervous system set up by alcohol elsewhere are unlike those found in the

[1] Edinger. Zwölf Vorlesungen ueber den Bau der Nervösen Centralorgane, 1892, p. 31.

optic nerve in the mixed cases. When the ocular apparatus is affected in pure alcoholics the *eye muscles*, *i. e.*, their nerve supply, and not the optic nerve are most likely to suffer.

Horner (248) goes still further. He is convinced that neither alcohol nor tobacco, *as such*, produces the pathological changes in the opticus. They act by inducing gastric catarrh and so interfere with the general nutrition as to bring about such alterations in the nerve that follow certain cases of anemia, chronic discharges, etc. However, the rarity of retrobulbar neuritis in chronic dyspepsia not associated with alcohol, as well as its infrequency in cancer, tuberculosis and similar affections form a strong argument against Horner's extreme views.

The pathology of the central (red, green—sometimes blue and white) scotomata in *diabetic* smokers and drinkers is not clearly defined. That these defects occur in the diabetes of strictly temperate patients is undoubted and the fact seems to confirm Horner's views of the causation of A.-T. amblyopia generally, since the impression remains that the central defects flow from the malnutrition attendant upon the glycosuria rather than upon a special intoxicant. This may be said with some degree of certainty: *When the central field for blue or white is affected the neuritis is of glycosuric origin* and the prognosis is grave, *i. e.*, the case usually goes on to simple atrophy. W. O. Moore's excellent paper (249) on this subject is of great interest.

On the other hand, and in view of the fact that tobacco does not produce visible organic changes in nerves elsewhere,[1] it is thought by some that the orbital neuritis of toxic amblyopia can not be due to nicotine. Hirschberg believes, at any rate, that tobacco may so affect the smaller retinal vessels supplying the macula as to produce an ischemia of that region. Berry also denies the theory of a retro-bulbar neuritis, believing that the poisonous effects of tobacco are expended on the cerebral origin of the papillo-macular fibers and postulates a common center for these in the brain. As an opportunity for an examination of the whole course of the optic nerve in toxic amblyopia rarely occurs, and since not more than two cases of pure tobacco or alcoholic amblyopia have thus far been examined, one cannot state posi-

[1] A few observers claim that it does. In an article contributed to the *Recueil d'ophtalmologie*, 1885, page 98, Jan records a case of unilateral paresis of the third nerve in a man 42 years of age, otherwise healthy, but addicted to the inordinate use of tobacco. The author argues that this can only be an instance of peripheral nicotine neuritis.

tively in what respect, if any, the lesions in the "pure" cases differ from the mixed cases referred to, or how they differ from one another. *A priori* reasoning would lead us to believe that the organic changes are practically the same in all cases of toxic amblyopia of which relative scotomata form a prominent symptom. But this certainly needs confirmation, not only in respect of tobacco and alcohol alone, but in the amblyopia due to *carbon bisulphide, cannabis indica and iodoform.*

Sachs calls the fibers that first undergo degenerative changes and from which these spread to surrounding parts the "nuclear group" ("*kern-gruppe*") as it is here that the most destructive and best marked alterations are almost always to be found. These proceed until the papillo-macular bundles are affected; but the morbid process does not reach such a high degree in the latter, and thus it is easy to understand why an absolute defect is never found centrally and why the disease in this region is usually reparable. The alterations do not affect the nerve fibers themselves but merely the areolar septa, in the form of hyperemia and edema, so that the *true nervous tissue enclosed by the former are merely temporarily injured.* Thus the curability of a recent amblyopia may be looked for with certainty.

Regarding the anatomical explanation of that important ophthalmoscopic sign in tobacco-alcohol amblyopia, decoloration of the temporal half of the papilla, I quote further from Sachs (*q. v.*): "the physical explanation of this condition has not hitherto been sufficiently dwelt upon. Gowers considers it as due to a disappearance (atrophy) of the capillary vessels and a reduction of the red element in the normal color of the disc.

"Of more importance and easier of demonstration is the influence of the atrophy on the coloration of the papilla. The contraction of the areolar spaces of the lamina cribrosa and the marked aggregation of their trabeculæ, in consequence of a diminution in size of the nerve bundles that pass between them, must increase the quantity of light reflected from the anterior surface of the lamina itself. Moreover the thinning of the *overlying* nervous layer contributes largely to the same result. This phenomenon is really a 'contrast' effect, the remaining area of the papilla being either of the normal reddish color or made still redder by a hyperemic condition often present.

"The histological changes seen in sections of the nerve trunk, on both sides of the point of entrance of the retinal vessels, differ from those found in the latter region in that in the former the

hypertrophied connective tissue is unaccompanied by cell proliferation, while at the vascular entrance the alterations present inflammatory changes within some of the bundles and about some of the vessels."

The correspondence of the temporal triangular wedge to the papillo-macular bundles of fibers is beautifully confirmed in a case reported by Knapp (250) where, in an absolutely temperate girl, 18 years of age, *a coloboma of the macula lutea*, with the usual opticus sector plainly atrophied, was discovered by the ophthalmoscope.

PROPHYLAXIS AND HYGIENE.

It is proper here to say a few words about prophylactic treatment, although the precautionary measures desirable in the case of persons exposed to the deleterious action of the toxic agents we have been considering, will appeal to the common sense of every medical man.

It need hardly be urged that a well informed practitioner should remember how large a number of the commoner drugs which he is called upon to use in daily practice, may, in some patients and under certain conditions, be hurtful to the eye, or may interfere with its function, and that he should not neglect these danger signals of disease when they display themselves and so diminish the dose or entirely stop the remedy.

Other precautions suggest themselves. It has been noticed, for instance, that most cases of carbon disulphid amblyopia occur during those seasons of the year when windows and doors are shut and ventilation is imperfect. It is imperative, therefore, that in rubber or other factories, where this agent is employed, the strictest attention should always be given to devices for carrying off the volatile fumes and for their dilution with an abundant supply of fresh air.

One of Delpech's patients (251) designed the following apparatus for avoiding inhalation of carbon disulphid fumes: "In a chamber which can be freely ventilated through its two extremities, a horizontal board is fixed to the sides by its two ends; from its anterior edge a board descends to the floor of the chamber; from its posterior rises a vertical plank, fourteen inches high; this is pierced by three pairs of apertures so arranged as conveniently to give passage to the hands and forearms of three workmen. From the upper border of this vertical plank a sheet of glass passes upwards and forward, and allows the

workers to see their hands. The closure of the chamber is completed anteriorly, so that the only communication between it and the remainder of the room is through the six circular apertures. These are protected by impermeable and supple india rubber, which fits closely to the wrists of the workers by means of bracelets. The workmen sit with their legs beneath the horizontal table. All the operations are carried on within the chamber. It is stated that no odor was perceptible, and that although the operations were slightly retarded they were not so to any inconvenient extent."

Workers in *white lead* manufactories should be especially careful to keep their hands and finger nails clean and free from the poison, and when engaged in dry mixing should wear respirators. According to Berger, in the large lead works of Ivry, near Paris, ideally conducted from a hygienic standpoint, the workmen never suffer from symptoms of saturnism.

Under the heading "Prevention of Industrial Lead Poisoning," the *British Medical Journal* (II, 1893, page 1345) has the following:

The Departmental Committee, appointed by Mr. Asquith to inquire into the white lead and allied industries, and to suggest any precautions necessary for the protection of life and health, has presented its report. The greatest change recommended is the exclusion of females from all direct contact with white lead. In some works this is already done, and it is believed that the total number of women who would be displaced if this recommendation was carried out would not exceed 600. Further, they recommend that no female under 20 should be employed in white lead works; that before employment women[1] should be submitted to medical examination, and that in both sexes a medical certificate should be required after absence through illness before return to work. They recommend that women should be required to wear overalls and head-coverings, and special shoes and stockings, while engaged in certain parts of the works. With regard to the enameling of iron plates, the recommendations are very similar; and it is proposed that in color works, also, the employment of females and male "young persons" should be prohibited, and that in lead smelting these two classes should not be permitted to clean the flues; further, that nobody should be allowed to work in the flues for more than two hours at a time, nor leave afterwards before taking a bath. The provision of special lavatory accommodation is advised in color works, lead smelting, yellow lead, electric accumulator, turning and enamelling of iron hollow ware, and red and orange lead works, and in the last it is recommended that all persons employed should be submitted to a weekly medical

[1] T. Oliver (Gulstonian Lectures, 1891, I.) found that women exhibit a greater susceptibility to lead poison than men. Of 135 cases noted by him in the Newcastle Infirmary 91 were women and 44 men. C. A. W.

inspection. In the case of white lead and the enamelling of iron plates and hollow ware, the provision of a dining room is recommended. The report contains a large number of proposed regulations directed to prevent poisoning through dust or by want of personal cleanliness, specially adapted to the needs of each industry, and it is proposed that the usage which obtains in the case of accidents—a compulsory report to her Majesty's Inspector of Factories and the certifying surgeon of the district —should be extended to cases of lead poisoning.

If in popular works on personal hygiene, as well as in lectures and essays prepared by members of the profession for the guidance and enlightenment of the laity, certain facts connected with the loss of vision sometimes produced by indulgence in tobacco and alcohol were set forth (without the exaggeration which sometimes characterizes the statements of prohibition and teetotal enthusiasts) it would at least serve as a warning to smokers and drinkers to cease or to moderate the, to them, abuse of these stimulants. The medical man should warn patients (those over thirty years of age particularly), with dyspepsia or other diseases affecting nutrition, that their smoking and drinking are very likely to lead to loss of vision through disease of the optic nerve.

The assertion frequently made by me, that obscure ocular symptoms or a transient amblyopia often accompany the medicinal employment of our common drugs—quinin, salicylic acid, iodoform, cannabis indica, etc.—and the daily use of tobacco, alcohol, tea, coffee and chocolate, is worth bearing in mind as explanatory of occasional attacks of weakened sight.

It is not intended to discuss, except very generally, the treatment of those concomitant troubles which so often afflict toxic amblyopes unless they have a direct bearing upon the visual failure. It need hardly be said that all the toxic symptoms should be treated together.

Whatever be the form of poison that has caused the amblyopia, it should at once be discontinued. To this general rule there are, however, some exceptions. When the physician discovers that his patient does not entirely abstain from the deleterious agent he must be content with regulating its amount and time of indulgence; and he will often better accomplish this by allowing him to take a definite quantity than by attempting to force him to go without it altogether. Hutchinson and others do not restrict the amblyope in the matter of beer or wine, if taken in moderation, but sternly forbid the use of all forms of tobacco. On the other hand, Minor finds his patients make excellent progress toward recovery when no embargo is laid upon their smoking or chewing. The obser-

vation that total abstinence is not a necessary factor in treatment has been made by many observers. Hill Griffiths, for example, as well as Lawford and Nettleship refer to it. Still, one can not help believing that in such cases the patient *recovers in spite of the poison and not in consequence of it*, and so convinced am I, from observation of the behavior of patients treated with and without a continuance of the intoxicant, that a quicker cure is reached in cases of entire abstinence that I consider it desirable to impress the patient with the idea that the length of time necessary for a cure will to a large degree depend upon the extent to which he indulges in his old habits. If, however, it is considered desirable to allow the patient to continue his tobacco or alcohol or both, he should be given moderate quantities of beer or light wine, taken only after meals, and he should smoke (not chew) a small quantity of mild tobacco, or one cigar, daily, and always after eating.

Next to abstinence from the evident cause of the disease is the recovery of the systemic tone which is nearly always lost in toxic amblyopia of the first class. So far as possible a return should be made to a normal condition of health. The regulation of the bowels, attention to kind of food, care in personal habits, etc., are of great importance. *The digestive power is frequently weak and should be fortified by appropriate means.* Gastric catarrh or other form of dyspepsia is almost always present. Bitter infusions and tonics are nearly always of value, indeed, it is probable that, to the tonic effects of certain specifics used in this disease, most of their value is due. Out-door exercise will be useful to those of sedentary occupations. The use of Turkish baths has been highly recommended, and in alcoholic cases especially has a decided value. In these various ways a much needed supply of good blood is carried to the badly nourished optic nerve tissue.

Coming to the so-called specific remedies, preparations of *nux vomica, strychnia particularly*, are very useful, especially in pallor of the disc and when general toxic (nervous) symptoms are present. Decidedly the most effective method of exhibiting strychnia is by hypodermic injection, beginning with a small dose, say gr. $\frac{1}{50}$ once daily, and gradually increasing it until dryness of the mouth, stiffness of the muscles of the jaw and jerking of the extremities are produced. My practice is to order a fresh one per cent solution (for easy determination of the dose) of the sulphat or nitrate, and, using the same medicine dropper to insure uniformity in the size of the drops, inject the solution once a day, gradually increasing the dose by one or two drops until no further

increase is tolerated. I then diminish the dose one drop ($\frac{1}{100}$ gr.) daily until no reaction is produced, and thenceforth continue that quantity. In conjunction with the injection I prescribe tonic doses of tinct. nucis vom. or liq. strychnia, combined or not with iron or quinin, before meals.

Iodid of potassium is another useful remedy and to be given, like strychnia, in gradually increasing doses. When there is hyperemia of the disc or signs of odema this drug is to be preferred to nux vomica preparations.

On account of the temporary improvement induced by inhalations of *amyl mitrite*, that drug has been recommended by several observers, Deutschmann especially, but although I have frequently tried it, I do not believe that it produces any permanently useful effects.

Coursserant (252), de Wecker and others advise hypodermic injections of pilocarpin in tobacco-alcohol amblyopia.

The tonic effects of electricity should not be forgotten, and I believe its use is attended with benefit in almost all cases of central amblyopia, although I know very little of its *modus operandi*. The interrupted galvanic current, in doses of from one to five milliamperes should be employed, the negative electrode to the eye and the positive to the nape of the neck, for a few minutes daily.

Potassic bromid was employed twenty years ago in the treatment of the amblyopia from alcohol, probably on account of its beneficial effect in other manifestations of alcoholism. See, for example, the papers of Bull (253), and L. Turnbull (254), the latter claiming priority over Quaglino (255) in the use of this remedy. The Italian ophthalmologist not only shows that he had used the bromid several months before Turnbull, but credits MacNamara and Galezowski with its recommendation at a still earlier date. He prescribed it in doses of 1 grm. to be gradually increased until as much as 8, 10 or 12 grms. daily are taken. The Italian medical journals from 1871 to 1880, and even later, contain enthusiastic references to the value of potassium bromid in amblyopia ex abusu. The papers of Fumigalli (256) and Simi (257) are of especial interest.

Quinia sulphat has also had its advocates, but it is not likely that it has a specific action, but produces its good effect indirectly, as a general tonic. Ponti (258) employed it in 1873 and claimed for it special advantages.

I have already spoken of the use of hypodermic injections of

pilocarpin in alcohol-tobacco amblyopia. Coursserant asserts that immediate relief (*vide ante*) is given, that the cure is rapid and in every way satisfactory. He considers it especially valuable for poor people, who need their eyesight sooner than their more affluent neighbors! He presents a list of twenty-three cases, all treated by this means, with the addition of abstinence, tonics, the use of tinted glasses and, sometimes, hydrotherapy. He claims that cures were made in from nine to forty-five days.

I have myself had some experience with pilocarpin injections in such instances and think highly of them. I believe that where one can have his patient under proper control, especially in a hospital, these injections, given daily, beginning with $^1/_8$ gr. and increasing the dose if necessary to produce marked salivation, are of signal advantage and do cut short the time of treatment. Of course the dose, the interval between the sub-cutaneous medications, as well as other details of treatment, must be varied to suit the individual case. As a rule I give them early in the morning with the following remedial adjuncts: the patient does not rise for breakfast, but takes instead of that meal copious drinks of hot and weak lemonade *after* the injection. He is then wrapped in blankets, with hot bottles to his feet and allowed to sweat thoroughly for half an hour. The hot bottles and all but one blanket are now removed for another half hour. Then he is rubbed down, allowed to dress and takes a light breakfast. In the afternoon, after lunch, he may go about as usual. I would strongly advise those who have not tried this plan to make the experiment in suitable cases.

Arsenic. According to Osler (259) peripheral multiple neuritis is occasionally a result of arsenical poisoning, the symptoms of which closely resemble those due to chronic alcoholism. The remarks made regarding the relation of these nerve changes in the case of alcohol probably also apply to the nervous lesions produced by arsenic. Having them in view one may regard the retinitis and its attendant vitreous disease, seen in Hutchinson's case (49), as an arsenical neuritis of the peripheral variety. Probably, also, the nystagmus observed by Krehl (123) was due to the same cause—a neuritis of the external ocular muscle supply —that Uhthoff assigned to this symptom in his case of alcohol amblyopia.

Aside from Liebrecht's case (50), Dana (121) and H. Derby (122) have abundantly proved the production of optic neuritis by this poison. The former thus concludes his elaborate researches: "1. A disease resembling tabes may be caused by arsenic taken

medicinally or otherwise. 2. The arsenical paralyses are due to a multiple neuritis. 3. Arsenical paralyses, like those of diphtheria, alcohol and lead, are of two types, (*a*) the ordinary mixed motor and sensory paralyses, and (*b*) the pseudo-tabetic form." In other words the optic neuritis due to arsenic is (or may be) part of a multiple neuritis or it may take on the retro-bulbar form or present the usual picture of an optic neuritis.

Carbon Disulphid. Where this agent is employed in conjunction with the *chlorid of sulphur* in vulcanizing, it is the former that occasions the retro-bulbar and simple optic neuritis, which are the characteristic ocular lesions of the intoxication. Decided changes are found at the papillary region. In the earlier stages these are haziness of the disc and other signs of a chronic papillitis, but later on pallor and atrophy appear. Central defects in the visual field are almost always found when sought for at the onset of the ocular symptoms. Indeed we may regard the early changes as almost invariably those of a retro-bulbar neuritis gradually deepening into a true simple atrophy, unless the patient is removed from the malign influence of the poison and promptly treated.

Becker (260) remarks that the oval scotomata in his case lay more above than below, as in alcohol-tobacco amblyopia, and believes the whole process to be probably a retro-bulbar neuritis affecting the macular fibers, the color sense being more disturbed than the form sense.

Treatment. Improvement begins as soon as the patient is removed from the influence of the poison. Many of the cases included in the report of the committee appointed by the Ophthalmological Society of the United Kingdom were treated by phosphorus. Recovery from most of the symptoms — the anaphrodisia and weakness of the legs being very intractable— occurred after several months. Hirschberg (261) treated his two patients with potassic iodid combined with a course of sweating. Becker gave the iodid with iron, and, later, *ext. nucis vom.* internally, followed by strychnia injections. Lavigerie (262) claims good results from the use of potassic iodid and strychnia. Gallemaerts' (115) case—a well marked example of retro-bulbar neuritis—was treated with quinin and strychnia and improved greatly.

Cocain. The acute cases call for powerful stimulants, especially amyl nitrite inhalations, ether injections and electricity.

Golowkow (263) reports the following case:

A patient, for toothache, was given two hypodermic injections (a Pravaz syringeful each time) of a two per cent solution of cocain muriat at an interval of ninety minutes. Five minutes afterwards there was noticed dilatation of pupil, extreme pallor, small pulse, rigors, and great difficulty of breathing. In ten minutes the pulse was 200 and dicrotic, respirations 60, pains in back and cardiac region, fear of death, convulsions of extremities. Inhalations of strong *liquor ammoniac* and its internal administration (4 to 5 drops every five minutes) caused in half an hour a decided diminution of the symptoms.

Ergot. The permanent cataract as well as the temporary amblyopia are both probably due to the cutting off of the nutrient supply to the retinal vessels, to the optic nerve, and to the ciliary vessels supplying the lens. Knies thinks that the general convulsive seizures of ergotism may have something to do with the production of raphanic cataract just as it is probably the cause of lamellar cataract in rachitic children. This is also the opinion of Talko, who does not think it due to the action of the ergot. Meier (143) also believes that the ergotism acts through the medium of the ciliary nerves and that these in their turn bring about a contraction of the vessels, shutting off the nutritive supply to the lens.

Iodoform. This is unquestionably a drug that like tobacco and alcohol produces a retro-bulbar neuritis, and although no autopsy was made in any of the cases reported, all the symptoms point to changes in the nerve closely resembling those found in other members of the same group. Priestly Smith gave his patient at first hypodermic injections of strychnia and, later on, the same remedy, combined with iron, by the mouth. Hutchinson's case was treated with hypodermic injections of strychnia (gr. $^1/_{10}$) daily. In a fourth case reported by Valude (264) the symptoms were such as might have followed the suppuration, diarrhea and hectic fever, that are sometimes set up by extensive burns. The patient was a boy, 12 years of age; the burn extended over the lower part of the right side of his body, and was at first treated with iodoform, and shortly afterward the patient became totally blind. Eleven months subsequently to that, V., R. = fingers at 10 cm.; V., L. = fingers at 20 cm. The discs became white and atrophic, color perception was lost, but the retinal vessels were not contracted.

Lead. Unfortunately there are very few autopsies recorded. In Atkinson's case no changes in the ocular apparatus are mentioned. The various manifestations of lead amblyopia probably correspond with very different morbid alterations in the tissues of the eye. In

the mild forms, where there are no ophthalmoscopic appearances, one can but guess at the probable organic lesion. Gowers (265) thinks that the transient amblyopia is caused by the effect of lead on the nerve centers, as in uremia and diabetes. Gunsberg (129) who publishes a case of transitory amblyopia due to lead poisoning, would class it among the uremiæ. He considers that the kidney affection is caused by the plumbism, which in its turn brings about a temporary disturbance of vision. Weber (266) thinks that the amaurosis is not due to kidney disease, but is a brain symptom. He explains the temporary amblyopia by regarding it as the result of arterial spasm and the over filling of the veins—such a condition as is present in an attack of lead colic. These symptoms occur in a person but a short time exposed to the poison.

Long-standing cases of white atrophy, as well as those that show acute inflammatory neuritis (papillitis) with retinal hemorrhages are the result of nervous irritation set up by the circulation of lead salts in the system. So far as we know, the histological changes are those that accompany these diseases when due to other causes, such as diabetes, albuminuria and brain tumors. As we may have retinitis when no kidney disease is present, and optic atrophy without decided spinal or cerebral symptoms, it is not proper to regard the latter as only indirectly dependent upon the circulation of plumbic salts in the system. When two or more possible causes of the ocular affections co-exist in the same patient, their pathology is to that extent obscured. The local appearances of most examples of albuminuric and diabetic retinitis are, however, so pathogmononic and so different from the inflammatory fundus-changes seen in lead amblyopia that the question of causation does not often arise. The possible coincidence of brain tumor with lead amaurosis must also be borne in mind.

As the actual method of causation of any of these morbid states is still *sub judice*, it is idle to speculate about their origin in the comparatively rare instances furnished by lead poisoning.

Parisotti and Molotti (267) observed a case of optic nerve atrophy which after careful examination by the ophthalmoscope, they concluded was the result of an *endarteritis saturnina obliterans*. The ocular muscular pareses are undoubtedly the result (as in the paralysis of the forearm extensors) of a peripheral neuritis. The third nerve is affected in precisely the same way, although not so frequently, as the muscular branches of the musculo-spiral and posterior interosseous.

Many theories have been advanced respecting the essential structural changes in the various manifestations of chronic lead poisoning. Whatever secondary alterations may occur it is probable that the process *begins* (Oeller, Kussmaul, Meyer) in the terminal vessels as a fatty metamorphosis or arterio-sclerosis (obliterating peri or endarteritis). Later on, the nervous, muscular and other tissues supplied by these nutrient vessels may be converted into fat, fibrous tissue or the hyaline substance. As before mentioned, these changes, when they occur in the retina, may, during life, be studied ophthalmoscopically.

The following five cases reported by Landesberg (125) will serve to show the results of *treatment* in cases of lead amblyopia.

Case 1. Patient 40 years of age; worked fifteen years in plumber's shop. Had several times suffered from general attacks of lead poisoning. Atrophy of both papillæ. V., R. $= \frac{10}{200}$; V., L. = fingers at four feet. The treatment consisted of warm baths and hypodermic injections of strychnia, after which V., R. $= \frac{10}{100}$; L. unchanged.

Case 2. Lead worker 21 years of age, who handled chiefly lead oxide, besides general symptoms had paralysis of the rectus externus on R. side. Complete recovery.

Case 3. Lead worker, 34 years of age, had several attacks of general lead symptoms. R. E., complete paralysis of all branches of the oculo-motorius. Pupil slightly contracted and the accommodation normal. K. I. and diaphoretic treatment did no good, but strychnia subcutaneously brought about a complete cure.

Case 4. Lead worker, 39 years of age, had central atrophic excavation of both papillæ with great narrowing of the arteries; also commencing ataxia and interference with audition. V., R. $= \frac{20}{200}$; V., L. $= \frac{10}{200}$. Treatment did no good.

Case 5. Painter, 23 years of age, who had shortly before suffered from lead intoxication, Neuritis optica, both sides. V., R. $= \frac{20}{70}$; V., L. $= \frac{20}{40}$. K. I. with pilocarpin *sub cutem* brought about complete recovery and good vision.

Breuer (268) advises local blood letting, the artificial leech to the temples once a week, with subcutaneous injections of morphia into the temporal region.

Quinin. According to Knapp (91) the clinical features are pallor of the disc, marked diminution of retinal vessels in number and caliber, and contraction of the visual field. Buller (93) thought these symptoms to be the result of an effusion into the lymph spaces around the nerves, too transient to cause papil-

litis, but sufficient to produce edema and blanching of the retina, and to reduce the blood-carrying capacity of the central arteries. E. A. Browne (92) thinks that the nutrient fluids of the body, becoming charged with quinin (and acting through the vasomotor system) cause a contraction of the peripheral vessels and prevent the entrance of blood into the retinal arteries and veins.

Brunner (269) (and Horner) made experiments on dogs under the influence of large doses of quinin, and concludes that the disease is essentially a retinal ischemia. Ulrich (270) confirmed this finding in 1887. In the hope of being able to throw some further light upon this subject, de Schweinitz (90) produced quinin blindness in dogs by hypodermic injections—one to four grains to the pound. Ophthalmoscopic appearances before the death of the animals were much the same as that found in the human subject. Blindness was produced in from three to fourteen hours and lasted from thirty-six hours to twenty-nine days. The eyes were hardened in Mueller's fluid, cut in paraffine and stained with borax-carmine and indigo-carmine. Wiegert's staining was used for the detection of nerve changes. No gross lesion was found except in one case. Here there was decided dilatation of the blood vessels, the central vein was plugged with a clot and white thrombi filled the smaller veins. There were no alterations in the retina, and Wiegert's stain showed no nervous lesion. In every corneal section there was remarkable dilatation of the perivascular lymph spaces with degeneration of the cellular protoplasm. On the whole, de Schweinitz believes that while his experiments do not prove or disprove any of the hypotheses hitherto advanced, those who place the lesion in the optic nerve chiasma and eye-ball come nearest the truth, and that there is present in quinin amaurosis a species of temporary edema. That retinal thrombosis is not present in the human species is evidenced by the more or less rapid recovery from the disease.

The author made a second series of experiments (271) the result of which he reported to the twenty-seventh meeting of the American Ophthalmological Society. He found that the changes previously discovered can be produced by all of the various salts of quinin, and that prolongation of the quinin blindness results in a true optic atrophy sometimes associated with the production of thrombosis or embolism in the central retinal vessels. In sections made from a dog, kept completely blind for two months, the microscope showed cupping of the optic nerve entrance, complete atrophy of the optic nerve, chiasm and tracts, an organized

thrombus in the central vessels, and some degeneration of the lenticular ganglion. A very remarkable fact is the selection of the optic nerve for the influence of quinin, as careful sections of the ciliary and other cranial nerves showed absolutely normal structure.

The change in the pericellular lymph spaces, which had been found in the first research, was shown to be unconnected with any action of quinin, being purely an accidental occurrence, perhaps due to some fault in the technique. The conclusion from these experiments are: that the action of poisonous doses of quinin is undoubtedly originally due to a constriction of the peripheral vessels; that later, distinct changes, either in the blood itself or in the blood vessels, are originated, and that consequent thrombosis may occur, followed by complete atrophy and fatty degeneration of a large portion of the visual tract. These conclusions are in accord with those of Barabasheff (272) based on observation of the clinical symptoms produced by very large doses of quinin in human adults.[1]

The *treatment* of quinin amaurosis is much the same as that of tobacco amblyopia, but it, of course, must vary in accordance with the character of the fundus changes and is very unsatisfactory. Kaspar Pischl's case (273 and 101) (where the usual symptoms were present and the F. of V. for white was narrowed to three degrees) recovered under strychnia injected hypodermically so that the perimeter measurements for white were almost normal; field for colors somewhat restricted; discs still pale and vessels narrowed. Webster Fox (274) successfully treated his case—a boy, 13 years of age, whose vision after three months use of quinin, sank suddenly to $\frac{20}{200}$—with hydrobromic acid administered internally. In Peña's (275) report a 7-year old scrofulous boy had an ophthalmoplegia, loss of vision and the usual fundus changes from quinin. The treatment consisted at first, of cod liver oil, tonics and hypodermic injections of strychnia nitrate, followed, later, by the constant electric current. R. C. Prewitt (276) had a patient, boy, 5 years of

[1] A few months ago Dr. de Schweinitz wrote me, in answer to an inquiry, as follows: "I have not done anything very special in regard to the toxic amblyopias recently, but am gathering together some of my work on this topic for publication. I regret to say that my recent experiments in alcohol have been entirely negative, as I think I told you those in tobacco were, but neither of them was carried on to any great length. Those in Filix mas also turned out negatively, at least as far as I have gone. I have not examined all of my specimens as yet, and have hopes that perhaps some may show lesions."

age, who on the second day after taking four grains of quinin every two to four hours became perfectly blind. The drug was stopped, ergot and potassic bromid were administered and in a few days sight was restored. Berger (*loco cit.* p. 410) considers laudanum *plus* alcohol in large does, an antidote to quinin, and in a case reported by him (a woman, 22 years of age, blind and deaf after a single dose of 150 grains) gave these remedies, followed by strychnia hypodermically, with some improvement, although, as in a majority of such instances, the limited field and marked fundus changes persisted. Claiborne (277) has also lately added his (similar) experience of the treatment of quinin amaurosis.

Dr. de Gouvea, of Rio Janeiro, at the last meeting of the International Medical Congress, related an interesting case of quinin amaurosis (278), which he said was quite common in Brazil:

A strong farmer, 30 years of age, took 20 grms. of quinin sulphate with suicidal intent, and in spite of an emetic immediately administered, lost consciousness. On recovery he was blind and deaf. Eight months afterwards he had doubtful perception of light in both eyes, snow white papillæ and barely visible retinal vessels. Hearing improved. He was given amyl nitrite inhalations, cold douches, followed by rough towelling, and later strychnia injections in the temples. After a treatment for a month by these methods without result he was sent away with advice to continue the cold water cure. Eight months later he returned with V. of I in one eye and $^2/_3$ in the other. The visual fields are concentrically contracted; there are no marked changes in the papillæ and the retinal vessels are somewhat more visible. Tinnitus still present.

Salicylic Acid and Sodic Salicylate. Knapp (135) states that in three cases the visual disturbances after these drugs are about the same as in less severe attacks of quinin amaurosis and leave behind them no noticeable traces. The results of de Schweinitz's experiments on dogs (90) where large doses were given were entirely negative. He failed to discover anything that might lead one to suppose that the character of the lesions resembles those of quinin.

Some additional clinical evidence in favor of Knapp's suggestion regarding a similarity between the tissue alterations in the amaurosis of the salicylates and the milder forms of quinin amblyopia is furnished by such cases as Rogers' (Vol. III, p. 81 of these Annals) and the following experience of my own:

Dr. F., 23 years of age, consulted me August 13 last. His eyesight had had always been good until ten days before, when he found himself suddenly unable to read. This got worse during the following two or three days until he noticed failure of distant vision also and that his pupils

were widely dilated. He had not been taking mydriatics internally, had not used eye drops or any application to the eyes. No sore throat for months. For rheumatism, attacks of which he has occasionally, he has been in the habit of using powders of sodic salicylate. Lately he had taken in all nine or ten gramme doses, and after the last dose became quite deaf, with vertigo, buzzing noises in the ears and throbbing in the head. Last of all the ocular signs appeared. The tinnitis and other aural symptoms left, but the eye difficulties persisted. On the first day that I saw him, ten days after the eye symptoms set in, V., R. $= \frac{8}{15}$ and J. VI at 30 cm.; V., L. $= \frac{9}{10}$ and J. VIII at 30 cm. Pupils dilated, but respond sluggishly to bright light and to efforts at accommodation. With + 2 D. left, and + 1.75 right, patient can read J. I at 30 cm. There were no visible fundus changes. Under $^1/_{10}\%$ eserin ointment, patient slowly recovered normal vision for both distant and near work.

PTOMAINES. One of the active agents in fish poisoning, and, indeed, in several other forms of decomposed food that produced *mydriasis*, was found by Brieger to be *ethylenediamine*. It is a strongly alkalin base, readily forming neutral salts with acids.

Treatment is practically the same as for atropin amblyopia.

---

160. C. W. KOLLOCK. Toxic effects of small doses of duboisin. *Phil. Medical News*, No. 13, 1887.

161. ZIEM. Intoxication mit Homatropin. *Centralbl. für pkt. Augenheilkunde*, 1887, p. 236.

162. DESCHWEINITZ AND HARE. A contribution to the physiological action of the hydrobromate of homatropin. *Medical News*, 1887, p. 731.

163. HARLAN. See *Zehender's klin. Monatsbl.* for 1891, p. 189.

164. F. E. CHENEY. A case of hysterical mydriasis, paralysis of accomodation and blindness following the use of the hydrobromate of homatropin. *Boston Med. and Surg. Journal*, Jan. 23, 1890, p. 82.

165. TESTI. Una famiglia avvelanata col jusquiamo bianco. *Roccogl. medic.*, p. 201.

166. W. MCGOWAN. Pilocarpin in poisoning by belladonna. *The Lancet*, July 26, 1890.

167. LORING. Text Book of Ophthalmoscopy.

168. PICARD. Sur l'action de la morphin chez les chiens. *Comptes rendus de l'Académie des Sciences*, Tome 86, p. 144.

169. LABORDE. Action de la morphin sur la rétine dans les cas de morphinisme chronique. *Soc. de Biologie*, Jan. 13, 1877.

170. SCHREIBER. Ungewöhnliche Folgen einer akuten morphiumvergiftung, u. s. w. *Zeitschrift für klin. Med.*, xiv, 1888, 1 and 2.

171. P. HOOPER. Cases of aconite poisoning. *Phil. Med. Times*, 1883, p. 328.

172. HAAKMAR. Vergiftiging door Nijtras Aconitini. *Weckblad van het Nederl. Tijdschr. voor Geneesk*, 1880, p. 231.

173. BUSCHER. Intoxicationsfälle durch Aconitium Nitricum Gallicum, nebst Sectionsbericht. *Berlin. klin. Wochenschr.*, 1880, 337.

174. Woodburg. Brief report on a case of poisoning following the administration of a new preparation of aconite root. *Phil. Med. Times*, 1889, p. 227.
175. G. Griffith. Chloralism and alcoholism; chloral and bromid of potassium. *The Practitioner*, Feb. 8, 1879, p. 99.
176. R. Uhlrich. Ueber das Verhalten des intraocularen Drucks by Chinin und Chloral Vergiftungen. *Graefe's Arch. für Ophthalmol.*, Bd. xxxiii, 2, p. 1.
177. Cheatham. *Alabama Med. and Surg. Journal* 1887.
178. Mittendorf. *Ophthalmic Review*, Oct., 1890.
179. C. S. Coghill. Nitrite of amyl in chloral poisoning. *British Med. Journal*, June, 1879, p. 969.
180. W. K. Murphy. On the action of chloral hydrate. *The Lancet*, 1873, pp. 150-191.
181. C. Aragó. Amaurose compléte transitoire, consécutive a l'action de l'atropine et de la calabarine. *Annales d'oculistique*, 1873, p. 185.
182. F. Fuhrmann. Ein Fall von medicinaler Pilocarpinvergiftung. *Wiener med. Wochenschr.*, 1890, No. 34.
183. M. Landesberg. Zur Kentniss der Jaborandi und Pilocarpinbehandlung in Augenkrankheiten. *Zehender's klin. Monatsbl.*, 1882, p. 48.
184. Hutchinson. Review in Hirschberg's *Centralbl. für pkt. Augenh.*, 1887, p. 240.
185. H. Leloir. Recherches cliniques et expérimentales sur l'empoisonnement par l'aniline. *Gazette médicale de Paris*, 1879, p. 606.
186. Fr. Mueller. Ueber Anilin-Vergiftung. *Deutsch. med. Wochensch.*, 1887, p. 27.
187. J. K. Mackinlay. Intense pigmentation of cornea and conjunctiva. *Trans. Oph. Socy., U. K.*, 1886, p. 144.
188. H. Knapp. Ein Fall von Parese der Augenmuskeln durch Kohlenverdunstung. *Archiv. für Augenheilk.*, ix, 2, p. 229.
189. Illing. *Wien. med. Zeitschrift*, 1874, No. 23.
190. Emmert. Vereinsbericht. *Correspondbl. für schw. Aertze*, 1890, p. 42.
191. E. Becker. Ueber Nachkrankheiten der Kohlenoxydgasvergiftung, u. s. w. *Deutsche med. Wochenschr.*, July 2, 1891, p. 849.
192. C. B. Ball. Notes on a case of carbonic acid poisoning. *British Med. Journal*, 1877, p. 562.
193. H. Sattler. Ueber einen Fall von Herpes zoster ophthalmicus. *Wiener med. Wochenschr.*, 1889, No. 9.
194. Michel. Handbuch der Augenheilkunde, p. 563.
195. H. Salamonsohn. Ueber polioencephalitis acuta superior. *Deutsche med. Wochenschr.*, 1891, p. 849.
196. Georges Martin. Cécite causée par l'acide sulphurique. *Journal de méd. de Bordeaux*, 1888-9, p. 67.
197. R. Dubois. Action des Inhalations d' éthylene pur sur l'oeil. *Comptes rendus de l'acad. des Sciences*, June 28, 1889.
198. Panas. Action des Inhalations du chlorur d'éthylene pur sur l'oeil. *Archives d'ophtalmologie*, 1889, p. 77.
199. Schweig. *The Medical Record*, Dec. 20, 1876.

200. Hewkley. Fugitive Iodism. Oedema of Eyelids. *British Med. Journal*, 1888, p. 1160.
201. Lorenz. Ein eigenthümlicher Fall von Jodvergiftung. *Deutsche med. Wochensch.*, 1883, No. 45.
202. Ehrmann. *Wiener Mediz. Blaetter*, 1890, p. 44.
203. E. Niemann. Akute Chloroformvergiftung durch Trinken des Chloroforms. *Berlin klin. Wochenschr.*, No. 1, 1887.
204. H. Schlaeger. Die Veränderungen der Pupille in der Chloroformnarcose. *Centralbl. für Chirurgie*, 1877, p. 385.
205. Vogel. Ueber die Veränderungen der menschlichen Pupille bei der Chloroformnarkose.
206. Budin. *Gazette des hopitaux*, 1874, p. 910.
207. E. H. Jacob. Ether as an anesthetic. *The Lancet*, Oct., 1879.
208. F. Warner. Loss of associated movements of the eyes under chloroform and in disease. *British Med. Journal*, 1877, p. 845.
209 R. Schirmer. Netzhautablösung während der Chloroformnarkose entstanden. *Zehender's klin. Monatsbl.*, 1871, p. 246.
210. Wicherkiewiez. Quoted by Berger, *loco cit*, p. 407.
211. P. Guttman. Zwei Beobachtungen ueber Nebenwirkung des Antipyrin. *Therapeut. Monatsbl.*, June, 1887, p. 274.
212. Nieden. Ueber Amblyopie durch Nitrobenzol (Roburit) Vergiftung. *Centralbl. für pkt. Augenheilk.*, 1888, p. 193.
213. Knaggs. A fatal case of sulphonal poisoning. *British Med. Journal*, Oct., 1890, p. 955.
214. Dillingham. Poisoning by sulphonal. *The Medical Record*, Dec. 13, 1890, p. 664.
215. A. Trousseau. La conjunctivite chrysophanique. *Bulletins de la Société franc, d'oph.*, 1886, p. 292.
216. Fr. Keppler. Die acute Saponinvergiftung und die Bedeutung, etc. *Berlin. klin. Wochensch.*, 1878, Nos. 32 and 33.
217. V. Salamon. Poisonous symptoms arising from eating the green rind of the horse chestnut. *British Med. Journal*, No. 19, 1887.
218. H. de Tatham. Temporary amaurosis from exposure to the vapor of hydrocyanic acid. *British Med. Journal*, 1883, i, p. 760.
219. G. F. Sowers. Case of peculiar poisoning by cyanide of potassium. *Phila. Medical Times*, 1877, p. 345.
220. Mueller-Warneck. Ein Fall von schwerer Cyankaliumvergiftung mit Ausgang in Genesung. *Berlin. klin. Wochenschr.*, 5, 1877.
221. T. W. Hill. Poisoning from an overdose of sweet spirits of nitre, etc. *The Lancet*, Nov., 1878.
222. A. Gruenthal. Netzhautblutungen bei Hydracetin-Intoxication. *Centralbl. für pkt. Augenk.*, March, 1890, 73.
223. von Reuss. *Archiv für Augenheilkunde*, xxiii, 3, p. 252.
224. Koch. Ueber die Wirkung des Oxalsäure auf den tierischen Organismus. Inaug. Diss. Dorpat., 1879.
225. Charrin et Roger. Review in the *Centralbl. für pkt. Augenheilk.*, 1888, p. 60.
226. Hugo Schulz. Ein Fall von Coniinvergiftung. *Deutsch. med. Wochenschr.*, No. 23, 1885, p. 255.

227. H. Bitter. Das Creolin. Inaug. Dissert., Breslau, 1890. Reviewed in *Centralbl. für Gynaekologie*, p. 888, 1890.
228. Hirschberg. *Centralbl. für pkt, Augenheilk.*, Dec., 1886.
229. Joseph Leidy. A case of petroleum-ether poisoning. *Therapeutic Gazette*, 1889, p. 443.
230. Bordier. Note sur les effets narcotiques du protoxyde d'azote. *Journal de Thérapie*, 1876, 23, p. 885.
231. Stadelmann. *Archiv für experiment. Pathol. und Pharmak.*, 1882, p. 231.
232. Eichbaum. Fall von chronischer Schwefelvergiftung vermittelst Haarpomade. *Berlin. klin. Wochensch.*, 1887, p. 792.
233. O. Seiffert. Extractum Piscidiae als Hypnoticum. *Berlin. klin. Wochenschr.*, 1883, p. 450.
234. Sachs. Ein Fall von Bromoformvergiftung. *Therapeut. Monatsbl.*, Dec., 1890.
235. S. Rosenberg. Ein Fall von Exanthema bullosum nach Salicyl Gebrauch. *Deutsch. med. Wochenschr.*, No. 33, 1886.
236. Cadiac et Mennier. Contributions a l'étude physiologique de l'essence d'anis. *Lyons Médical*, 1889, p. 514.
237. Penzoldt. Beitrag zur Pathologie und Therapie der Wutkrankheit des Menschen. *Berlin. klin. Wochenschr.*, No. 3, 1882.
238. J. Samelsohn. Zur Topographie des Faserverlaufes im menschlichen Sehnerven. *Centralbl. für med. Wissenschaft*, 1880, p. 418.
239. Lawford and Edmunds. A case of axial neuritis in chronic alcoholism, with microscopic examination of the nerves. *Trans. Oph. Socy. Un. Kgdom.*, Vol. vii, p. 76.
240. Nettleship and Edmunds. See *Trans. British Oph. Socy.*, Vol. i, p. 124.
241. Sachs. Anatomisch-klinischer Beitrag zur Kentniss des Centralscotums bei Sehnervenleiden. *Archiv für Augenheilk.*, Vol. 18, p. 42.
242. Stiltzing. See Werner's abstract in the *Archives of Ophthal.*, xxiii, 2, p. 233.
243. Lilienfeld. *Centralbl. für pkt. Augenheilk.*, 1885, p. 352.
244. Oppenheim. Beiträge zur multiplen Neuritis und Alkohol-lähmung. *Zeitschr. für klin. Med.*, Vol. xi, p. 232.
245. Lanceraux. Paralysies alcooliques. *Gazette des hopitaux*, April, 21, 1883, p. 361.
246. Myles Standish. A case of alcoholic paralysis, preceded and accompanied by amblyopia, ex abusu, with remarks. *Boston Med. and Surg. Journal*, April 20, 1886.
247. Sachs. Weiterer anatomisch-klinischer Beitrag zur Kentniss des Centralscotums bei Sehnervenleiden. *Archiv. für Augenheilk.*, xxvii, pp. 154-206. Translated by Casey A. Wood for *Archives of Ophthalmology*, Oct., 1894.
248. Horner. Ueber Intoxicationsamblyopie. *Correspondbl. für schweizer Aerzte*, 1873, No. 13.
249. W. O. Moore. Diabetic affections of the eye. *New York Medical Journal*, March 31, 1888.
250. H. Knapp. Optic Orbital neuritis, including alcohol and tobacco amaurosis. *Archives of Ophthalmology*, 1891, p. 128.

251. See *Trans. Oph. Society, Un. Kingdom*, Vol. v, p. 167.
251. H. Coursserant. Du traitement et du diagnostic des amblyopies toxiques (alcoolo-nicotiennes) par les injections sous-cutanées de chlorhydrate de pilocarpine. *Bull. de la Soc. fran. d'oph.*, Tome 3, p. 266.
253. C. S. Bull. Bromid of Potassium in the treatment of amblyopia potatorum. *Am. Journal Med. Sciences*, Vol. 70, 1875, p. 129.
254. L. Turnbull. A new remedy for the treatment of amblyopia potatorum. *Phila. Med. and Surg. Reporter*, 1874, p. 484.
255. A. Quaglino. Sui vantaggiosi effetti del bromuro di potassio nella cura delle amblyopie dipendenti dall abuso dell bevande spiritose. *Annali di Ottalmologia*, iii, pp. 24–40.
256. Fumigalli. Sulla cura dell' amblyopia per abuso di bevande spiritose col bromuro di potassio. *Annali di Ottalm.*, iii, p. 201.
257. Simi. Sull' uso del bromuro di potassio nella amblyopia alcoolica. *Imparziale*, Firenze, 1876, xvi, 65.
258. F. Ponti. Il solfato di chinina contro l'amblyopia da neuro-retinite per abuso di tabacco. *Annali di Ottalmologia*, ii p. 107.
259. Wm. Osler. Principles and Practice of Medicine, p. 779.
260. F. Becker. Ein Fall von CS_2 Amblyopie. *Centralbl. für pkt. Augenheilk.*, 1889, p. 138.
261. Hirschberg. Schwefelkohlenstoffvergiftung. *Centralbl. für pkt. Augenheilk.*, 1889, p. 268.
262. Lavigerie. *Journal de méd. et Chirurgie*, May, 1889.
263. Golokow. *Sitzungsbericht der kaukas. med. Gesellschaft*, xxvi, No. 27.
264. Valude. Névrite et atrophie optiques chez un brulé atteint d'intoxication iodoformique. *Annales d'oculistique*, May, 1893, p. 378.
265. Gowers. Medical Ophthalmoscopy, p. 269.
266. G. Weber. De l'amblyopie saturnine. Thése de Paris, 1885.
267. Parisotti et Molotti. *Rec. d'ophtalmologie*, 1885, No. 9.
268. Breuer. Ueber Amblyopia saturnina. Inaug. Dissert, Bonn, 1876.
269. Brunner. Ueber Chininamaurose. Inaug. Dissert, Zurich, 1882.
270. Ulrich. *Graefe's Archiv für Ophthal.*, 1887.
271. de Schweinitz. Additional experiments to determine the lesion in quinin blindness. *Trans. Am. Oph. Socy.*, 1890, p. 466.
272. P. Barabaschew. Zur Frage von der Chininamaurose. *Archiv für Augenheilk.*, xxiii, p. 91.
273. Kaspar Pischl. Quinin-blindness. *Medical News*, July 29, 1893.
274. L. Webster Fox. Quinin-amblyopia cured by the internal administration of hydrobromic acid. *Am. Journal of Ophthalmology*, 1884, p. 115.
275. Peña. Intoxicationsamblyopie hevorgerufen durch Chinin. Reviewed in the *Centralbl. für Augenheilk.*, 1883, p. 171.
276. Prewitt. Amaurosis, a case in practice. *Miss. Valley Med. Monthly*, April 10, 1886, p. 116.
277. Claiborne. A case of quinin amaurosis, with remarks. *Am. Journal of Oph.*, Aug., 1894.
278. de Gouvea. Amaurose quinique. *Centralbl. für pkt. Augenheilk.*, Aug., 1894, p. 233.

[THE END]