TRANSACTIONS

OF THE

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VOLUME VII.

1894-1896.

HARTFORD:
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1897.

TRANSACTIONS

OF THE

AMERICAN

OPHTHALMOLOGICAL SOCIETY.

THIRTIETH ANNUAL MEETING

WASHINGTON D. C., 1894.

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OF THE

AMERICAN OPHTHALMOLOGICAL SOCIETY.

1894-95.

ACTIVE MEMBERS.

NAME.	RESIDENCE.	PLACE.
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Dr. F. B. Loring,	1420 K Street,	Washington, D. C.
Dr. F. W. Marlow,	401 Montgomery Street,	Syracuse, N. Y.
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Dr. J. S. Prout,	26 Schermerhorn Street,	Brooklyn, N. Y.

Name.	Residence.	Place.
Dr. B. Alex'r Randall,	1806 Chestnut Street,	Philadelphia, Pa.
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Dr. J. M. Ray,	414 West Chestnut Street,	Louisville, Ky.
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Dr. Stephen O. Richey,	732 17th Street,	Washington, D. C.
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Dr. Wheelock Rider,	53 South Fitzhugh Street,	Rochester, N. Y.
Dr. Frank W. Ring,	101 Park Avenue,	New York, N. Y.
Dr. Samuel D. Risley,	1722 Walnut Street,	Philadelphia, Pa.
Dr. Edmund C. Rivers,	16th and Stout Streets,	Denver City, Col.
Dr. D.B.St. John Roosa,	20 East 30th Street,	New York, N. Y.
Dr. John D. Rushmore,	129 Montague Street,	Brooklyn, N. Y.
Dr. Robert Sattler,	64 West Seventh Street,	Cincinnati, Ohio.
Dr. G. E. de Schweinitz,	1401 Locust Street,	Philadelphia, Pa.
Dr. W. W. Seeley,	S. E. cor. 4th St. & B'dway,	Cincinnati, Ohio.
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Dr. Francis P. Sprague,	229 Commonwealth Ave.,	Boston, Mass.
Dr. Myles Standish,	200 Dartmouth Street,	Boston, Mass.
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Dr. William Thomson,	1426 Walnut Street,	Philadelphia, Pa.
Dr. John Van Duyn,	111 South Salina Street,	Syracuse, N. Y.
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Dr. O. F. Wadsworth,	393 Boylston Street,	Boston, Mass.
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Dr. Jas. Wallace,	121 No. 16th Street,	Philadelphia, Pa.
Dr. David Webster,	327 Madison Avenue,	New York, N. Y.
Dr. J. E. Weeks,	154 Madison Avenue,	New York, N. Y.
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Dr. Wm. H. Wilmer,	1330 N. York Av., N. W.,	Washington, D. C.
Dr. F. M. Wilson,	317 State Street,	Bridgeport, Conn.
Dr. J. P. Worrell,	20 South Seventh Street,	Terre Haute, Ind.
Total,		124.

HONORARY MEMBER.

Dr. C. Schweigger,	Berlin, Prussia.
Whole Number,	125.

MINUTES OF THE PROCEEDINGS.

THIRTIETH ANNUAL MEETING.

ARLINGTON HOTEL,
WASHINGTON, May 30, 1894.

The Thirtieth Annual Meeting of the Society held in connection with the Third Congress of American Physicians and Surgeons at Washington, D. C., was called to order by the President, Dr. G. C. HARLAN, at 10.15 A.M. The President announced the following committees:

Committee on Bulletin — Drs. C. A. OLIVER and C. M. CULVER.

Committee on Membership — Drs. JOHN GREEN, C. S. BULL, ARTHUR MATHEWSON, SAMUEL THEOBALD, and W. H. CARMALT.

Auditing Committee — Dr. SWAN M. BURNETT.

The Committee on Bulletin reported and the following papers were read:

1. "Recent Experiences in the Operative Treatment of Detachment of the Retina," by Dr. C. S. Bull. Discussed by Drs. Theobald and de Schweinitz.

2. "Two Cases of Sympathetic Inflammation," by Dr. F. M. Wilson.

Drs. G. M. Gould of Philadelphia, Allen of Pittsburgh, Coe of Washington, Adams of Newburgh, and Reik of Baltimore, were invited to be present and participate in the discussions.

3. "Two Recent Magnet Operations," by Dr. H. Knapp. Discussed by Drs. Knapp, Lambert, Dennett, and Green.

4. "Foreign Bodies in the Orbital Cavity," by Dr. W. B. Johnson. Discussed by Drs. Knapp and Johnson.

Drs. Wright of Boston, Coleman of Augusta, and Aiken of

Savannah were invited to be present and take part in the discussions.

5. "Three Cases of Malignant Tumor of Orbit," by Dr. G. C. Harlan. Discussed by Drs. Heyl, Bull, Randall, Reeve, Johnson, Knapp, and Harlan.

Dr. Tilly of Chicago invited to be present and take part in discussion.

6. "Tumor of the Optic Nerve," by Dr. Swan M. Burnett. Discussed by Drs. Knapp, Lippincott, and Burnett.

7. "Case of Melanotic-Giant-Celled Sarcoma of Lid," by Dr. W. H. Wilmer.

8. "The Halo-Symptom in Glaucoma," by Dr. S. O. Richey.

9. "Two Cases of Glaucoma with Intra-Ocular Hemorrhages," by Dr. C. A. Oliver.

Dr. Muncaster of Washington invited to be present and take part in discussions.

10. "Additional Studies on the clinical value of repeated careful correction of Manifest Refractive Error in Plastic Iritis," by Dr. C. A. Oliver.

11. "Family History of Iridiremia and Coloboma Iridis," by Dr. D. De Beck.

12. "Unusually Large Loss of Vitreous in Extraction of Cataract," by Dr. J. A. Lippincott.

13. "Case of Ophthalmitis Suppurativa following Discission of Capsular Opacity," by Dr. S. Theobald. Discussed by Drs. Heyl and Knapp.

14. "Modification of Operation for Canthoplasty," by Dr. C. F. Clark. (By title.)

15. "Epithelioma of Lid. Excision and Transplantation of Skin without a Pedicle," by Dr. G. E. de Schweinitz. (By title.)

16. "Epithelioma Simulating Meibomian Cyst," by Dr. G. E. de Schweinitz. (By title.)

17. "Some Typical Examples of Subnormal Accommodative Power," by Dr. S. Theobald.

18. "The Ophthalmoscope does not always reveal Latent Hypertropia," by Dr. S. Theobald.

Adjourned at 2 P.M. to meet at 9 A.M., May 31st.

May 31st.

Society met in Executive Session at 9.15 A. M.

A communication from the Cosmos Club of Washington, extending the hospitalities of the club to the society, was read, and the thanks of the society returned therefor.

Treasurer's report read and referred to the Auditing Committee who reported the vouchers correct, and the report of the Treasurer was then accepted.

Voted, That the assessment for 1894 be $5.00.

A list of names proposed for membership was read and referred to the Committee on Membership for the ensuing year.

Upon recommendation of the Membership Committee, the following gentlemen were elected members: Dr. JAS. WALLACE of Philadelphia, Dr. WM. F. AIKEN of Savannah, Dr. HARRY FRIEDENWALD of Baltimore, and Dr. L. A. W. ALLEMAN of Brooklyn.

The nominating committee reported the following list of officers, who were elected:

President — Dr. G. C. HARLAN.

Vice-President — Dr. O. F. WADSWORTH.

Corresponding Secretary — Dr. J. S. PROUT.

Recording Secretary and Treasurer — Dr. S. B. ST. JOHN.

Publication Committee — Drs. W. S. DENNETT, R. H. DERBY, and S. B. ST. JOHN.

Voted, That the meeting of 1895 be at the Pequot House, New London.

Executive session adjourned at 10 A. M.

Reading of the papers resumed.

19. "So-called Muscular Asthenopia," by Dr. G. W. Hale.

20. "Practical Value of the Ophthalmometer," by Dr. Edw. Jackson.

21. "Practical Value of Low-Grade Cylinders in Asthenopia," by Dr. J. A. White.

22. "Clinical Study of the result of treatment and cor-

rection of Ametropia in the arrest of Progressive Near-Sight," by Dr. S. D. Risley.

23. "Hypermetropia and Heterotropia," by Dr. H. F. Hansell.

Drs. Ziegler, Allen, and O. Thompson of Philadelphia were invited to be present and discuss the papers.

24. "Three Cases of Strabismus with Anomalous Diplopia," by Dr. C. H. Thomas. These papers, 19–24, were discussed by Drs. Ring, Howe, Theobald, Burnett, Randall, Dennett, Lippincott, Lambert, and Risley.

25. "The Late Ophthalmoscopic Appearances of a Case of Supposed Embolism of the Central Artery of the Retina," by Dr. C. A. Oliver.

26. "Exhibition of Mires for the Ophthalmometer," by Dr. W. S. Dennett.

27. "Exhibition of a Refractometer for Retinoscopy," by Dr. W. E. Lambert. Discussed by Drs. Hay, Lambert, Randall, Thomson, and Bennett.

28. "Case of binocular Coloboma of Lens without Coloboma of Iris or Choroid and with accommodation retained," by Dr. C. F. Clark.

29. "Rupture of Lymph Sheath of a Retinal Vein," by Dr. A. G. Heyl.

30. "Colloid Disease in the Macular Region analogous in appearance to the so-called 'Drusen' in the Nerve Head," by Dr. G. E. de Schweinitz. (By title.)

31. "Case of Atrophy of Optic Nerve," by Dr. C. W. Kollock.

32. "Three Cases of so-called Ectropion Uveæ," by Dr. L. Howe.

33. "Exhibition of Water-color Sketch of Case of Embolism of Central Artery of Retina," occurring in the practice of Dr. G. C. Harlan.

34. Neuro-Paralytic Keratitis of both eyes, lasting over nine years, by Dr. P. A. Callan.

35. "Case of Entropion, probably congenital, complicated by corneal ulcers, Operation — Recovery," by Dr. J. A. Lippincott.

36. "Exhibition of a Portable Perimeter," by Dr. F. M. Wilson.

37. "Exhibition of an Artificial Eye, for Use with Ophthalmoscope," by Dr. C. A. Oliver.

38. "Exhibition of a Sterilizer," by Dr. J. A. Andrews.

39. "Concerning Monocular Diplopia, with Cases," by Dr. G. E. de Schweinitz. (By title.)

40. "Binocular Dislocation of the Crystalline Lenses," by Dr. C. F. Clark.

Adjourned,

S. B. St. JOHN,
Secretary.

Present at the Thirtieth Annual Meeting:

Dr. G. C. Harlan,
Dr. C. S. Bull,
Dr. F. B. Loring,
Dr. S. B. St. John,
Dr. G. E. de Schweinitz,
Dr. W. E. Lambert,
Dr. Ch. H. Thomas,
Dr. W. B. Johnson,
Dr. F. W. Ring,
Dr. C. F. Clark,
Dr. A. G. Heyl,
Dr. G. W. Hale,
Dr. C. W. Kollock,
Dr. N. J. Hepburn,
Dr. Jno. Green,
Dr. W. H. Carmalt,
Dr. C. M. Culver,
Dr. L. Howe,
Dr. S. M. Burnett,
Dr. S. D. Risley,
Dr. F. M. Wilson,
Dr. S. Theobald,
Dr. C. A. Oliver,
Dr. Edw. Jackson,
Dr. H. Knapp,
Dr. W. V. Marmion,
Dr. W. S. Dennett,
Dr. G. Hay,
Dr. B. A. Randall,
Dr. B. L. Millikin,
Dr. R. L. Randolph,
Dr. W. H. Wilmer,
Dr. O. F. Wadsworth,
Dr. H. F. Hansell,
Dr. J. B. Emerson,
Dr. D. De Beck,
Dr. P. A. Callan,
Dr. J. D. Rushmore,
Dr. R. A. Reeve.

RECENT EXPERIENCES IN THE TREATMENT OF DETACHED RETINA, WITH A DETAILED REPORT OF THIRTY-EIGHT CASES.

BY CHARLES STEDMAN BULL, M.D.,

OF NEW YORK CITY.

The number of cases on which these conclusions are based was thirty-eight. Of these, twenty-three were men and fifteen were women.

Their ages ranged from nineteen to seventy-four. There was one case between 10 and 20 years; there were six cases between 20 and 30 years; six cases between 30 and 40 years; seven cases between 40 and 50 years; eleven cases between 50 and 60 years; five cases between 60 and 70 years; and two cases between 70 and 80 years.

The error of refraction was simple myopia in 22 cases; simple myopic astigmatism in one case; simple hypermetropia in six cases; simple hypermetropic astigmatism in one case; compound hypermetropic astigmatism in two cases; and in six cases the refraction was emmetropic.

The detachment of the retina occurred spontaneously in 30 cases, and was due to traumatism in 8 cases.

The detachment of the retina was preceded by more or less extensive hemorrhage into the retina in 6 cases, and by hemorrhage into the vitreous in 9 cases. A more or less extensive laceration or tear in the retina was visible in six (6) cases, which allowed a distinct view of the choroid through the rent. The intra-ocular tension was found normal in 15 cases; subnormal in 20 cases; and increased in 3 cases

The lens was perfectly transparent in 15 cases, but in 8 of these cases, peripheral opacities appeared later. In 15 cases there were peripheral or nuclear opacities of the lens, or both, at the time of the first examination.

The vitreous was generally hazy in 22 cases. There were floating opacities in 17 cases, and fixed membranous opacities in 14 cases.

There was more or less marked degeneration of the choroid, with interstitial atrophy, in 22 cases. There was iritis at some time during the course of the treatment in 5 cases, and acute choroiditis in one case.

The retina subsequently became totally detached in 9 cases, either during the treatment or at a varying period after the treatment had been concluded.

The lens subsequently became entirely opaque in 19 cases.

In one case an extraction of cataract was made with iridectomy before any treatment was directed towards the relief of the detachment of the retina, and with an excellent result. The wound made in the limbus healed rapidly, the coloboma remained unobstructed, the posterior capsule did not require discission, and there was no bad effect produced on the detachment of the retina.

In one case an iridectomy upwards had previously been done, without producing an effect upon the detachment.

In one case, the eye first affected by the disease, and which had subsequently become entirely blind, was enucleated by another surgeon preparatory to treatment of the disease in the other eye, but without producing any effect upon the condition of the second eye.

All the cases were subjected to the following treatment: The patients were placed on their backs in bed, atropine was instilled in one or both eyes, according to the necessities of the case, and a bandage was applied to the affected eye, and this treatment was kept up for a period varying from three to eight weeks.

Pilocarpine hydrochlorate was injected hypodermically in daily doses in 25 cases, beginning with a minute dose and increasing it to toleration. In a number of these cases the drug produced such unpleasant or alarming symptoms that it was necessary to discontinue it. My experience has taught me that it should not be prescribed in persons suffering from functional or organic cardiac disease.

In those cases in which *pilocarpine* was not borne well, or in those where it was contra-indicated, small doses of sodium bicarbonate and potassium iodide, largely diluted, were given,

the object being to induce free action of the kidneys and bowels. Corrosive sublimate in small doses was given in the cases of iritis and choroiditis, and in all cases of extensive opacities of the vitreous.

Puncture of the *eyeball* through the sclera, into the subretinal space, was done in 19 cases, in every instance subconjunctively.

Division of membranous bands in the *vitreous* and of the detached retina, thus letting the subretinal fluid out into the vitreous chamber, was done in 7 cases.

As regards the *results* of the above *treatment*, there was a temporary improvement in the vision and the detached retina, varying from a few weeks to several years before the vision became reduced, and the detachment increased in extent, in 23 cases.

There was no improvement whatever in 11 cases.

There was an apparent permanent cure, with entire disappearance of the detachment, and restoration of useful vision in 4 cases.

There was little or no reaction following puncture of the eyeball through the sclera, or after division of the detached retina and the membranous bands in the vitreous in any of the cases. This fact I have already noticed in two papers upon "The Surgical Treatment of Membranous Opacities of the Vitreous," the first one published in the Transactions of this Society for 1888, and the second published in the Ophthalmic Review for 1890.

Conclusions. The following brief conclusions seem to be justified by the results of the treatment in the above cases:

1st. The science and practice of ophthalmology have as yet discovered no better means for dealing with detachment of the retina than the old methods which have been advised and carried out for so many years, viz.: rest on the back in bed, atropine, a bandage, and the internal administrations of some drug which may induce absorption of the subretinal fluid.

2d. The continued use of pilocarpine, either hypodermically or by the mouth, may cause great prostration, even in cases in which it is apparently well-borne; and the desired effect may

sometimes be produced by small does of bicarbonate of soda and iodide of potassium, largely diluted with water.

3d. In all recent cases, puncture of the sclera subconjunctively may do good temporarily by letting out the subretinal fluid and allowing the retina to collapse, thus producing some improvement in the vision; but the apparent improvement is generally transient, and when membranous bands exist in the vitreous, no improvement can be expected from simple puncture.

4th. Division of fixed membranous opacities in the vitreous causes but little reaction, and may do positive good, even without division of the detached retina, as it reduces the danger of extension of the detachment. It is positively contra-indicated in cases where the vitreous opacity is vascularized, as it would certainly induce free hemorrhage into the vitreous. It should never be done in an irritated or inflamed eye.

5th. Division of the detached retina, which allows the subretinal fluid to escape into the vitreous chamber, may always be done in a quiet eye, and causes little or no reaction. If membranous bands are present in the vitreous, these should also be divided at the same time.

6th. In most cases, all these operative procedures produce but temporary improvement, and in many cases no effect whatever is gained by them.

7th. There seems no good reason for any further endorsement of the method advocated by Schöler, but every reason for rejecting it from the domain of ophthalmic surgery.

CASE I. A. B., a gentleman, aged 60, was seen in the latter part of September, 1883, and was then wearing glasses of —D 8. He was a teacher, and had been obliged to use his eyes constantly, day and night. For more than a year he had noticed an increase in the size and number of the muscae, from which he had always suffered, and for some weeks he had phosphenes almost constantly in the left eye. Two days before I saw him, while correcting some manuscript, the vision in the left eye became suddenly obscured, and he had not been able to read with it since. On examination I found: R. E., 3/200, with sph. —D 8 = 18/70. No improvement by cylindrical glasses.

Vitreous hazy. Peripheral opacities in the lens. L. E., 3/200, with sph. —D 8 = 10/100 eccentrically. Vitreous hazy, with fixed punctate opacities and a fine floating membrane. Retina detached in the infero-nasal quadrant, and bulging somewhat tensely towards the vitreous. Peripheral opacities in the lens. In the fundus of both eyes was a large sclero-choroiditis posterior, completely encircling the disc and quite extensive choroidal degeneration all over the fundus. There was a small, irregular scotoma in the right eye, and in the left eye a defect in the field corresponding to the retinal detachment. The patient was a man of full habit who took no exercise, and suffered from habitual constipation. He was placed on his back in bed, atropine was instilled in both eyes, two leeches were applied to the left temple, and the left eye was bandaged. A mild laxative was ordered to insure one loose movement of the bowels daily. Pilocarpine hydrochlorate was injected hypodermically daily, but was discontinued on the fourth day, as it produced serious symptoms of cardiac failure. In its place he was given a mixture of sodium bicarbonate and potassium iodide, largely diluted, three times a day. The pilocarpine had caused profuse diaphoresis, while the soda and potash solution produced two or three loose movements daily, so that the laxative was discontinued. At the end of three weeks of this treatment the patient had become so weak that I was obliged to allow him to rise from bed, and discontinue all treatment except the atropine and bandage locally. He was given tonics and plenty of good food, and allowed to walk up and down the room. The vitreous had become very clear and the defect in the visual field smaller, but ophthalmoscopically the picture was the same as before, and the detached retina still bulged tensely towards the vitreous. After a week's restorative treatment, the eyeball was punctured in the infero-nasal quadrant close to the ciliary region, and the conjunctival wound being held apart, several drops of a yellowish fluid exuded, and the detachment collapsed. The eye was at once bandaged, and the patient kept very quiet. No reaction followed, and an examination the next day showed no detachment and a very much reduced defect in the visual field. After a week in bed he was allowed to rise, and the bandage

was removed. An examination showed that the detachment had shifted from a position downwards and inwards to one downwards and slightly outwards, but the vitreous was clear. The patient declined all further treatment, and was obliged to resume his occupation of teacher, but has presented himself for examination at irregular intervals ever since. For more than a year there was no apparent increase in the detachment, in spite of continued use of the eyes, but one evening after several hours' work, the vision became very much worse, and the next morning the eye was blind. When I saw him I found a total detachment of the retina in the left eye, and this has remained ever since; the lens subsequently became entirely opaque. The right eye still remains as good as it was at his first visit.

CASE II. T. G., a gentleman, aged 48, and a teacher, was first seen on December 20, 1883. Always very myopic, and had worn the same glasses for all purposes until very recently. For about a week had noticed rapidly failing vision in the right eye, and now sees with only the temporal and inferior quadrants of the retina. Examination with test types, ophthalmoscope, and perimeter showed: R. E., V. = movements of the hand. Lens clear. Vitreous very hazy. Annular sclero-choroiditis posterior. Refraction about —D 8. Detachment of the retina upwards and inwards, involving nearly half the circumference of the fundus. Tension normal. L. E., V. = 5/100; with sph. —D 8 = 18/20. Media clear. Extensive choroidal degeneration.

The patient was placed on his back in bed, atropine was instilled in both eyes, and a bandage applied to the right eye. Pilocarpine was injected hypodermically every day, and produced moderate diaphoresis. This treatment was continued for four weeks, the bandage being removed and an ophthalmoscopic examination made daily. At the end of the fourth week, the detachment of the retina had shifted from upwards and inwards to downwards and inwards, and was reduced in size. The patient was allowed to sit up in a chair, and to walk up and down the room, but there was no further improvement, and, at the end of the fifth week, the sclera was punctured subconjunctivally in the inferior nasal quadrant, and several drops of a cloudy, amber-colored fluid immediately exuded. A bandage was ap-

plied and the patient kept in bed for a week. An ophthalmoscopic examination then showed the retina to be in place throughout, though the defect in the visual field still remained. The retina remained attached for nearly five weeks, and then returned directly downwards. The patient could not submit to any further treatment, as he was obliged to continue his work of teaching, and the vision slowly grew worse, till about four months later the detachment became complete, and subsequently the lens became opaque. The left eye remained intact throughout.

CASE III. Mrs. W. J., aged 28, first seen in July, 1884. Was always very myopic, but had never worn glasses regularly. One week ago noticed a cloud before the right eye, which has slowly increased in extent. An examination showed the following condition: R. E., 3/200, unimproved. Lens clear. Floating opacities in the vitreous. Atrophic degeneration of the choroid. Annular sclero-choroiditis posterior. Retina detached in irregular folds downwards and outwards.

L. E., 6/200, with sph. —D 16 = 20/70, and reads Jaeger No. 1 at five inches. Vitreous hazy. Extensive choroidal degeneration, including the annular atrophy around the disc.

The patient was put to bed, atropine was instilled, a bandage was applied, and pilocarpine was injected hypodermically daily. The latter was borne very well and produced well-marked diaphoresis. In ten days the retina became entirely reattached, and the field was completely restored. In two weeks the bandage was removed, but the patient was kept in bed a week longer and then allowed to sit up. Vision was restored to 20/70 with the correcting glass. The eye remained well for two weeks, and then without warning the detachment recurred. The same treatment was again resorted to and with the same favorable result. But between July 7 and October 28 the detachment recurred five times, and on the last recurrence it extended so as to involve nearly the entire lower half of the fundus. The sclera was then punctured subconjunctivally in the infero-nasal quadrant, and quite a quantity of turbid yellow fluid evacuated, and the detachment at once disappeared. After two weeks in bed with a bandage constantly applied, the patient was allowed to

rise and walk about gently. The vision had very much improved, though there was still some defect in the field. The eye remained unchanged for nearly two months, and then without warning the detachment recurred while the patient was dressing, and in a few hours became total. Eight months later the lens had become entirely opaque.

CASE IV. Mrs. S. L., aged 43, first seen November 19, 1884. Has always been very myopic. During the past two years the vision has steadily failed. Has had fourteen children, the youngest born two months ago. Just before the last confinement she noticed a clear, bladder-like body floating before the left eye. On examination I found:

R. E., 2/70, with sph. —D 16 = 18/70—. Lens clear. Very extensive degeneration of the choroid all over the fundus, especially around the disc. Large cobweb in the vitreous.

L. E., 2/70, with sph. —D 16 = 18/200. Punctate opacities and general haziness of the vitreous. Lens clear. Detachment of the retina upwards and outwards, and entirely opaque. Large rent of the retina in the equatorial region, upwards and outwards, through which the choroidal vessels are clearly visible. Corresponding defect in the visual field.

The patient was at once put on her back in bed, atropine was instilled in both eyes, a bandage was applied to the left eye, and pilocarpine was injected daily. The latter was borne very well, but after three weeks of this treatment there was no change in the appearance of the fundus. After waiting for another week without any improvement, the detachment being in the same position, I punctured the sclera in the usual way subconjunctivally in the supero-temporal quadrant, and the subretinal fluid was immediately evacuated. The retina at once fell back in place, the conjunctival wound was united by a suture, and a double bandage applied. The conjunctival wound healed in twenty-four hours. The bandage was kept applied over the left eye for a week, being changed daily, and was then discarded. There was no return of the detachment in this case for about four years and a half, and she was enabled to use her eyes with careful moderation for all purposes. I saw her at intervals of a few months up to April 24, 1889. The evening before, after

using her strong glasses at the theatre for three hours, the vision of the left eye again became suddenly obscured. The next morning I found in the L. E., V. = 1/100, unimproved. Punctate and membranous opacities in the vitreous, and a detachment of the retina upwards, outwards, and downwards, involving about three-fourths of the fundus, and this soon became total.

CASE V. Miss E. S., aged 50. First seen July 3, 1885. Has been very myopic from childhood. At the age of 20, after a long illness, she suddenly lost the sight of both eyes from what was considered to be extensive hemorrhages into the retina and vitreous. Vision to a useful degree slowly returned in the left eye, but only partially in the right eye. In May, 1885, she suddenly noticed a large dark spot on the temporal side of the field of the left eye. An examination on July 3, 1885, showed the following conditions:

R. E., fingers at six feet eccentrically unimproved. Hazy vitreous. Lens clear. Extensive old chorio-retinitis disseminata, more marked in region of macula and disc. Atrophy of the optic nerve. Detachment of retina downwards and outwards.

L. E., V. =10/100, with sph. —D 4.50 = 18/50 somewhat eccentrically. Faint opacities at periphery of lens. General chorio-retinitis disseminata. Vitreous clear. Small detachment of the retina at the extreme nasal side of the fundus.

Owing to the extreme degree of degeneration in the fundus of the left eye, I regarded the case as hopeless, but the patient was put to bed, atropine was instilled in both eyes, and a bandage applied to the left eye. She had suffered from functional cardiac trouble for many years, and pilocarpine was contra-indicated, so I gave her small doses of potassium iodide largely diluted, which acted freely on the kidneys and to some extent on the bowels. Much to my surprise, the detachment in the left eye slowly receded, and at the end of three weeks it had disappeared. The vitreous cleared up and vision rose to 18/30 with the correcting glass, at which point it has remained ever since, a period now of nearly nine years. This patient has been seen at irregular intervals ever since, and the vision and fundus have remained in about the same condition.

CASE VI. Señor F. F., aged 45. First seen July 21, 1885.

Has always had very good vision until about a year ago, when the left eye began to fail, and the sight has since steadily grown worse.

R. E., 20/20+; accepts sph.+D 1. Media and fundus normal.

L. E , 20/200 eccentrically, unimproved. Peripheral opacities in the lens. Numerous fine membranous opacities in the vitreous. Detachment of the retina downwards, inwards, and outwards, over nearly three-fourths of the fundus.

From the presence of the membranous bands in the vitreous and the gradual impairment of the vision, it was almost certain that the original lesion had been a choroiditis. As the other eye was normal, I thought it worth while to make a determined attempt to save the left eye. The patient was placed in bed, the eye was cocainized, the sclera was punctured with a narrow knife in the equatorial region in the supero-temporal quadrant, and the membranes in the vitreous were all divided. A puncture was then made in the infero-temporal quadrant, near the ciliary region, and considerable turbid fluid evacuated. Both these punctures were made subconjunctivally. The retina was partially replaced after the second puncture, and atropia was instilled and the eye bandaged. There was almost no reaction, and the vitreous showed no increase of the opacity; but after the first week there was no further improvement in the condition of the fundus. The detachment was perceptibly reduced in extent, but still occupied fully one-third of the fundus. This patient was kept in bed for four weeks and pilocarpine administered, but he bore the drug very badly, and I was obliged to discontinue it. There has been no perceptible change in this case for nearly nine years. The vitreous is still fairly clear, and vision is about 10/200, but the detachment occupies the lower half of the fundus, and the tension is decidedly below normal. The other eye is still intact.

CASE VII. Mr. D. M., aged 60. First seen September 16, 1885. Always very myopic. Wore the same glasses for all purposes for more than 30 years. About three weeks ago he suddenly became aware that he had lost the sight of the left eye. For some months previously he had noticed floating specks and cobwebs before this eye. Is a journalist and uses his eyes constantly.

R. E., 3/200; with sph.—D 9 = 18/30 — Peripheral opacities in the lens. Vitreous clear. Extensive degeneration of the choroid.

L. E., fingers eccentrically at extreme left of field. Vitreous cloudy, with floating and fixed opacities. Retina detached in a large fold downwards and inwards, which partially obscures the disc.

The patient's general physical condition was bad owing to his dissipated habits, and pilocarpine was contra-indicated by reason of advanced cardiac degeneration. He was placed on his back in bed, atropine was instilled, and a bandage applied. He bore confinement very badly, and some stimulus proved constantly necessary. At the end of ten days there was no improvement, and I was obliged to allow him to rise and walk about. The condition remained unchanged for another week, and I then punctured the sclera in the infero-nasal quadrant, but no fluid appeared beneath the conjunctiva. There was no immediate result from the operation, but on removing the bandage on the fourth day, the retina was found totally detached, and so remained till his death, four years later.

CASE VIII. Mr. F. P. W., aged 28. First seen November 27, 1885. Four years ago he received an injury to the left eye, of the nature of a contusion, which produced immediate blindness, lasting nearly forty-eight hours. Vision then began to return and slowly improved for about a year, at the end of which time he thought he saw as well as ever. What the lesion was he does not know, as he was in the interior of South America, and could not reach a physician, but it was probably an intra-ocular hemorrhage. Two weeks ago while writing, the vision of the left eye became suddenly obscured and has remained so ever since. An examination showed:

R. E., 20/20—; with cyl. + D 0.50 axis 90° = 20/20+. Media and fundus normal.

L. E., fingers eccentrically in lower and outer quadrants of the field. Floating and fixed membranous opacities in the vitreous. Detachment of the retina inwards and upwards over about half of the fundus.

Recognizing the original cause of the trouble as a traumatism,

I was inclined to take rather a favorable view of this case. He was put on his back in bed, atropine was instilled, and a bandage applied for a week. Pilocarpine was injected hypodermically and borne very well, but produced very little physiological effect in spite of large doses. At the end of a week the sclera was punctured in the equatorial region in the supero-nasal quadrant, and the narrow knife was carried through the detached retina and into the vitreous, in order to divide the membranous bands in the vitreous. The detachment collapsed at once, and the eye was immediately bandaged. Absolutely no reaction followed, and though the vitreous remained cloudy, there was no return of the detachment for nearly five weeks. It then returned in the same spot and to about the same extent as before. The patient was unwilling to submit to any further operative interference. I have seen him at intervals since and the detachment has shown no tendency to extend, but the vision has steadily failed, and the lens has finally become opaque.

CASE IX. Mr. E. M., aged 50. First seen May 16, 1886. Has always had what he called weak eyes, and has never been able to do any continuous work, but his vision was always good until four weeks ago, when the left eye suddenly became very defective.

R. E., 18/30; with sph. + D 0.50 = 18/15—. Media and fundus normal.

L. E., 2/70 + eccentrically with upper portion of retina. T+1. Slight ciliary injection. Lens and vitreous clear. Detachment of entire lower half of the retina. As this was a recent detachment, I decided to operate at once. The patient was put to bed and the eye cocainized. The sclera was then punctured subconjunctivally with the narrow knife in the infero-temporal quadrant just behind the ciliary region, and a moderate amount of turbid yellow fluid evacuated. The detachment partially collapsed, and with the ophthalmoscope a long rent in the retina was seen downwards and outwards, close to the ciliary region. Atropine was then instilled and the eye bandaged. Almost no reaction followed, but the patient was kept in bed and the eye bandaged for ten days. There was still a partial detachment and some haziness of the vitreous, but the vision

had somewhat improved and now measured 20/200. Immediately after the operation the hypodermic administration of pilocarpine was begun. The patient bore it very well and it was continued for two weeks, but without producing any effect upon the detachment of the retina which still existed. The eye remained in about the same condition for two years, and then the vision grew steadily worse, fixed and floating opacities appeared in the vitreous, the tension was at times increased and at times diminished, and eventually the lens became opaque and vision sunk to perception of light. Before the cloudiness of the lens prevented ophthalmoscopic examination, there was no further extension of the detachment noticed.

CASE X. Mr. G. B., aged 40. First seen October 20, 1886. Always very myopic, but vision always good until eight months ago. At that time he received a violent blow on the right eye, which was followed by decided inflammatory action, and since then vision has been very defective. Two weeks ago he was struck by a flying chip of stone in the left eye, and lost the sight of that eye immediately. Since then vision has returned in a part of the field.

R. E., 6/200 unimproved. Small nuclear cataract, lens in place. Floating opacities in the vitreous. Extensive degeneration of the choroid.

L. E., 2/70; with sph. — D 5 = 6/70 eccentrically. Faint opacities in the lens. Membrane in the vitreous. Fluttering iris. Lens in place. Detachment of entire lower half of the retina.

The patient was placed in bed, atropine was instilled in both eyes and a bandage placed over the left eye, and no further treatment was instituted till the irritating effects of the injury had subsided, which occurred in about three weeks. The vitreous was still so cloudy that puncture was deemed unwise, and pilocarpine was then injected daily for three weeks, the atropine and bandage being continued. There was a decided improvement in the media, the vitreous becoming markedly clearer, and the choroidal process being apparently arrested. Two months later the membranous bands in the vitreous and the detached retina were divided from below by a very narrow knife, through

a subconjunctival incision. A few drops of turbid fluid exuded, but there was no collapse of the detachment, and all further treatment was given up. This eye remains in practically the same condition to-day, after a lapse of nearly eight years, vision being 2/100 unimproved by any glass.

CASE XI. Mr. H. K. L., aged 54. First seen Nov. 26, 1886. Has always been myopic, but has never worn glasses, and has overworked his eyes all his life. In April, 1881, he suddenly discovered that he was totally blind in the left eye, and on consulting an oculist, he was told that the retina was detached. In May of the same year the vision of the right eye became suddenly very defective, so that he could only see with the extreme outer angle of the field, and here also there was found a detachment of the retina. He was kept on his back in bed for two months, atropine was instilled in both eyes, and the right eye was kept bandaged most of the time. He also had injections hypodermically every other day of some drug, which was probably pilocarpine, as it induced profuse perspiration. The vision began to improve first in the left eye, but subsequently also in the right eye, and at the end of six months he was able to read again with the right eye. In 1883 opacities appeared in the lenses of both eyes, and shortly before I saw him, he was told that the sight was destroyed in the right eye by the cataract, and that nothing could be done to restore it. Examination showed:

R. E., 2/70 unimproved. Lens nearly entire opaque. Fundus invisible. T— 1.

L. E., perception of light. Lens cloudy at periphery, very hazy vitreous. Detachment of the retina inwards, upwards, and outwards. T— 1.

He was told that nothing could be done for the left eye, and that it was very doubtful whether anything could be done to improve the right eye, as the extent of the detachment could not be determined. The first step was the extraction of the cataract, and to this he consented. The incision was made in the limbus, and was accompanied by an iridectomy. The capsule was opened and the lens evacuated without difficulty. There was very little reaction, the wound healed readily, and two

weeks after the operation a moderate detachment of the retina was discovered downwards and outwards. As the posterior capsule stretched and gaped and the vitreous grew clearer, very extensive degeneration of the choroid was seen, but there were no fixed bands of adhesion in the vitreous. Vision slowly improved, so that eventually with sph. + D 4 he could see 15/200, but beyond this it never rose, and he has never been able to read any printed type. The eye remained in about the same condition till his death, five years later.

CASE XII. Mr. J. H., aged 36. First seen Dec. 1, 1886. Always very myopic, and vision very defective. Sometime in the spring of 1886, he woke one morning and found the vision nearly gone in the left eye, and he was told that he had detachment of the retina. In October of same year, two months before I saw him, there had been an operation performed upon the left eye, which proved unsuccessful in restoring any useful vision. Examination showed that an iridectomy had been done upwards in the left eye.

R. E., 6/200, with sph. — D 6 = 18/40. Hazy vitreous. Extensive degeneration of the choroid, especially around the posterior pole of the eye.

L. E., 6 11/100 eccentrically unimproved. Lens clear. Vitreous very hazy, with floating opacities. Retina detached downwards, outwards, and inwards. Coloboma iridis upwards. I advised the usual treatment in the supine position in bed with atropine, pilocarpine, and a bandage, but he was not willing to submit to the confinement, and went away. In 1889, while in a distant city, the retina became slightly detached in the right eye; and the left eye, which had become entirely blind, was enucleated on account of the condition of the right eye. He consulted me again on the 28th of June, 1890, and I found in the right eye V = 6/200, which by sph. — D 5 was improved to 18/200. The lens was clear, the vitreous was quite hazy, and the retina was detached downwards and outwards.

He was treated for nearly four weeks by rest in bed, atropine, a bandage to the right eye, and pilocarpine hypodermically; but the latter was discontinued on the fourth day, owing to very grave symptoms of cardiac failure. There was

a decided improvement in the vision and in the detachment, which, however, lasted but three weeks. The latter then returned and involved more of the fundus, and I advised an operation. The sclera was punctured subconjunctivally downwards and outwards, and a few drops of fluid came out, but no effect was produced upon the detachment, and the vision gradually sank to 2/200, in spite of everything that was done to prevent it, and the lens slowly became opaque.

CASE XIII. Mr. C. W. L., aged 53. First seen Feb. 2, 1887. Always myopic. Put on glasses for the first time six years ago. About a year ago he suddenly lost the vision of the right eye, and it has never returned. There is a constant dull ache in the eye, which at times becomes severe. An examination showed:

R. E., 3/200 eccentrically unimproved. Lens cloudy at the periphery. Vitreous very hazy, with floating opacities. Retina detached upwards, outwards, and downwards over about four-fifths of the fundus.

L. E., 10/200, with sph. — D 8 = 18/20.

The patient was told of the hopeless nature of his disease, but when informed that something might be tried, consented at once. He was placed in bed, the eye was cocoanized, and a subconjunctival puncture of the sclera was made about 3 millimetres long, in the infero-temporal quadrant; only a few drops of turbid fluid exuded. Atropine was then instilled, a bandage was applied, and pilocarpine was injected hypodermically every day for three weeks. At first the vitreous cleared up, and some of the floating opacities disappeared, so that a better view of the fundus was obtained, and here very extensive degeneration of the choroid was found. But before the treatment was discontinued, the opacity of the vitreous again returned and vision was reduced to the standard at which it had been before the operation. No apparent effect was produced upon the detachment, which about a year later became total.

CASE XIV. Miss W., aged 27. First seen Feb. 6, 1887. Always very myopic, but has only worn glasses (sph.— D 4.50) for two years. Three weeks before she received severe blow on the left eye, which caused temporary loss of sight, then ery-

thropsia, and subsequently extreme loss of vision. An examination showed:

R. E., 5/200, with sph. — D 9=18/15. Media clear. No very marked degeneration of the choroid.

L. E., 3/200 unimproved. Lens clear. Vitreous generally hazy. Retina detached at extreme periphery in nasal and inferior quadrants. T— 1. No rupture of retina visible. Owing to the unusually healthy condition of the choroid, in spite of the high degree of myopia, I decided to operate at once. A subconjunctival puncture of the sclera was made in the infero-nasal quadrant, a few drops of clear fluid exuded, and the detached retina collapsed. Rest in bed, atropine and a bandage were then kept up persistently for five weeks. Pilocarpine was very badly borne by the patient and could not be employed. At the end of five weeks the vitreous became perfectly clear, the retina was in place, and the vision with sph. — D 7 had risen to 18/50. By total abstention from use of her eyes and careful management of her general health, which had suffered from confinement in bed, this favorable condition was maintained for nearly eight months. The detachment then suddenly returned without any warning, and involved the entire lower half of the retina. The vitreous became rapidly cloudy, and vision eventually sank to perception of light, and the lens became entirely opaque.

CASE XV. Miss E., aged 74. First seen Nov. 16, 1887. Always very myopic. Has used her eyes constantly all her life. Three days ago she struck her nose and orbital margin on the left side a violent blow against a chair, and in a few minutes noticed that she could see nothing but light with the left eye. Examination showed:

R. E., 5/200; with sph. — D 6 = cyl. — D 1 axis 90°= 18/30+. Lens and vitreous clear. Extensive degeneration of the choroid, especially around the disc.

L. E., perception of light. Vitreous filled with blood in process of absorption, with floating clots. Peripheral opacities in the lens. Three weeks later the retina was found detached in the supero-temporal quadrant. As the blood becomes absorbed and the vitreous slowly cleared up, the choroid was

found extensively degenerated, and a laceration of the retina was discovered upwards and inwards, near the region of the ora serrata. T— 1.

Owing to the advanced age of the patient and the extreme degree of choroidal degeneration, very little hope was felt of a favorable issue. The patient was placed in bed, atropia was instilled, a bandage was applied, and small doses of pilocarpine were injected. The latter soon produced unpleasant symptoms of cardiac failure, and was discontinued. The patient was kept in bed five weeks, free action of the kidneys being induced by small does of iodide and acetate of potash, largely diluted. The vitreous slowly cleared up, and the detachment gradually sank downwards until it involved the lower third of the retina. The vision improved to 5/200, with sph.— D 4, and remained at this point until the death of the patient, seven months later, and there was no further extension of the detachment.

CASE XVI. Mrs. C. R., aged 64. First seen June 16, 1888. Always hypermetropic, and has worn glasses for all purposes for many years. About ten years ago she suddenly noticed a cloud before the left eye while reading, and this slowly increased in extent, so that for about three years she had not been able to see with the eye. She was at the time told that she had a detachment of the retina. Then the vision slowly improved, and for several years she has had very useful vision with the left eye. Two weeks ago the same condition suddenly returned, and she can now only distinguish movements of the hand.

R. E., 10/200, with sph. + D 3.50=18/15. Media clear. Fundus normal.

L. E., movements of the hand. Nuclear and peripheral opacities in the lens. Vitreous hazy. Retina detached below and on both sides of the disc. T+1.

The usual treatment of rest on her back in bed, atropine and a bandage were resorted to, together with daily injections of pilocarpine, and this was persisted in for three weeks without any improvement. The vitreous became more hazy and there was no increase in the vision. It was then decided to puncture the sclera, which was done with a narrow knife sub-

conjunctivally downwards and outwards. Some turbid fluid escaped, and the detachment partially collapsed. The local treatment was continued for two weeks longer, but the retinal sac again filled up, the haziness of the vitreous increased, and the lens grew more opaque. The vision slowly sank to faint perception of light, with no correct projection, and the cataract became complete. The other eye remained intact, and there was not a sign of degeneration of the choroid ever observed.

CASE XVII. Mrs. C. S. E., aged 37. First seen July 28, 1888. Always very myopic, especially in the left eye, and for three years this eye has not been of much use. Constant dull ache in both eyes.

R. E., 3/200; with sph. — D 10 = 18/100. Lens clear. Hazy vitreous with floating opacities. Extensive choroidal degeneration.

L. E., movements of the hand. Extensive opacities of the vitreous. Detachment of the retina downwards and outwards. T — 1.

The usual treatment was at once instituted. Rest in bed, atropine, a bandage, and pilocarpine by daily hypodermic injections were maintained for four weeks, with some improvement. The vitreous became much clearer. All the floating opacities were absorbed, but there remained a broad, dense membrane, stretching entirely across the fundus. The vision rose to 5/200 with sph. — D 8, but there was no change in the detachment, and at the end of a month the patient was allowed to rise from the bed and move about. The state of the fundus and the vision remained unchanged for about two years, and then the sight rather rapidly failed, and within a month the retina became totally detached. The lens remained clear for two years longer and then became slowly opaque. The other eye is still as it was at the time of the first examination. This patient declined all operative treatment.

CASE XVIII. Mrs. M., aged 57. First seen Oct. 8, 1888. Always very myopic, and for many years the left eye has been useless. Some years ago had a sudden loss of vision in the right eye from hemorrhage into the vitreous and retina, from which she entirely recovered. About a month ago the vision

in the right eye again began to fail, and there is a constant dull ache in this eye.

R. E., 2/200; with sph. — D 18=10/200. Lens clear. Fixed and floating membranes in the vitreous. Small detachment of the retina downwards and outwards. T — 1.

L. E., fingers at six inches, and with sph. — D 18 = 2/200. Lens clear. Very cloudy vitreous. Detachment of the retina outwards, downwards, and inwards. T — 1.

Owing to the extreme myopia and extensive choroidal degeneration, no operation was deemed permissible. The patient was placed in bed, atropine was instilled, and a bandage was applied, and she was cupped on the right temple with Heurteloup's apparatus. The vitreous slowly cleared up but the detachment of the retina gradually extended until it involved the entire lower half of the retina. At the end of four weeks the patient became very much prostrated from the confinement in bed and the effects of the pilocarpine, and she was allowed to rise, and a course of tonic and restorative treatment was begun. She soon improved very much in general health, but the eye remained in about the same condition, and there was no change in the media or fundus for three years, since which time I have not seen the patient.

CASE XIX. Mr. C. E., aged 27. First seen April 23, 1889. In August, 1888, first noticed that the vision of the right eye was misty, previous to which both eyes had always been perfect; and this grew slowly worse until December, when it again began to improve, and eventually became entirely clear. Has used his eyes very constantly in microscopy. Two days ago the same thing occurred.

R. E., 10/100, unimproved. Lens clear. Vitreous hazy. Retina detached in radiating folds in infero-temporal quadrant, reaching from disc to periphery.

L. E., 18/15 — Myopic astigmatism — D 0.50 axis 90°.

This patient was at once put to bed, and the usual local and internal treatment begun and persisted in for five weeks with very satisfactory results. There was no myopia and but very little choroidal degeneration. By the end of the third week the vitreous had become entirely clear, and the radiating folds of

detachment had coalesced into one narrow, pouch-like cyst directly downwards in the equatorial region. At the end of the fifth week the retina was entirely in place and vision had risen to 20/50. He was then permitted to rise and move about, atropine and dark glasses being constantly used. At the end of the second month he was permitted to use his eyes moderately. For two years the eye remained sound and useful, with vision of 20/30 —, since which time I have not seen him.

CASE XX. Mr. T. B., aged 28. First seen Sept. 23, 1889. This is one of the cases reported to the Society in 1891, as treated by Schoeler's method, and reported in the Transactions for that year. No improvement in the vision, but reduction in the extent of the detachment.

CASE XXI. Mrs. M., aged 47. First seen Oct. 6, 1889. Failing vision in right eye for two months. Three weeks ago the vision of this eye became suddenly very much obscured.

R. E., 8/200, eccentrically unimproved. Lens clear. Vitreous generally hazy, with floating opacities. Detachment of entire upper half of the retina. T+1.

L. E., 18/30+; with sph.+D 1 = 18/15—. Media clear and fundus normal. No degeneration of the choroid.

Treatment by rest in bed, atropine and cocaine, and a bandage locally, and daily injections of pilocarpine, with plenty of nourishing diet, carried out through a period of four weeks, produced a very marked improvement in this case. The general haziness of the vitreous entirely disappeared, the floating opacities were partially absorbed, the detachment grew smaller and sunk down until it occupied the infero-temporal quadrant, and vision rose to 20/200. The patient was then permitted to get up and move about the house, and at the end of another week to go out driving. The pilocarpine was discontinued and the bandages left off, but the atropine and tonic treatment were continued. The detachment grew smaller, and the vision eventually rose to 20/70, but never exceeded this, and the detachment never entirely disappeared. The condition remained unchanged for more than a year, since which I have not seen the patient.

CASE XXII. Mr. W. P., aged 58. First seen February 4,

1890. Had always had extremely good eyes till three days before, when he noticed a sudden clouding of the vision of the left eye while writing, and found that he could see nothing above the horizontal plane.

R. E., 18/13—. Media clear. Fundus normal.

L. E., 18/40 — below the horizontal plane, unimproved. Media clear. Detachment of the retina in inferior quadrant, involving nearly two quadrants at the periphery.

There was no apparent cause for the occurrence of the lesion except long continued overwork, especially at night, as the refraction was emmetropic, the patient had proper presbyopic glasses, and there was no choroidal degeneration, nor any history of traumatism. Rest in bed with atropine and a bandage locally, persisted in for six weeks, eventually brought about a disappearance of the detachment and a restoration of the vision to the normal standard. How long this satisfactory condition lasted I am unable to say, as four months later the patient went to Europe, and I have never heard of him since. No pilocarpine or any other diuretic or diaphoretic was employed in the treatment of this case.

CASE XXIII. Mr. C. H. B., aged 59. First seen March 30, 1890. Has always had excellent vision in both eyes till March 14th, when he noticed a number of large black spots before the right eye. On March 26th the right eye became suddenly entirely blind. Since then the vision on the temporal side of the field has been partially restored, but he can see nothing to the left of the median line. The day before the black spots appeared he had been exposed for several hours to a furious storm of snow and wind, through which he had been obliged to walk for several miles, and he was completely prostrated by it.

R. E., 3/70 eccentrically. Lens clear. Vitreous hazy. Detachment of retina downwards, outwards, and inwards over about two-thirds of the fundus.

L. E., 18/70+. Unimproved. Lens clear. Vitreous generally hazy, with small floating opacities. General choroidal degeneration.

The patient was put to bed, atropine was instilled in both

eyes, and a bandage applied to the right eye. Owing to the existing choroiditis he was given hydrarg. chlorid. corrosiv. gr. 1/50 three times a day, and pilocarpine was injected hypodermically once a day. The latter was discontinued on the sixth day, as it induced nausea and vomiting, but the other treatment was kept up persistently for five weeks. The choroiditis gradually subsided, the vitreous of both eyes cleared up, and the floating opacities disappeared. The detachment of the retina in the right eye became much reduced in extent and the vision of this eye improved to 18/100, and that of the left eye to 18/40+. At the end of the fifth week the bandage was removed from the right eye, but he was kept in bed for another week. As time went on the sight of the left eye steadily improved and eventually reached nearly the normal standard, but the right eye remained in the same condition, as long as the patient remained under observation, a period of seven months.

CASE XXIV. Miss M. M., aged 31. First seen April 24, 1890. This is one of the cases reported to the Society in 1891, as treated by Schöler's method, and published in its Transactions for that year. The condition of the patient was made decidedly worse by the operation.

CASE XXV. Mr. W. A., aged 60. First seen May 11, 1890. This is one of the cases reported to the Society in 1891, as treated by Schöler's method, and published in its Transactions for that year. The condition of the patient was made decidedly worse by the operation.

CASE XXVI. Mr. J. M. W., aged 63. First seen June 19, 1890. Always very myopic. Is a civil engineer. Four years ago lost the sight of his right eye from detachment of the retina, and it has been useless ever since. Five days ago, while completing some surveying work in the field, he noticed a sudden obscuration of the sight of the left eye. He stopped his work at once, and as soon as possible came to see me.

R. E., perception of light. Complete posterior synechiæ. Lens opaque. T+1.

L. E., 3/200 : with sph. −D7 = 18/70−. Lens clear. Floating opacities and general haziness of the vitreous. Detachment

of the retina in the supero-temporal quadrant. The age of the patient and the condition of the right eye made the case a desperate one. He was at once put to bed, atropine instilled in both eyes, and a bandage applied to the left eye. Pilocarpine was contra-indicated on account of advanced cardiac disease, and in its place small doses of potassium iodide largely diluted, and mercuric bichloride, were administered, accompanied by a general tonic treatment. Under this treatment the vitreous gradually cleared up, and opacities were largely absorbed, but there was no improvement in the detachment of the retina, and the resulting vision after seven weeks of treatment was not improved. The ophthalmoscope showed extensive disease of the choroid with a myopia of D8. The vision of the left eye and the condition of the fundus have not materially changed since, during a period of four years.

CASE XXVII. Mr. T. E. B., aged 28. First seen September 23, 1890. Three years ago while ill, he read for a long time lying on his back in bed, for many days in succession, and since then he has suffered constantly from various asthenopic symptoms. In March, 1890, he received a blow on the right eye from a boxing glove, which temporarily produced nearly complete blindness. In April he was examined by an oculist, who discovered a detachment of the retina in the right eye. Since then there has been a slight improvement in the vision.

R. E., 15/200 eccentrically. Lens clear. Vitreous hazy, with a fixed membranous capacity. Retina detached downwards and outwards.

L. E., 18/15+, refraction normal.

As the cause of the detachment was a traumatism with resulting choroiditis, in an eye previously entirely normal, I decided to operate. Under cocaine a subconjunctival incision was made through the sclera in the infero-temporal quadrant, just back of the ciliary region, with a very narrow knife. The knife was plunged through the detached retina into the vitreous, and a complete division of the membrane in the vitreous was made. After the incision was completed, the conjunctival wound was closed by a single suture, atropine was instilled, and a bandage applied. On the next day the vitreous was very hazy, but the

detachment had entirely disappeared. On the second day all reaction had vanished, and pilocarpine was injected hyperdermically every day for fifteen days. The latter was then discontinued, and small doses of corrosive sublimate were administered thrice daily. At the end of the sixth week the vitreous had become almost entirely clear, and at the extreme periphery downwards there was still a small detachment, less than half the size of that which existed previous to the operation. There was rather extensive degeneration of the choroid, but the vision had risen to 18/70+. This eye still remains in the same condition, after a lapse of three and a half years.

CASE XXVIII. Mr. M. H., aged 73. First seen September 30, 1890. This is one of the cases reported to the Society in 1891, as treated by Schöler's method, and published in its Transactions for that year. Decided temporary improvement, followed two months later by almost total loss of sight from a return and further extension of the detachment.

CASE XXIX. Mr. B. W., aged 36. First seen December 28, 1890. This is one of the cases reported to the Society in 1891, as treated by Schöler's method, and published in its Transactions for that year. Immediate impairment of the existing vision resulted, followed by a very slow improvement, which, however, never reached the degree which existed previous to the operation.

CASE XXX. Miss A. E. M., aged 53. First seen February 7, 1891. Has always been very myopic, but her eyes have never given her any trouble. In May, 1890, she first noticed an irregular scotoma in the field of the left eye, and since then the vision has slowly failed.

R. E., 2/200: with sph. $-$D 10 $\supset$ cyl. $-$D 1.50, axis 180° = 18/40. Lens clear. Floating opacities in the vitreous. Extensive degeneration of the choroid all over the fundus.

L. E., Movements of the hand. Lens clear. Membranous opacities in the vitreous. Very extensive detachment of the retina downwards, outwards, and inwards.

Owing to the very extensive choroidal degeneration in both eyes, and the very large detachment of the retina in the left eye, any operation was deemed inadvisable. The patient was

put to bed, atropine was instilled in both eyes, a bandage was applied to the left eye, and a strong tonic treatment was administered for a week. Then pilocarpine was administered hypodermically every day for sixteen days. Its physiological effect was very marked, and eventually caused extreme prostration in spite of the tonic treatment, and its administration was stopped. At the end of five weeks there was no improvement in the vision and none in the detachment of the retina, though the vitreous had become very much clearer in both eyes. Six months later opacities appeared in the lens which increased so rapidly that within three months the lens had become entirely opaque. The other eye still remains in the same condition.

CASE XXXI. Mr. W. O., aged 35. First seen March 23, 1891. When a boy he had a great deal of trouble with his eyes, and was for a long time forced to give up his education, because his vision was so defective. He was for a long time under constitutional treatment of some sort, and regained sufficient vision to prosecute his studies. Several months ago he began to be troubled with foggy vision in the left eye, and there was a constant dull ache in the eye whenever reading or writing. He consulted an oculist, who told him that there was a detachment of the retina in the left eye, and that there was a chorio-retinitis in both eyes. When I examined him, I found:

R. E., 18/100: with sph.+D1.50⌒cyl.+D1.75 axis 165°= 18/50. Media clear. Extensive old chorio-retinitis.

L. E., 18/200 unimproved. Refraction hypermetropic and astigmatic. Lens clear. Membranous opacity in the vitreous. Detachment of the retina downwards and outwards. Extensive old chorio-retinitis.

The condition of the fundus of both eyes rendered an unfavorable prognosis almost a certainty. He was put to bed, and the usual treatment of atropine, a bandage, and pilocarpine hypodermically begun. The latter drug produced extreme nausea and prostration, and after the third dose was discontinued. Small doses of potassium iodide, largely diluted, were administered in its place, which produced very free diuresis and diarrhœa, and I was obliged to stop its use. The patient was kept on his back in bed for six weeks. At the end of that time the

vitreous was much clearer, and the vision had improved to 18/70, with a sphero-cylinder, but there was no demonstrable change in the detachment of the retina. Since the autumn of 1891 there has been a slow, but steady failure of vision in this eye, but the detachment has remained of about the same extent. Puncture of the sclera and detached retina, and division of the membranous opacity in the vitreous, caused almost no reaction, and produced not the slightest favorable effect upon the vision or the detachment.

Case XXXII. Mr. J. C. O., aged 50. First seen July 14, 1891. One year ago, after severe mental strain, he woke one morning with a large black spot before the left eye. He consulted an oculist, who told him he had had a serious retinal hemorrhage. The blood was gradually absorbed and vision slowly improved. Subsequently he had another larger hemorrhage in the same eye, which obscured nearly the entire vision, and since then he has only been able to see with the temporal half of the field of vision. He is astigmatic and has worn correcting glasses.

R. E., 18/30−: sph.−D 0.50⊃cyl.−D 1, axis 180°=18/15−. Media clear and fundus normal.

L. E., fingers eccentrically on the temporal side. Lens clear. Large membrane, containing blood-vessels, in the vitreous, attached to the temporal margin of the disc behind and to the ora serrata in front. Extensive disorganization of the retina and choroid, with a small detachment downwards and outwards.

The extensive disorganization of the retina and choroid in the left eye, and especially the presence of blood-vessels in the membrane stretching across the vitreous, positively contra-indicated any attempt to divide this membrane, as it would have caused extensive hemorrhage into the vitreous. The generally enfeebled condition of the patient forbade the employment of pilocarpine.

He was put to bed, atropine was instilled, and a bandage applied to the left eye. Strong tonic treatment was administered, and after the first two weeks, small doses of mercuric bichloride were prescribed. The eye gradually became quiet, the vitreous became somewhat less hazy, and at the end of four weeks the

patient was permitted to leave his bed, and the bandage was removed from the left eye. The vitreous membrane remained unchanged, but the detachment showed no tendency to increase for nearly two months. Vision had improved to 5/200, and all treatment was stopped. Fourteen weeks after I first saw him the eye became suddenly blind, and an examination showed that the retina had become totally detached.

CASE XXXIII.— Mrs. M. McB., aged 47. First seen Nov. 16, 1891. In June last she received a violent blow on the head by falling from a landau in a runaway accident, and was unconscious for two days, and ever since there has been a marked loss of vision in the left eye. She has always been very myopic, but has never worn glasses with any regularity.

R. E., 10/200: with sph.—D 8 ⊂ cyl.—D 1 axis 90° = 18/40+. Media clear. Extensive degeneration of the choroid.

L. E., 3/200 unimproved. Lens clear. Vitreous very hazy. Detachment of the retina downwards. The patient stated that the vision of the left eye varied from time to time, and that it was always better in the morning after a night's rest. She was at once put to bed, atropine instilled, and a bandage placed over the left eye. Pilocarpine was administered hypodermically once a day for two weeks, without producing the slightest effect either upon the vitreous or the detachment. It was then discontinued, and the sclera was punctured with a narrow knife in the infero-temporal quadrant. A few drops of turbid fluid exuded under the conjunctiva, and the detachment partially collapsed. The atropine, bandage, and corrosive sublimate were continued, and in the course of three weeks more the vitreous became nearly entirely transparent. The vision rose to 18/200 with sph.—D5, and remained at this point for a period of several months, but there was no further improvement, and the detachment remained as it was after the puncture of the sclera.

CASE XXXIV.— Mr. J. H. K., aged 19. First seen, January 2, 1892. In November, 1890, during a game of football, the right eye was injured by a blow. The vision was entirely lost for a few hours, but he persisted in finishing the game. After a few hours of rest the sight began slowly to improve until about Christmas, 1890, he could see quite well. He

remained quiet and useful till April, 1891, when the vision again suddenly failed, and has never returned. Since then there have been occasional attacks of pain and congestion in the eye.

R. E., fingers at 3 feet. Iris dilated and immovable. Lens clear. Fixed and floating opacities in the vitreous. Retina detached downwards, outwards, and inwards. T—1.

L. E., 18/15, Emmetropia.

Treatment by confinement in bed, atropine, a bandage, and pilocarpine daily hypodermically for four weeks produced no improvement in the vision, and no subsidence in the detachment, though the vitreous became very much clearer. The general haziness disappeared, and most of the floating opacities were absorbed. I then punctured the sclera beneath the conjunctiva in the infero-temporal quadrant with a narrow knife, but without the slightest result. No fluid exuded beneath the conjunctiva, and there was no collapse of the detached retina. The knife was again introduced and the separated retina freely divided. This produced some collapse of the detachment, but no improvement in the vision. There was little or no reaction following these punctures, but after two weeks further confinement in bed with a bandage, there was no perceptible change, and all treatment was abandoned. This patient was seen at intervals ever since. The retina became totally detached and the lens entirely opaque. The eye at times was irritable with well-marked ciliary injection, and in the latter part of May, 1894, there appeared an obstinate conjunctivitis of the left eye with rather intense photophobia, accompanied by constant pain in the right eye, which rendered enucleation of the blind eye advisable.

CASE XXXV.— Miss L. A., aged 32. First seen January 16, 1893. Always very myopic. Five years before, following a long-continued strain of the eyes in literary work, a detachment of the retina occurred in the right eye. This was treated by another surgeon by confinement in bed, atropine, and a bandage, and by hypodermic injections of pilocarpine, for nearly five weeks, and resulted in an apparent cure, as the vision returned and the defect in the visual field was restored.

All use of the eyes was interdicted for a year, and she spent two years in travel abroad. The right eye remained fairly well until a few weeks before I saw her, when the vision suddenly grew worse, and the loss of sight was accompanied by a dull ache.

R. E., fingers at one foot eccentrically. Lens slightly cloudy at the periphery. Thin membranous opacity in the vitreous. Ciliary injection. Iritis with adhesions. Retina detached downwards, outwards, and inwards. T+1.

L. E., 4/100: with sph.— D 8 ⊂ cyl.— D 1. .50 axis 180° = 18/304. Floating opacities in the vitreous. The patient was put to bed, atropine was instilled four times a day, the eye was bathed with hot water four times a day, and in the intervals a bandage was applied. She was also given mercuric bichloride 1/50 three times daily. The iritis proved very obstinate, and it was not until the end of the second week that the iritic adhesions began to yield. They were eventually all broken, except one broad synechia downwards and inwards. The vitreous then began to clear up and the vision to improve. The atropine, bandage, and bichloride were continued for nearly a month longer, by which time the vision had risen to 6/200, beyond which it did not go. Owing to the extreme degree of choroidal degeneration and the extent of the detachment, any operative interference was deemed ill advised. The eye remains in about the same condition at the present writing.

CASE XXXVI. Miss T. O., aged 45. First seen May 16, 1892. Four days previously, on awakening in the morning, she found that the right eye was totally blind. She had for many years strained her eyes by long hours of night work. An examination showed the following unfavorable conditions:

R. E., fingers eccentrically at six inches. Lens clear. Several small floating clots in the vitreous. Very extensive retinal hemorrhages. One very large one below the disc, stretching all across the fundus. Several small ones on the disc and along the vessels. On May 20th several small fresh hemorrhages were found, with patches of yellowish exudation below the disc. Small detachment of the retina at the extreme periphery of the fundus downwards. Signs of periarteritis and

periphlebitis. Urine of a high specific gravity, but contains neither albumen, sugar, nor casts. Large amount of urates and uric acid crystals.

On May 27th there were several small fresh hemorrhages noticed, and the large hemorrhage showed signs of absorption by breaking up into small patches.

L. E., normal in every respect, but presbyopic.

This patient was treated from the beginning in the usual way. She was placed in bed, atropine and cocaine were instilled, and a bandage was applied. She was given small doses of potassium iodide and sodium bicarbonate largely diluted, tonics, and a liberal diet. The repeated hemorrhages occurred while under this treatment, and for a period of five weeks there was no improvement in the vision and no change in the fundus. She was then permitted to rise and move about. On July 14th she had a violent epistaxis, which was so continuous and profuse that it necessitated plugging of the nostrils. The next day she claimed that she could see much better, and I found that she could count fingers at three feet all over the field. There was, however, no change in the fundus, and the vision soon sank to the former standard. In October, she had a similar attack of epistaxis, with another improvement of the vision, which lasted for several days and then disappeared. On January 27, 1894, the retina became totally detached, and one week later occurred a cerebral hemorrhage from which she did not recover.

CASE XXXVII. Mrs. W. H. M., aged 59, first seen January 20, 1894. Always myopic, but her eyes have been very strong. Just before Christmas she had a bad attack of "la grippe," with marked blurring of the sight of the left eye. This soon passed off, but one week ago the vision of the left eye again became entirely obscured, and has improved but little since.

R. E., 10/200; with sph.—D 4 ⌒ cyl.—D 1 ax. 180° = 18/15. Media clear. Usual signs of a myopic fundus.

L. E., 3/200, unimproved. Large central hemorrhage in the vitreous. Peripheral opacities in the lens.

The patient was put to bed, atropia was instilled, and a bandage was applied constantly. There was a steady but slow improvement up to March 5th, when the vision in the left eye had

risen to 18/40 with sph.—D 4, and she could read Jaeger 2 at 8 inches. On March 10th, while sitting quietly in a chair, the vision of the left eye again became suddenly obscured, and an examination a few hours later showed a detachment of the retina upwards and outwards, over about one-third of the fundus. V = 18/50—. The patient was immediately put to bed, the bandage reapplied, the bowels freely opened, and pilocarpine administered hypodermically, which produced the usual physiological effects to an alarming degree. The nausea was so intense that I feared to repeat the dose. After three days had passed, I ventured to give the pilocarpine in tablets by the mouth, and in this way the drug was borne very well and produced profuse diaphoresis. This treatment was kept up for four weeks and was then stopped. The atropine was continued but the bandage was discarded. The vitreous became entirely clear, and the detachment had shifted its position to downwards and outwards. The vision slowly improved and the detachment grew gradually smaller until on May 18th it had entirely disappeared. Vision was then 18/40— with a sph.—D 4, and she could read Jaeger 4 fluently.

CASE XXXVIII. Mr. E. V. H., aged 53. First seen February 6, 1894. Fourteen years ago he suddenly lost the vision of the right eye from extensive intra-ocular hemorrhage, from which the recovery was very slow. Several times since then there has been a recurrence of the hemorrhages, but always slight in degree. On three occasions there have been mild attacks of iritis in this eye, which subsided under appropriate treatment. The vision has been quite defective in this eye until ten days before I saw him, when it suddenly became very much worse, and he supposed another hemorrhage had occurred. An examination showed :

R. E., fingers at one foot eccentrically. Discolored iris, with an oval pupil, long diameter vertical. Posterior synechiæ. Lens slightly cloudy at periphery. Vitreous slightly hazy. Detachment of the retina downwards and outwards.

L. E., 18/40—, unimproved. Media clear. Fundus normal.

Six weeks constant treatment by atropine, bandage, and minute doses of potassium iodide and mercuric bichloride caused

a cure of the iritis, absorption of the posterior synechiæ, a clearing up of the cloudy vitreous, and some slight improvement in the vision, but the detachment of the retina remained unchanged. The repeated hemorrhages which had occurred had probably caused such disorganization of the retina and choroid, that no useful improvement of the vision could ever be expected. This patient was seen as recently as May 16th, and the condition of the fundus and vision remained unchanged.

DISCUSSION.

DR. SAMUEL THEOBALD of Baltimore.— I should like to ask Dr. Bull how he makes the puncture in the sclera; what knife he uses.

DR. BULL.—I always use the narrow knife of Von Graefe, making the puncture in the sclera in the quadrant corresponding to the detachment; always making a wound through the conjunctiva at some distance from the point I desire to reach, and pushing this aside until I get at the proper place. I have not found it necessary to unite the conjunctival wound by suture. The edges coapt themselves without any binding suture.

DR. THEOBALD.— Did Dr. Bull make the puncture only to the extent of the knife-blade?

DR. BULL.— I always enlarged it, making a wound $2\frac{1}{2}$ to 3 millimetres in length. As to Schœler's operation, which Dr. Risley just now asked me about, it consists in making a puncture through the sclera, choroid, and retina, into the vitreous chamber, and injecting from 2 to 6 drops of the tincture of iodine slowly, and awaiting the results which he hopes for by inciting inflammation in the vitreous humor. Three years ago I reported to this Society a series of five cases in which I had performed this operation, with the most lamentable results. The experience then gained proved to me that the method recommended by Schœler should be positively abandoned.

DR. G. E. SCHWEINITZ of Philadelphia.— I have listened with much pleasure to Dr. Bull's interesting paper, chiefly because it gives me an opportunity to compare my own experience in the Philadelphia Hospital on the value of operations for the relief of detachment of the retina with his own, and I find myself in accord with the statement that operative interference is frequently unavailing, and that in many cases we are in possession of no better therapeutic measure than the so-called "rest cure." I have recently published in two

papers some results of my own with scleral puncture, which have value chiefly because I was enabled to follow the cases for long periods of time, and observe the ultimate results. It is evident that primary cures with this method of treatment are often followed by re-detachment.

I would like to call the attention of the Society to the use of one drug in the medical treatment of detachment of the retina, namely, salicylic acid. This is by no means a novel suggestion, as it is one of the drugs ordinarily found in the list of those recommended to aid in the absorption of the subretinal fluid. I was particularly led to its use after reading the very interesting results published by Dr. George Dock, of the University of Michigan, in the treatment of pleural effusions by the administration of frequently repeated small doses of salicylic acid. From the standpoint of the physiological action of drugs I do not know that it is any better than pilocarpine, but I have been impressed with the point made by Dr. Bull, that old people, such, for example, as I am accustomed to treat in the hospital before referred to, suffering from cardiac weakness, bear pilocarpine badly, though salicylic acid, carefully administered, may be given without untoward effects. I have not used it to the exclusion of other treatment; that is to say, the patient has also been put to bed, the compress bandage has been applied, and the pupils have been kept dilated with atropine, and although I cannot say that I have ever observed a retina replaced under the influence of this drug, I have seen the field of vision markedly improve, together with a corresponding improvement in direct visual acuity. If, as seems evident, salicylic acid has the power of stimulating the absorption of a pleural effusion, there is good reason to believe that it ought to have a similar effect in cases of spontaneous detachment of the retina.

TWO CASES OF SYMPATHETIC INFLAMMATION.

BY DR. F. M. WILSON,

BRIDGEPORT, CONN.

Cases of sympathetic plastic irido-choroiditis, with their inflexible rule of blindness, are dreary reading at the best, and I have sometimes wondered how many such cases it takes to convince the average man that there are no exceptions to this rule. When I sent my title to the committee I had under my care two cases of sympathetic irido-choroiditis of this plastic variety, in which useful vision had persisted for about a year, since that time "the rule" has claimed one of them; his vision has gone down to 3/200, and will probably continue to "go." The other is as follows:

CHARLES HAMMILL, age 7, October 10, 1891. — Hit in right eye with a piece of wood, size unknown, about two hours ago; rupture of globe, 4 to 5 mm. long in ciliary region below; some vitreous lost; vitreous hanging from wound; anterior chamber filled with blood; good P. L.

December 8, 1891 (two months later). Right eye quiet; total posterior synechia; lens opaque; eyeball soft; defective P. L.; enucleation advised, but declined. I did not see him again until

January, 1893 (two years later), when I treated him for suppurative otitis, and again advised enucleation of right eye, without success.

May 15, 1893. He comes with irido-choroiditis established in left eye; slight redness; slight photophobia; yellowish exudation on surface of iris and into pupillary space; four-fifths of pupillary edge of iris adherent; vitreous cloudy; R. V. = doubtful P. L.; L. V. = $\frac{20}{80}$. Preventive enucleation was, of course, no longer possible, nevertheless, as there was no possibility of sight in the right eye, it was enucleated on *May* 17, 1893.

June 1, 1893. Vision has gone down to 4/200, chiefly by reason of increased opacity of vitreous.

On September 8, 1893, eye quiet; redness and photophobia gone; L. V. = $\frac{20}{200}$.

Feb. 14, 1894.	*May* 11, 1894.	*May* 18, 1894.
L. V. = $\frac{20}{100}$.	L. V. = $\frac{20}{70}-$.	L. V. = $\frac{20}{70}+$.

The iris has been kept continuously under the influence of atropine, which has been practically the only treatment. He took hydriodic acid for several weeks, but has had none for nine months or more.

In place of the excluded case I have taken the liberty to report another, where the question might be raised as to whether enucleation did not cause inflammation in the other eye.

MRS. ARTHUR W., age 30, December 6, 1893. — In October, 1882, eleven years ago, she first came to me with large central perforation of left cornea, the result of purulent conjunctivitis. At that time a large leucoma formed with complete anterior synechia, and slow disorganization of left eyeball since 1882. This disorganized globe has become red and painful quite a number of times, and that is what she now comes for.

December 12, 1893. Under leeches, atropine, and hot water, the left eyeball is getting quiet; no symptoms in right; R. V. = $\frac{20}{20}$ and No. 1 at 6 in. I next saw her on

February 10, 1894. She has now another attack of pain and redness in left eyeball, and for the first time is willing to consider the question of enucleation. Again under leeches, atropine, and hot water, the eye got quiet, and on

February 28, 1894, I enucleated it at the Bridgeport Hospital. The tissues about the ball were more or less matted together, but the enucleation was easy, and nothing unusual occurred.

One maneuver, perhaps, should be mentioned. For a year or more at all my enucleations, just before the dressings were applied, I have flooded the tissues with absolute alcohol — *i. e.*, taking a piece of cotton or gauze saturated with alcohol, with a gentle boring motion I have thrust it to the very bottom of the cavity from which the eyeball came. It has always seemed to me that the healing took place much more kindly.

March 1, 1894. First dressing; wound healing kindly.

March 2, 1894. Wound healthy.

March 3, 1894 (three days after operation), she was discharged from hospital.

Up to the day of operation her right eye was tested, either by my associate, Dr. Miles, or myself, every day, and we always found $\frac{20}{20}$ vision and good accommodation, with absence of pain, redness, photophobia, or epiphora. During the four days she was in the hospital her vision and accommodation were not tested, but she did not have pain, redness, photophobia, or epiphora.

March 7, 1894. During last night pain suddenly attacked right eye. It was severe enough so that her husband gave her two $\frac{1}{8}$-grain morphine pills before morning. She now comes to office with pain, redness, photophobia, and epiphora. Her vision is $\frac{20}{20}$; she reads No. 1 Jaeger at six inches. There is no pink zone over ciliary region; the engorgement is principally of the large blood vessels. There is distinctly more redness over the external rectus than in other parts of ball. This area is also tender to touch, while other parts of eyeball are not. The iris reacts promptly to light; there are no posterior synechiæ. In an eye unexposed to sympathetic inflammation, I should have made a diagnosis of episcleritis.

March 14, 1894. Symptoms have slowly subsided. The pain has seemed out of proportion to the other symptoms. Hot water fomentations locally and antipyrin in 5-grain doses internally have given her more relief than anything else.

March 15, 1894. Relapse; eye very red and painful again; kept her awake all last night; slight chemosis; hot water and antipyrin resumed.

March 26, 1894. All pain has gone; slight redness persists.

April 5, 1894. Eye quiet; vision normal.

There are three ways of explaining this case:

1st. That the pain, redness, etc., had nothing to do with the other eye.

2d. That sympathetic irritation started before the enucleation, but was in some mysterious way delayed on the route.

3d. That the enucleation caused the sympathetic irritation.

The last seems to me most probable.

TWO RECENT MAGNET OPERATIONS — ONE AN IDEAL SUCCESS, THE OTHER A TOTAL FAILURE — WITH REMARKS.

BY DR. HERMAN KNAPP,

NEW YORK CITY.

CASE I. — Fragment of steel in lower part of retina; removed with magnet three days after injury. Ideal recovery.

Alfred Stevensen, a car-builder, aged 37, of Dover, N. J., was sent to the New York Ophthalmic and Aural Institute, in the afternoon of February 23, 1894, by Dr. Derry. He said that between 11 and 12 o'clock the same day, when he was striking a steel bolt with a hammer, a piece flew off and struck his right eye. Experiencing some pain in his eye, and unable to see quite as well with it as with the other, he went to the doctor, who examined him and sent him at once to the clinic. There was a small linear wound at the outer edge of the cornea, 2–3 mm. long, closed; some conjunctival injection and lachrymation; cornea, anterior chamber, and lens normal; vitreous slightly turbid, with some flakes on temporal side, and an air bubble in upper part; retina congested and somewhat hazy; in its lower part there was a chip of steel distinctly seen, with small hemorrhages around it. V. = 20/50; L. V. = 20/20. He was put to bed, and advised to lie on his back as quietly as possible until the next day, when the foreign body was to be extracted.

February 24th, in the afternoon, he was examined before the pupils of the "Institute," who all saw the foreign body and the air bubble. All the irritation had left the eye, the patient felt no discomfort, and saw with that eye as well as with the other (20/20). He could no longer be persuaded to have anything done with it, but was determined to go home at once. Under these circumstances, I told him to go to bed as soon as he was home, and keep his bed for a few weeks, during which time the foreign body might be fastened, and not do any harm

later. He should, however, let Dr. Derry examine his eye every day, and if inflammation set in, to come back at once, and have the little fragment taken out. He went, but returned two days later. Circumcorneal injection, lower part of fundus hazy, foreign body still in the same place; but its longest diameter now turned horizontal, from almost vertical, as it was before. The retina around it hazy; the bubble no longer seen. V. = 20/50. Patient now asked to have the foreign body removed, which was done without delay.

Operation. When cocainized, the eye was incised with a Baer's knife, which was thrust obliquely through the conjunctiva and the other coats, in front of the equator, between the external and inferior recti muscles, near the place in which the foreign body was seen with the opthalmoscope. The wound was 4 or 5 mm. long, and when the knife was withdrawn closed perfectly, without presentation or escape of vitreous. It was held open by the sterilized curved end of a platinum wire, used as a bacteriological inoculation rod. The sterilized thicker tip of a Hirschberg electro-magnet was introduced 4 mm., and withdrawn at once. The chip of steel hung on it. The platinum loop was taken off, no vitreous escaped, and the wound closed firmly. The eye was covered with corrosive sublimate gauze and a small pad of wetted absorbent cotton, held in position by two strips of isinglass plaster.

There was no reaction to speak of. The circumcorneal injection and turbidity of the vitreous disappeared; the wound united firmly; the seat of the foreign body in the background of the eye was marked by a small white patch, the lacerated retina, and choroid. The patient was discharged twelve days after the operation, cured. V. = 20/20; F. and T. normal. Has been seen several times since. The eye has continued good.

Another case, where the patient came too late, and the operation failed, was the following:

CASE II. — Piece of iron penetrated eye; interior disorganized; foreign body not found with magnet, nor after enucleation.

John Rordgren, aged 24, foundry workman, Boston, Mass.

Seven weeks ago, while striking a piece of iron, a chip flew off and entered his right eye. The eye has been blind since that moment, but only moderately inflamed. When he came to the clinic there was cataract, the eyeball soft, no perception of light in the upper part of the visual field. I inferred from this condition that the foreign body lay, as usual, in the lower part of the vitreous, having caused inflammation and detachment of the retina; accordingly advised the patient to let me try to extract the foreign body with the magnet, and, in case of failure, take his eye out, to which he consented. I made an incision in the lower outer part of the sclerotic; introduced the magnet several times, without touching the foreign body; then enucleated the eye, and opened it at once. The vitreous was filled with an opaque, soft, partially gelatinous, partially fibrous mass in its lower portion, the upper being of the same condition, only less marked. The foreign body could not be found, either by careful ocular inspection, or by searching with the electro-magnet, or by palpation with the finger. It might have passed out of the eye, though a scar in the sclerotic could not be found.

Foreign bodies, after penetrating the eye, usually remain in it, but numerous examples are on record where they pierced also the posterior wall of the globe, and were found in the optic nerve or in the orbit, or not detected at all. I show you an eyeball which was injured by a foreign body, and taken out six months later (March 19, 1894), sightless, shrunken, and irritable. The interior was disorganized. The small foreign body struck obliquely in the posterior part of the sclerotic, its sharp point projecting over the external surface, as you can see and feel.

The extraction of iron or steel foreign bodies from the interior of the eye with the magnet has given me but very few permanently good results, if I except those cases where the foreign body was situated in the anterior part of the eye — *i. e.*, the anterior chamber, iris, and lens. Rarely we have an opportunity to see the patients and treat them soon after the accident, when we can recognize and remove the foreign body readily. Even if the patients come early, the foreign body can

be directly seen, in most cases, only when it did not pass through the lens. Larger statistics have been published by Hirschberg, and lately (*Arch. of Ophth.*, 1894, p. 167) by Hildebrand, from the practice of Dr. Mayweg of Hagen, Rhenish-Prussia. Hirschberg introduced the electro-magnet into the vitreous in 65 cases, and succeeded in extracting a foreign body only in 29, *i. e.*, 44%; Mayberg, out of 51 cases, in 38, *i. e.*, 74%; Hirschberg obtained good vision in 7 cases (10%), Mayweg in 31%.

My own experience in extraction of foreign bodies from the depth of the eye is by no means so favorable. The cases in which permanently good vision, without subsequent detachment of the vitreous and shrinkage of the eye, was obtained have been exceptional.

The question arises whether we should not leave foreign bodies alone when they are imbedded in the background of the eye without causing irritation. There are a number of such cases on record; a few recent ones are published in the last number of the *Archives of Ophthalmology*. I should say, if we can detect and localize them some days or a few weeks after their entrance, I would advise extracting them; if later, I would not interfere as long as they cause no irritation. I pass round three ophthalmoscopic drawings, in which foreign bodies, clearly seen with the ophthalmoscope, had been tolerated in the background of the eye. In two of them they worked loose — the one in five months, the other later. Both eyes were lost. In the third the foreign body was very small, and thus far has produced no irritation.

As regards the operation, I used and would recommend the two following modifications:

1. *Make the incision obliquely through the sclerotic*, because such a wound, after the operation, is firmly closed by the vitreous pressing the sharp inner lip of the inner side of the wound against the outer lip, thus favoring rapid union, preventing presentation and escape of vitreous, with their consequences, of which the later development of fan-like cords in the vitreous, starting from the scar, are particularly prejudicial to the preservation of good sight.

2. *During the introduction and withdrawal of the magnet keep the wound open with a sterilized platinum wire, or a similar instrument.* In this way the foreign body will not be easily stripped off from the lips of the wound.

Two years ago Prof. Haab of Zurich communicated to the German Ophthalmological Society of Heidelberg some remarkable cases in which iron foreign bodies had been moved from the depths of the eye into the anterior parts, even through the lens, by a very strong electro-magnet, a Ruhmkorff coil. These experiments were confirmed by Dr. Schlosser in the same society last year. They open a new field, to cultivate which in this country we should not be slow.

DISCUSSION.

DR. C. W. KOLLOCK of Charleston, S. C.— I would like to mention a complication which happened in a magnet operation in my own practice, and would like to know if any of the members present have had a similar experience. In this instance, the patient had the lens punctured by a piece of steel. A portion of this was in the anterior chamber and a portion in the lens. The iris became attached to the piece in the chamber and after the incision was made in the cornea and the magnet introduced I could not succeed in drawing it out Finally, I had to do an iridectomy. In performing this, the steel was pulled out of the lens but fell into the anterior chamber. There was an immediate hemorrhage from the iris which filled the chamber. This, of course, was very annoying because it is very hard to get rid of hemorrhage in the anterior chamber, and I thought all my work was spoiled for the time being. I introduced the magnet to search again, and the hemorrhage clotted immediately. I then fancied I was in a worse position than before, but I was mistaken. This proved to be my salvation, for I could push the clot aside and leave a clear space, which I did by using the iris forceps. After introducing the magnet again, the piece of steel flew out from under the clot and became attached to the magnet, and I succeeded in getting it out with the aid of the forceps. This clotting of blood was a complication which I had never seen before.

DR. W. S. DENNETT of New York.— I would like to ask, Mr. President, about the coil of wire spoken of by Dr. Knapp?

DR. H. KNAPP.— The eye was applied to the broad end of a Ruhmkorff coil, so that the full force of the coil was obtained and this was done only with the idea of drawing the steel where it could be extracted afterwards in some other way.

DR. JOHN GREEN of St. Louis.— In Dr. Knapp's paper allusion was made to the accident of the foreign body being wiped off in the act of withdrawal through the scleral wound. Most electro-magnets in the market have tips which are nearly cylindrical, or slightly conical. My colleague, Dr. A. E. Ewing of St. Louis, some years ago, had an electro-magnet made with a broad, flat pole, which is introduced through a linear incision with greater ease than the usual blunt conical pole, and which, after the attachment of the foreign body, is turned transversely to the direction of the scleral wound, thus enlarging the opening at the moment of withdrawal. Quite large chips of steel have, in different cases, been thus removed, and there has been very little tendency to rub off the piece of steel at the moment of exit. I think that this flat form of tip has a very decided advantage over the ordinary conical tips, of circular cross section, such as are ordinarily provided by the instrument makers.

DR. H. KNAPP of New York.— Just one word in concluding this discussion. Dr. Green mentioned a flattened tip for the electro-magnet. This, I think, is very appropriate. A flattened tip has been used by Dr. Mayweg with advantage for the extraction of pieces of steel, particularly when they were more or less firmly embedded in the iris. By lateral movements of the electrode he could loosen them, and in withdrawing dilate the wound by turning the flattened tip.

FOREIGN BODIES IN THE ORBITAL CAVITY.

BY WALTER B. JOHNSON, M.D.,

PATERSON, N. J.

The cases of foreign bodies in the orbital cavity, herewith reported, are of interest because of the very considerable size of the bodies themselves, the demonstrated ability of the orbital contents to withstand the ravages of the inflammatory processes induced by their continued presence, and the comparatively satisfactory results attained, except in case No. 2, which terminated in death as a result of suppurative meningitis induced by perforation of the right anterior lobe of the cerebrum.

The size of at least one of the other foreign bodies, *i. e.*, case No. 1, would seem to indicate the certainty of its having penetrated the cerebral cavity, although there was no evidence of any inflammatory process having occurred as a result, and no method of determining its exact course.

CASE I. C. B., age 14, 1886.

The patient applied for treatment at the Paterson Eye and Ear Infirmary, stating that one week previous to his present visit he fell from a cherry tree while picking cherries, striking the left side of his face upon a number of dead cherry branches, receiving several lacerated wounds about the forehead and nose and a punctured wound of the left upper eyelid. A physician of the city of Passaic, at which place the accident occurred, was called and sutured the wound in the lid. He suffered great pain during the night, and the eye, which commenced to swell immediately after the injury, became still more prominent. The day following the injury he called upon Dr. H. D. Withers of Paterson, N. J., who resorted to antiphlogistic treatment, which had no beneficial effect, the exophthalmos continuing to increase and the œdema of the lids continually progressing.

July 16th. The patient was referred to the Paterson Eye and Ear Infirmary for treatment. Ether was administered. An examination disclosed a complete ptosis of the lid, which was

reddened and distended, considerable exophthalmos and some conjunctival chemosis. The swelling of both eyelids was so extensive that sufficient separation could not be made to permit satisfactory examination of the eyeball. The wound in the upper lid, which was situated in the median line about midway between the margin of the lid and the eyebrow, had undergone almost perfect union, one small point only remaining open. There was no perception of light; on palpation a hard substance was discovered under the upper eyelid immediately behind the punctured wound.

The edges of the wound were freely separated with the scissors and a foreign body located at a point fully one-quarter of an inch behind the outer edge of the wound. It was seized with a pair of strong forceps and removed, considerable force being necessary to dislodge it; its course seemed to be backward and somewhat downward towards the apex of the orbital cavity. Its removal was not followed by the discharge of pus.

The foreign body was a piece of dead cherry branch and was two and three-quarters inches in length and one-quarter of an inch in thickness; the bark was intact; the end which penetrated the orbital cavity was broken in a sharp jagged point, the outer end being almost flat.

The wound was left open and the eye dressed with cooling lotions. During the following day the pain, which had been very severe, subsided. The wound healed kindly and without any material suppuration; the exophthalmos, œdema, and inflammation gradually diminished. There were no symptoms of cerebral affection either during the week that he carried the foreign body in his orbit or the ten days subsequent to its removal, although it seemed that the foreign body must have passed backward into the orbit and probably through the sphenoidal fissure into the cerebral cavity.

July 26th. Ten days after the removal of the foreign body the boy left for his home in Brooklyn and subsequently con-

sulted Frank W. Ring, M.D., of New York, who treated him and reported his case in the *New York Medical Record* of August 13, 1887, in part as follows:

July 28th. "There is complete ptosis of the lid; it is swollen, red, and œdematous, capable of no movement whatever. The eyeball is natural in appearance; complete paralysis of all the muscles; absolute loss of movement of the eye. Pupil slightly dilated, not susceptible to light. Vision limited to slight perception of shadows. Ophthalmoscopically there are no marked changes, blood vessels good size, no tortuosity, slight œdema of the disc with some grayish haziness; complains of the unpleasant sensation caused by the drooping lid; no pain."

February 22, 1887. "The vision has not improved to any marked degree during the last three months. From fingers at two feet he now sees 6/200. There is slight ptosis. A divergence from insufficiency of the internus not disagreeably marked. The pupil semi-dilated and fixed. The nerve is bluish white — blood vessels of retina decreased in size. Has no pain and little discomfort from loss of vision. The right eye has $20/15 \times H$ .75 D. General condition excellent."

"Several instances have occurred where larger foreign bodies than this have remained undiscovered back of the eye in the cellular tissue, and even penetrating into the brain; but I can find record of none occurring where the ultimate result of such injury was attended with so little calamity."

CASE II. J. P., age 49, Holland.

On the 26th of April, 1894, was brought to St. Joseph's Hospital, Paterson, N. J., from Boonton, with the following history:

On the morning of this same day, he was running a circular saw, when the power was suddenly increased, causing a pine plank he was sawing to be shivered, sending small splinters in all directions. A piece of the plank struck him in the right eye, causing several wounds of the eyelids and the conjunctiva.

April 27th. On examination the upper eyelid was found to be entirely cut through about in the median line; the cut extending from the margin of the lid towards the temporal side of the eyebrow upwards and outwards one inch and a quarter;

there was a vertical incision three-quarters of an inch in length across the inner canthus through the upper eyelid and entirely detaching the lower eyelid, which was torn off for a distance of one inch through conjunctiva and skin; a portion of skin was also torn from the cheek below this point up to the cut over the inner canthus; the lids were œdematous, although the ocular conjunctiva was not materially involved; there was a small cut in the eyeball on the nasal side about at the limbus, the pupil was widely dilated, the globe was tense, the impact of the blow having caused an extensive intraocular hemorrhage. At a point fully half an inch behind the plane of the eyeball there was lodged a foreign body. There was no perception of light. The patient was etherized and the foreign body seized with a pair of thumb forceps and easily removed; it was a splinter of pine wood, two and one-eighth inches in length, and about one-quarter


Case N°2

of an inch square. The direction was backward and upward. The eyelids were carefully sutured. Hot applications were ordered, and an occasional drop of a solution of sulphate of atropia, four grains to the ounce, and a hypodermic of morphine if pain was severe. On the evening of the operation the temperature was 101°; it fell to 100° next morning, and remained within one or two-fifths of this temperature for the next five days.

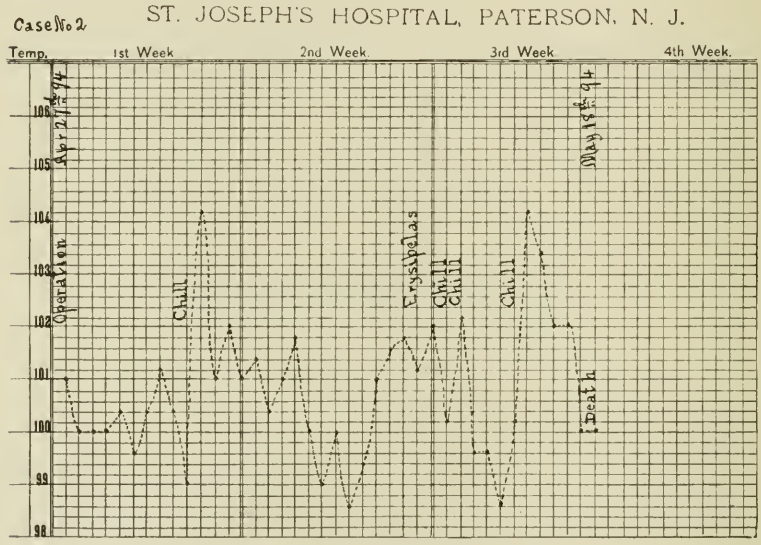
April 30th. Three days after the operation, a purulent discharge appeared at the conjunctival wound, the œdema had diminished, the pain disappeared, and the patient was quite comfortable; the sutures were removed, and considerable union had taken place; the lower lid, however, had separated at the inner canthus.

May 3d. On the afternoon of the sixth day he was allowed to sit up, but had not been out of bed fifteen minutes before he had a severe chill followed by an elevation of temperature of $104\frac{1}{5}°$.

May 4th and 5th. The following two days were very restless. He was delirious, and when he could talk intelligently,

he complained of severe headache, especially in the back of his head.

May 6th, 7th, 8th, and 9th. For the following six days after the chill, his temperature ranged from 101° to 102°; during this time the œdema constantly decreased, but the headaches continued, and the purulent discharge increased; the eyeball became progressively worse; suppurative choroiditis developed.



May 10th to 15th. At the end of the second week erysipelas of the face extending to the head, and involving both ears, appeared. He again became delirious, and remained so for the greater part of the time that the erysipelas lasted. Lead and opium wash was applied constantly. Iron and quinine was administered; he drank large quantities of milk. During the erysipelatous attack the panophthalmitis progressed very rapidly and the cornea sloughed. He had several chills during this stage; his temperature ranging around 102°; in his lucid moments he complained of excruciating pain in his head.

May 15th. His temperature fell to normal, the erysipelas entirely disappeared, the delirium subsided, and he became rational for twenty-four hours. The following day another chill

and temperature of $104\frac{2}{5}^{\circ}$ induced delirium and restlessness so that he could with difficulty be kept in bed.

May 17th. His condition was fair and the indications were favorable, but at night his restlessness returned; there was a very copious semi-purulent discharge; the cornea separated and the contents of the eyeball escaped. He was mildly delirious, and had a constant diarrhœa.

May 18th. He grew steadily worse, and in the morning, at 8 o'clock, died, just three weeks after the foreign body was removed from the orbital cavity.

The data for the history of the case was kindly furnished by J. D. Gressim, M.D., house surgeon at the hospital.

Autopsy eight hours after death, rigor mortis present; the eyeball, which was moderately full yesterday, is flat, the contents of the globe having been discharged during the night; the œdema of the eyelids which was very well marked yesterday has entirely disappeared. The calvarium was removed, over the cerebrum under the dura mater there were extensive deposits of pus and lymph, both hemispheres being involved. The left side, although opposite the injury, had been the more seriously infected, and contained the greater quantity of the new deposit. The vessels of the membranes were engorged, especially over the occipital lobe, and there were several deposits of lymph on the under surface of the dura mater, involving the dura mater; the pus deposits were upon the arachnoid, and there was some serum under the arachnoid, but no purulent or lymphoid deposit had occurred there. There was no deposit of lymph or pus at the base of the brain except at the point of perforation. The right frontal lobe on its orbital surface had been perforated by the foreign body and had undergone inflammation, softening, and disintegration.

The orbital plate of the frontal bone was fractured and was displaced; the fracture, which was very extensive, extended from a point on a line with and one-half inch to the right of the crista galli outward three-eighths of an inch and backward to one and one-half inches to and involving the sphenoidal fissure and the optic foramen extending through the lesser wing of the sphenoid bone and along the articulation of the orbital plate of

the frontal bone with the cribriform plate of the ethmoid. The edges of the fracture were separated about one-quarter of an inch at the point at which the foreign body penetrated the cerebral cavity, which was about midway between the point at which the line of fracture began and the sphenoidal fissure.

The brain substance was normal and had apparently undergone no inflammatory action except at the point of injury where the softening and disintegration had occurred; this softening involved the brain substance for a space equal to the size of a silver dollar, and extended into it for about one-half inch, beyond which point the brain tissue seemed perfectly healthy. The fluid in the ventricular cavities was slightly turbid, but there was no apparent distension or congestion.

CASE III. O. L., aged 8, German, Dec. 26, 1889. The patient, a strong, well nourished boy, applied at the Paterson Eye and Ear Infirmary for treatment, and stated that two days previous to his present visit, while running, he fell upon a piece of stick which he was carrying in his hand, and that a large splinter had penetrated the eyelid. A neighboring woman removed the splinter and in pulling it out was obliged to use great force.

When his mother, who was out at work, reached home, she found him suffering great pain and there was excessive tumefaction of the eyelid, which progressed continuously and was accompanied by increased pain, which was so severe that he was

unable to sleep. The patient was very weak and dizzy and vomited several times during the afternoon and evening. The day after the injury the pain and swelling had increased, the vomiting and dizziness had subsided. He was then brought to the Infirmary.

December 26th. On examination of the right eye a small scab about $\frac{1}{8}$ of an inch in diameter indicated the point at which the punctured wound was located, which was in the upper eyelid about one-quarter of an inch from the median line and nearer the eyebrow than the margin of the lid. There was some exophthalmos, sub-conjunctival ecchymosis and chemosis of the ocular conjunctiva, especially at the upper and outer side in the vicinity of the wound. The eyelids were swollen and œdematous, the upper lid being inflamed, reddened, and very tense. On forcible palpation a foreign body was located deep in behind the point of the puncture. There was slight perception of light. The pupil was dilated and fixed. The pain was so severe and the lids so difficult to separate that a satisfactory ophthalmoscopic examination could not be made. There was complete ptosis and the movements of the eyeball were very limited, especially outward and upward. Ether was administered, the small scab was removed and a slight purulent discharge oozed from the wound. The foreign body was located; it was situated fully one-half inch behind the edge of the wound. The eyelid was incised from the wound outward and inward, and the foreign body seized by a pair of strong thumb forceps. It was easily removed. There was no discharge of pus from the deeper part of the wound. The course of the foreign body was almost directly backward. It was a piece of pine wood one and one-quarter inches in length and about one-eighth inch in thickness; it was nearly square.

Case N°3

There was no subsequent discharge from the wound, which healed kindly. The pain rapidly subsided. All of the inflammatory symptoms continuously improved. At the end of three weeks the eye had entirely resumed its normal appearance and

the muscles regained their full strength. The vision had steadily improved and was 20/30 in the affected eye.

July 21, 1891. Nearly two years after the injury he was again examined; there was no difference in the appearance of the eyes except a slight scar on the right upper lid and the vision was 20/15 each.

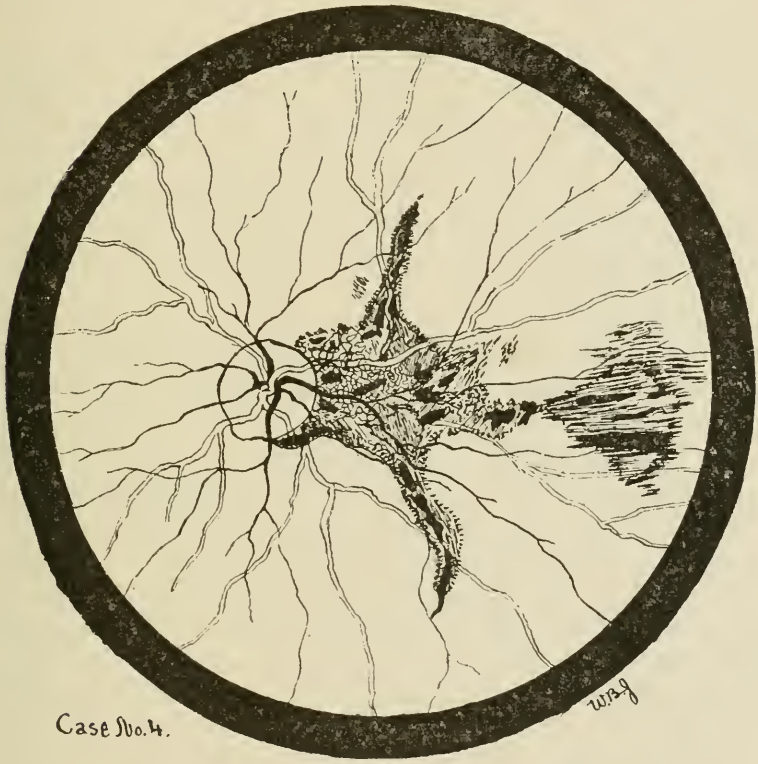
CASE IV. W. M., aged 36, U. S., 1888. Applied for treatment at the Paterson General Hospital, stating that while engaged in firing salutes for a political procession the cannon was prematurely discharged by the concussion of the ramrod and he received an injury.

On examination thirteen hours after the accident the face was found to be literally filled with cannon powder, dry grass, and stubble, with which the cannon had been wadded. He had an extensive scalp wound and a lacerated wound of the hand; the little finger was torn away. The eyelids were swollen and perforated by bits of the stems of weeds and grass; in the right eye some of the foreign bodies had penetrated the eyeball; in the left eye a number of large pieces of the stems of weeds had passed into the orbital cavity on the nasal and temporal side of the globe, the eyeball itself having escaped serious external injury, although there were many more pieces of grass and weeds than in the right side; three or four grains of powder were impacted in the cornea and two grains passed entirely through it and were lodged in the iris. The pupil was dilated widely and not responsive to light; he had no perception of light in either eye.

September 5th. The patient was etherized and dozens of pieces of dried weeds, powder, grass, and stubble were removed, varying in size from the thinnest blade of grass to the stems of weeds and stubble nearly one-eighth of an inch thick and in some cases fully one inch in length.

The right eyeball collapsed upon the removal of the penetrating foreign body, which had torn a ragged wound through the cornea, destroyed the lens, and entered the cavity of the vitreous. The efforts at the removal of the foreign bodies were continued until everything except some of the powder grains were removed. Active antiphlogistic treatment was ordered.

September 6th. Following the operation, which was very tedious, there was a decided increase in the œdema of the lids, and in the conjunctival chemosis, which increased until the fourth day, when the inflammation which was especially marked in the right eye became more severe. Panophthalmitis developed; enucleation seemed absolutely necessary.



September 11th. The inflammatory symptoms have somewhat abated, an enucleation was postponed; the pain and œdema commences to diminish.

September 15th. The patient has steadily improved; he is now able to see shadows with his left eye, the pupil is still dilated, the vision in the right eye is entirely destroyed, the tension is greatly diminished, and there is commencing phthisis bulbi.

Ophthalmoscopic examination was not satisfactory in consequence of the cloudiness of the vitreous; an extensive subretinal hemorrhage seemed to have occurred. The subsequent course of the disease was uneventful; the symptoms gradually disappeared.

September 29th. He was allowed to return home, his vision being about 6/200. From this time his improvement has been very slow, but positive until the present time.

Present condition, May, 1894. The right eye has developed phthisis bulbi, the cornea is partially destroyed and the eyeball sunken and irregular; there are several cicatricial contractions; he has never had any pain since the subsidence of the original inflammation. The left eye has a large symblepharon on the temporal side of the globe resulting from conjunctival contraction. The eyeball is discolored by powder stains; the pupil reacts promptly to light.

Ophthalmoscopic examination reveals an extensive rupture of the choroid, which is situated on the temporal side of the optic nerve entrance and extends to the extreme limit of the field as depicted in the accompanying cut.

The character of the rupture would seem to indicate that it was partially the result of direct violence upon the peripheral portion of the injured choroid, and partly the result of contra coup on the part of the choroid near the nerve entrance; at these points there seems to exist two separate and almost distinct ruptures; the concussion from the cannon added to the force of the foreign bodies striking the eyeball must have been very great.

R. V. = 0.

L. V. = 10/200.

He has a sensation of light in the left eye which constantly flitters before the eye night and day and can be seen even when the eye is closed. He describes this light as a black center surrounded by moving light, which is no doubt due to the blind spot in the field of vision caused by the choroidal rupture. He was for some time after the injury troubled with rainbow light flashes, which would circle around and then burst. As time passes he sees less of these and he thinks his vision has

steadily but very slowly improved. He has at present no discomfort except the inability to see. He used to suffer from photophobia, but it has now entirely subsided. He is and has been constantly employed as night watchman. There has been no change in the objective or subjected symptoms observed at any examination which has been made during the past two years.

DISCUSSION.

DR. H. KNAPP of New York.— Foreign bodies in the orbit are sometimes very difficult to deal with, both as to diagnosis and treatment. A few months ago I was called by a surgeon to see in consultation a boy who had been wounded by a No. 22 birdshot, which had entered the upper inner corner of the orbit. The eye did not move upwards and the upper part of the orbit was hard, evidently filled with blood. As we could not locate the body we agreed that the most advisable course to pursue was to wait. This course was followed, and the boy, who had had complete ptosis, recovered the mobility of his eye to a certain degree. When I first saw the patient, immediately after the injury, there was a good deal of blood in the interior of the eye, in the inner upper part, the retina was raised, apparently detached; lower down, I could not see the fundus clearly. I thought that this was simply owing to the foreign body having struck the eye on the posterior part outside and producing hemorrhage inside. Now the interior of the eye has cleared up, in the inner upper part there is a long scar about five or six diameters of the optic disc, and around it a good deal of black pigment. Below the optic disc there is a hemispherical elevation of two disc diameters in breadth and three in length. Its crest is seen sharply with strong convex lenses. The retina covers this foreign body without any movement, and the surface of the elevation is slightly striated and grayish white. From all this I could only conclude that the bullet had not merely struck the sclerotic, but had pierced it, entered the eye, and is now fastened at the background in the lower part, causing irritation. The fourth case of Dr. Johnson reminded me of this case.

DR. W. B. JOHNSON of Paterson, N. J.— I remember a case somewhat similar to the case mentioned by Dr. Knapp, in which a shot from a shotgun — birdshot — passed entirely through the eyeball. I think I reported that case with some thirteen or fourteen other cases in Milwaukee, last year, under the title of "Quiescent Foreign Bodies." That birdshot, however, differed from his case in that it passed entirely *through* the eyeball, and

there was a subsequent return of normal vision in that eye, although the shot passed just without the limbus in the ciliary region, and the point of location at which the shot passed out of the eye could also be demonstrated on the fundus by ophthalmoscopic examination. It became a foreign body in the orbit, and became encysted there, I suppose. There was no further trouble, and the vision became normal.

I think these cases of foreign bodies in the orbital cavity are very interesting. Fortunately we do not see very many of them, and I think it is a very good thing that we do not, although the orbital contents, certainly in a great many instances, are able to withstand a great deal of injury and come out of it in very good condition. Case No. 2, however, in which the foreign body penetrated the cerebral cavity, was very serious. In the reported cases of foreign body in the orbit which came to autopsy, the cerebral cavity had generally been penetrated and cerebral disease had resulted. Whether many of the other cases which recovered, although the foreign bodies were so large as to have almost certainly penetrated the cerebral cavity, really did recover after such penetration, can only be conjectured, although the indications all seem to point to the probability of such injury occurring without fatal termination.

THREE CASES OF MALIGNANT TUMOR OF THE ORBIT.

By GEORGE C. HARLAN, M.D.,

PHILADELPHIA, PA.

The great variety and grave significance of orbital diseases make this always an important subject in clinical ophthalmology, and may justify the report of three cases that have recently occurred in my practice, and which seem to present some points of sufficient interest to claim a few minutes of your time.

CASE I. *Epithelial Orbital Tumor Originating in the Lachrymal Sac; Rapid Recurrence.* J. McC., a farmer, 40 years old, in good general health, was admitted to the Pennsylvania Hospital, November 25, 1893. He stated that his attention had been first called to the right eye about eight months be-

fore by an overflow of tears. Afterwards there was a good deal of pain in eye and temple, and the lower lid commenced to swell.

The lower lid was protruded and the eye was pushed upward and outward by a tumor which reached from the inner canthus to the junction of the middle and outer thirds of the lid, overlapped the orbital margin and extended back into the orbit on the lower and inner side of the ball. It was entirely beneath the conjunctiva, which was not involved, and was solid and very hard to the touch. The nasal sinuses were free from disease.

Vision, 15/cc. With the ophthalmoscope, the fundus was indistinct from haziness of the cornea, but a swelling of the disc could be determined. There were no glandular enlargements.

The tumor was removed on December 2, 1893, through a free incision in the lid, without disturbing the eyeball. It was as large as a small hen's egg and of irregular conical form, was firmly adherent at the lachrymal groove and extended along the floor and inner wall of the orbit, where the bone was denuded of periosteum, nearly to the optic foramen. Recovery was delayed by the formation of an orbital abscess, which was lanced above the ball, but the patient was discharged in good condition in three weeks (January 23, 1894). The eye had no power of adduction.

The growth was examined by Dr. McFarland, Demonstrator in Pathology in the University of Pennsylvania, who pronounced it a "squamous epithelioma, greatly resembling scirrhous cancer, but an undoubted epithelioma."

On March 13th, a little more than three months after the operation, the patient presented himself again. There was no exophthalmos, and vision had increased from 15/cc to 15/40; but a hard mass of considerable size could be felt at the inner canthus and extending back into the orbit in the position of the former tumor. It was decided to remove the whole contents of the orbit, including the periosteum, which was done on March 17, 1894. There was extensive destruction of the walls of the lachrymal groove, making an opening large enough

to admit the end of the little finger. The edges of this opening were cut away with the gouge and the Paquelin cautery was freely applied.

The points of interest in this case are the character of the growth, its place of origin, and its rapid recurrence. Tumors of an epithelial type are rare in the orbit, and have been described as originating in the lids, the conjunctiva, the lachrymal gland, or the mucous membrane of neighboring sinuses. A degenerated dermoid cyst may be the point of origin (Berlin). I have not met in literature with any report of a growth of this kind originating in the lachrymal sac. The history given by the patient, and the conditions revealed by the operation leave no doubt of such an origin in the present case. The earliest symptom was epiphora. The skin and conjunctiva were not involved, and the closest adhesion was at the lachrymal groove, the walls of which were subsequently extensively eroded.

CASE II. *Sarcomatous Growth Completely Filling the Orbit; Apparently Originating in Tenon's Capsule.* S. F., a laborer, aged 52, was admitted to the Pennsylvania Hospital, February 1, 1894. The history of the case was indefinite and obscure. We could only make out that the sight of the right eye had commenced to fail two or three months before, and that the patient had suffered a good deal from pain in the eye and head since that time.

The lids were enormously distended, and the eye, which was sightless, was displaced outward and upward by a hard tumor that filled the orbit. The conjunctiva was chemosed, and the ball was perfectly immovable. The upper third of the cornea was covered by a mass of tissue presenting the appearance of a very dense pannus. There were no glandular enlargements. The contents of the orbit were removed, and were found to consist entirely of a solid mass in which the eyeball was imbedded, no anatomical structures being microscopically recognizable. The ball was compressed to a pear shape and firmly incorporated in the tumor, but the sclerotic was sound. A greater part of the floor of the orbit was destroyed, and there were two holes, about five millimetres in diameter, in the roof. What remained of the periosteum was carefully removed. The patient made a prompt and good recovery.

The tumor was examined microscopically by Dr. H. M. Fisher, Pathologist of the Hospital, who pronounced it a large, round-celled sarcoma.

The chief point of interest in this case is the very rapid development of the tumor. The patient belonged to a class not likely to detect the earliest symptoms of disease, but he stated very positively that he had suffered no inconvenience until less than three months before his admission to the hospital.

The solid incorporation of the eyeball in the tumor, and the encroachment of the growth upon the anterior part of the sclerotic and the cornea point to the capsule of Tenon as the place of origin.

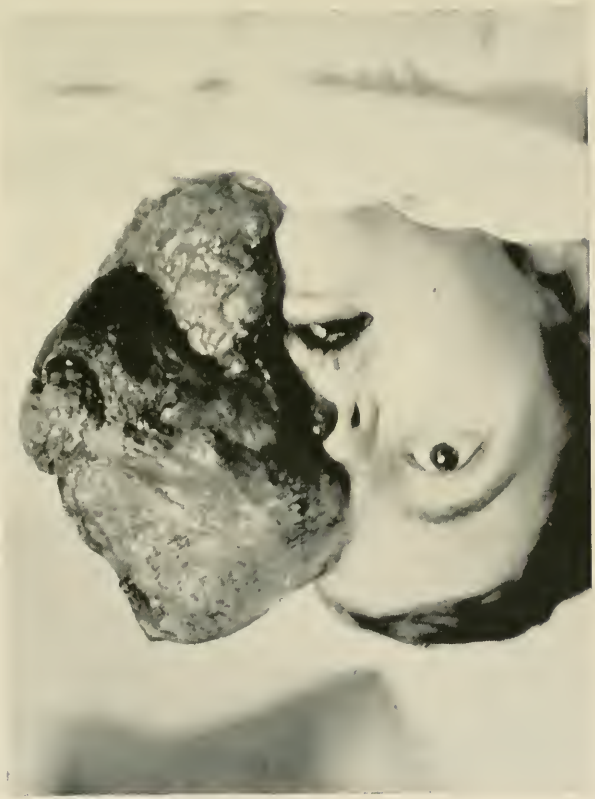
CASE III. *Sarcoma of the Orbit, Rapidly Recurring and Attaining an Enormous Size, in a Child Nine Years of Age.* W. H., a well-developed boy nine years old, rather large and mature for his age, was brought to the Wills' Eye Hospital on the 19th of January, 1894. His parents, who came with him, were both healthy; no constitutional taint could be elicited in the history of the family on either side; one other child was strong and well, and the patient had been hearty until the commencement of the present disease. The parents stated that about the first of August last a redness of the left eye was noticed, and in a few weeks the upper lid commenced to swell. Vision was not at first affected, and was not entirely lost until October, when the swelling was very great and the eyeball protruded. A little later there was slight bleeding from the eye. The child complained of temporal headache.

On November 3d the contents of the orbit were removed by Dr. Chisholm of Baltimore, who, kindly replying to my inquiries, writes me that the growth originated in the orbital tissue, and that the protruded eye was destroyed by pressure. There was a fungus mass half as large as a man's fist, which bled occasionally. The patient was so exhausted that it was feared he might die upon the table, but recuperated rapidly after the operation, and in two weeks was apparently in good health and strong enough to ride upon his bicycle.

About a month after the operation the parents first noticed

a swelling of the lids again, which rapidly increased. On admission to the hospital the patient was in fair general condition, and was free from pain. There was enormous distension of the lids, the skin of which, however, was nowhere broken. The ciliary margin of the upper lid measured more than nine centimetres. The swelling was limited above by the eyebrow, which was only slightly raised, and though tense gave such a decided sense of fluctuation on pressure that it was difficult to resist the impression that it contained fluid. The lower lid was distended to a globular form and was forced downward and outward. Between the lid margins projected a red mass, presenting the appearance of an excessively chemosed conjunctiva. There were no preauricular or other glandular enlargements. The right eye was normal, with full vision.

A few days after admission there was profuse hemorrhage, which was nearly fatal, but which was finally checked by dusting freely with finely powdered monsel salt. The blood came chiefly from along the lid margins, apparently welling up beneath them. The bleeding recurred several times, to a much less extent, but was easily checked by the same application, and after ten days ceased entirely with the exception of a slight oozing. The growth increased rapidly, assumed more and more a fungous character, was bathed with a fetid sanious discharge, threw off shreds of slough, and became very offensive. It extended through the lachrymal duct, filled the nasal cavity and appeared externally as a plug in the nostril. The skin showed a remarkable resistance to its encroachment, and even to the last that of the upper lid maintained its integrity except a superficial slough from pressure at the summit of the swelling; that of the lower lid lost its epithelium and was crowded back beneath the fungous mass. The tumor continued to increase until a few days before death, when its growth no longer kept pace with the loss by sloughing and there was some diminution in its size. These photographs show it at its maximum when it was fully half as large as the patient's head, and extended nearly to the scalp above, to the ear at the side, and three inches beneath the chin below. The margin of the



skin is seen in the side view; in the other it is lost by blurring of the outlines with the discharge which covered the surface.

It was evident that operative interference would be worse than useless, and treatment was confined to attempts to make the diseased mass as little offensive as possible. It was washed frequently with peroxide of hydrogen and various antiseptics were applied. The child never complained of pain, there were no cerebral symptoms, and death occurred at last, on March 24th, from exhaustion.

A post-mortem examination was made by Dr. Guilford, the senior house surgeon, twelve hours after death. The portion of the tumor extending over the brow and face was necrosed, and was little more than an indistinguishable mass of sloughing tissue. The part chiefly contained within the orbit, about the size of a hen's egg, was vascular and firm. It completely filled the cavity and sent projections beyond it through the eroded walls. The lachrymal bone and about a third of the ethmoid were destroyed, leaving a large opening through which the growth extended into the left side of the nose. There was also a circular opening, half an inch in diameter, in the orbital plate of the frontal bone through which a process of the tumor passed, pressing up the dura mater. The sphenoidal fissure was greatly enlarged by the destruction of the smaller wing of the sphenoid, and of a considerable portion of the larger wing, and the growth passed into the cranial cavity, pushing a mass of orbital fat before it. The optic nerve showed no macroscopic changes, but the third nerve, at its point of exit, was involved in a nodule of the growth about half an inch in diameter. .The dura mater was somewhat thickened where it came in contact with the tumor, but there was no general meningitis, and the brain was healthly.

The orbital portion of the tumor was submitted for microscopical examination to Dr. D. B. Kyle, who pronounced it a "mixed-celled sarcoma, made up mostly of small round cells." The optic nerve was healthy.

The rapid growth of the tumor, and the enormous size that it attained are remarkable, as is also the entire freedom from

pain and from cerebral symptoms, even headache, though the intracranial cavity was invaded.

The absence of glandular enlargements in this, as well as in the previous case, was a subject of remark, but it is known that the lymphatic glands usually remain unaffected in orbital sarcoma; a fact which tends to confirm the view that the germs of this disease are disseminated through the blood vessels rather than through the lymphatics.

I had an impression, which was shared by some of my colleagues who were interested in this case, that extensive orbital tumors in children usually originate as retinal glioma, and that extraocular orbital sarcoma is comparatively rare in very young subjects. I find, however, a number of cases reported. Among them, four by Lawford* in children from two to ten years of age, in none of which was the ball primarily involved; one of sarcoma in each orbit in a child four years of age by Snell;† and one by Dr. Weisner of the Demilt Dispensary, in a child six years of age, which rapidly recurred and attained a very large size.‡

DISCUSSION.

DR. A. G. HEYL of Philadelphia.— I would like to say a word or two with reference to aniline dyes in the treatment of epithelioma. In Germany the aniline dyes have been used in subcutaneous injections, and I have under my care at present a case which I will here mention. It came to me with the following history: Seven years ago a small scab appeared near the external canthus. It was removed by a surgeon, but the wound never perfectly healed. Two months ago there was a large ulcer with profuse granulations near the outer canthus. The cornea was destroyed and a subcutaneous brawny swelling clear out to the temple, existed. To have attempted to remove or dislodge the tissue would have required an area as large as the palm of my hand, with every chance of making matters much worse. I gave the patient a simple wash of yellow pyoktanin, and was surprised at the end of three weeks to find that the brawny swelling about the ulcer was disappearing. The case has continued to grow better until, at the present time, the ulcer is

* Royal London Ophthalmic Hospital Reports, Vol. XII, Part I.

† *Trans. Ophth. Society*, of the United Kingdom, October 19, 1893.

‡ *Internat. Journal of Surgery*, Vol. II, 1889.

closing, and it may be possible to do something in the way of an operative procedure. I have treated another case of epithelioma with this same lotion with little benefit, or with nothing like the benefit in this present case. The case I have in mind is one where the lid has been partially destroyed and the tissues below the lower lid are encroached upon by the ulcer. The two cases were microscopically dissimilar. The case benefited by the pyoktanin was characterized by exuberant granulations in the ulcer and brawny subcutaneous swelling. In the case *not* benefited the surface of the ulcer was smooth and depressed below the skin surface, with little brawny infiltration about the edges of the ulcer. Possibly the great uncleanliness of this patient, along with alcoholism, may have interfered with the action of the drug. I speak of these cases to call attention to the use of aniline dyes as a palliative of some value in this disease.

DR. C. S. BULL of New York.— Dr. Harlan's first case is very interesting. He describes the case as originating in the lachrymal sac. Was there in addition to that any growth in the nasal cavities?

DR. HARLAN.— The nasal cavities were carefully examined and found free from disease.

DR. B. ALEXANDER RANDALL of Philadelphia.— I was of opinion that the aniline dyes might possibly be of some value in combatting neoplasms, so I used them in some epitheliomatous conditions. But any predilection I might have had in their favor was dashed the other day by the reappearance at my clinic of a patient with epithelioma of the auricle. I thought I had completely curetted away the growth when it was recent and small, as well as dressed freely with pyoktanin, but the man reappeared some six months later, perhaps a year later, with a much more extensive recurrence. This was again removed, and the surgical intervention may result in permanent success.

DR. R. A. REEVE of Toronto, Ont.— I would like to mention a case of orbital sarcoma unconnected with the eyeball primarily, which was under my care some years ago, and in which case I photographed the tumor. This was twenty-one inches in circumference, weighed twenty-three ounces, and was removed simply to relieve the child from the effects of the weight and distress.

DR. W. B. JOHNSON of Paterson, N. J.— In connection with the suggestion of medicinal injections in sarcomatous disease, I have had some little experience with the injection of the toxic products of erysipelas, and while I cannot say anything in their favor as being effective in these sarcomata of the orbit, I have

had one case of sarcoma of the pharynx where cicatricial bands formed and choked or destroyed by absorption the sarcomatous tissue to a very great extent, the accompanying glandular swelling disappeared, and the sarcoma has not returned, although no treatment has been given for four months. I had some experience with the toxic products of erysipelas also in connection with Dr. W. B. Coley, who has kindly furnished the products for use in the case mentioned, and treated a case of sarcoma of the squamous portion of the temporal bone, which, however, resulted unfavorably. It was a case involving the temporal bone, and extending to the dura. I would like to say here that I think that in view of the fact that there certainly have been cases of sarcomatous disease which have been alleviated, if not entirely cured, by the use of the injections of the toxic products of erysipelas, it is a desirable thing that it should be further tried; especially should further trial be made upon those cases of inoperable sarcoma where anything would be better than nothing.

DR. H. KNAPP of New York.— I would like to make a few remarks with regard to the three cases mentioned by Dr. Harlan. With regard to sarcoma of the orbit, these tumors may originate in the adjacent cavities, especially when they produce exophthalmos I was very much puzzled by a case similar to one of Dr. Harlan's the winter before last, where a child of healthy parents developed an exophthalmos within two or three days. The upper lid was somewhat swollen and the eye pushed almost straight forward, but on the firmest pressure I could not detect any tumor. In a week the exophthalmos was very much greater, and a distinct tumor was felt on the inner upper side of the orbit. This tumor could not be anything but a sarcoma, and I advised removal, which was done immediately afterward by a very large incision, going all around, and I removed the sarcoma, as it seemed to me, cleanly; but there was a defect in the upper inner part of the orbital walls, and the tumor rapidly returned. It came under the treatment of Dr. Coley, who has just been mentioned as being connected with another case, who applied the toxine of erysipelas. Then, during my absence, Dr. Born removed the eyeball and the relapse, and he went into it as thoroughly as he could. The eye treated was irritated with the toxine without the least effect. The doctor thought he could arrest the tumor, of which not much was left, but its return was just as rapid; it filled the orbit very quickly, so that the parents asked me to make another operation and remove whatever I could. I told them I considered the case hopeless, and advised them not to have it interfered with. They asked

me what would become of the tumor if left alone, to which I replied that it would doubtless grow further and disfigure the child very much, and that during its growth, until it had terminated the child's life by exhaustion, it would be very intractable. Thereupon they asked me to relieve the child as well as I could by removing whatever was left of the tumor — to go as far as I thought proper. I did so. I found that the tumor had occupied and destroyed the upper inner portion of the wall of the orbit. In the removal of the tumor I took away a considerable portion of the base of the skull. In the progress of the operation a soft blue membrane, distinctly pulsating, was seen and felt behind the apex of the orbit. It was on the anterior wall of the cavernous sinus. The child bore the operation very well. It died, however, a month later. There was no particular suppuration. The interest in the case centered in the observation that the region of the tumor was either in the ethmoidal or sphenoidal cells. I have seen a number of such cases. They produce exophthalmos, which is rapidly progressive as soon as they pierce the orbital wall. The accessory cavities of the orbit and the nose are more frequently the origin of orbital disease than we suppose. The greater my experience has become, the more I am convinced of this fact.

DR. C. S. BULL of New York.— My opinion, which has been gradually developed from my experience in cases of orbital tumor in which there is a very rapid increase of the exophthalmos, is that the origin of the trouble is either in the ethmoid or sphenoidal sinuses. That is the result of my experience in post mortem examinations and clinical observations. While, as surgeons, we are justified, I think, in doing everything we can to relieve the unpleasant symptoms, particularly that of pain, yet I think it is our duty to tell our patients, where we have formed an opinion as to the origin of these tumors, even in cases where an operation has not yet been done —not in the case of relapsing tumors, but in original tumors—that the seat of the disease is so deep that no favorable result can be expected; that even if we remove the portions in the orbit, the growth will return because of the location of the original tumor, and that the life of that patient is inevitably shortened by operative procedure directed toward the removal of the tumor. Furthermore, that in a relapsing tumor the removal of the growth materially and rapidly shortens the life of the patient. If these facts are stated to the patient and his family, and they are willing to accept the issue, it is probably our duty to operate, but, in my opinion, not otherwise.

On motion of Dr. Knapp of New York, Dr. Robert R. Tilley of Chicago was invited to sit with the Society and participate in the discussions.

DR. ROBERT TILLEY of Chicago.— I have had a case under my observation very similar I suppose, from the remarks of Dr. Knapp,—I did not hear the original paper,— to the one that is now under discussion. About three years ago an old lady from Wisconsin came to Chicago to consult me. Upon examination I found the left eye protruded excessively; it was directed certainly at an angle of 45 degrees from its ordinary course. The nose was so completely filled that her statement that she had not been able to lie down to sleep for six months was very easy to believe. I examined the nose carefully, and was unable to determine the nature of the tissues, because of the passages being so much occluded. It was absolutely useless to endeavor to get at it from the nares. I undertook the operation in St. Luke's Hospital in the presence of Dr. J. E. Owens and a number of railway surgeons. I opened the nose from the frontal sinus to within about half an inch of the tip of the nose, and extracted a quantity of tissue which turned out to be sarcomatous, and in size nearly as large as my two fingers. After exploring the cavity the two frontal lobes of the brain were clearly exposed, and the pulsations could be distinctly seen. The operation was performed with very little difficulty, but the tumor began to appear after about one month. Immediately after the operation the old lady laid down and slept through the entire night, something that had been entirely impossible for her to do in the preceding six months, according to her son's statement. Soon afterward she expressed herself as being perfectly well, and the eye returned to its normal position, which was a source of very great comfort to the old lady.

Only two weeks ago I saw a case very similar, though perhaps not so far advanced. It was, however, associated with the right orbit, and there was a distinct enlargement of the middle turbinated bone. The eye was only slightly protruded, and relatively only slightly directed from its normal course, too much, however, for him to have any difficulty about double images. I told him and his son, an engineer, who was with him, what in all probability was the best course to adopt, but he did not choose to follow my advice, and probably I shall not see him again.

DR. GEORGE C. HARLAN of Philadelphia.— There is not the slightest doubt that in the case of my patient the disease originated in the orbit. At the time of the operation, Dr. Chisholm

removed the contents of the orbit and found none of the neighboring cavities open. Later, as I have stated, the disease did invade the nasal and intercranial cavities, but not until some time after the patient came under my care. The appearance of the tumor in the nasal cavity was not observed until a few days before death. At the post mortem, processes of the tumor were found in the intercranial cavity, and also a mass of orbital fat, not involved in the disease, which had been mechanically pushed before the rapidly increasing growth.

TUMOR OF THE INTERVAGINAL SPACE OF THE OPTIC-NERVE SHEATH.

BY SWAN M. BURNETT, M.D., PH.D.,

WASHINGTON, D. C.

Joseph Messmann, 7 years of age, was brought to me on June 28, 1893, on account of an extreme exophthalmus of the left eye. The following history I obtained from his father, who accompanied him, and from Drs. McSherry and Meyers of Martinsburg, W. Va., who had attended the boy since infancy. Though not at all strong-looking, nor large for his age, his general health, except for the ordinary diseases of childhood, is reported as having been fairly good. In the latter part of 1889 he had an attack of *la grippe*, followed by a hacking cough and a remitting fever which latter lasted for some weeks. Accompanying and succeeding this there was a very quick and irregular action of the heart. It was during this period of irregular heart action that a slight protrusion of the eye was first noticed. The cardiac trouble subsided in about a year. In the spring of 1890 it was discovered that he could not see very well with that eye. It is supposed that it was about this time that the exophthalmos was first noticed. Even at the time when the blindness was first detected he could count fingers only at 2 or 3 feet. By the autumn the blindness was complete, though the protrusion had increased but slightly and was noticeable only on careful inspection. The progress of the exophthalmos has been very gradual, and without any pain except an occasional slight one at

the back of the head, which, most probably, had no connection with the eyes, and his general condition seemed unaffected. He ate, slept, and played as usual. The accompanying photograph (Fig. 1) was taken about a year before I saw him, that is, two years after the trouble was first observed.

At the date of the examination the protrusion was considerably greater than this,—the posterior wall of the globe being

FIG. 1.

about on a level with the bridge of the nose and the lids very frequently closed behind the ball. The protrusion was directly forward or slightly downward, and the movements of the globe, though much restricted, were about the same in all directions. The cornea was clear and the iris normal; pupil large and reacted slightly consensually, but not directly to light. The veins of the conjunctiva and of the lids were swollen and tortuous (obstructed return circulation). The refracting media were

clear. The optic disk was bluish white with an irregular edge and the retinal veins were enlarged and tortuous. (Fig. 2.)

Operative interference was advised, and he returned on the 18th of July and was sent to the Children's Hospital. The operation was performed under chloroform on the 19th. Under anesthesia, a careful examination was made by palpation and auscultation to determine the nature and connections of the

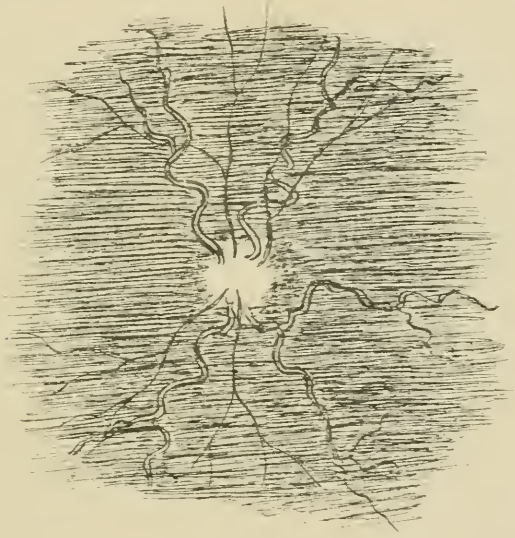


FIG. 2.

growth. The heart sounds were normal and there was no bruit nor fremitus heard on or around the eyes, and only a slight retrocession of the ball was caused by compression. The finger passed behind the globe met with no irregularities on the orbital walls, and the optic-nerve close up to the globe and for some distance beyond, though enlarged, was smooth. It was traced to an elastic mass, with a smooth flat anterior surface, which apparently filled the apex of the orbit.

It was considered inadvisable to attempt the removal of this large mass with preservation of the eyeball. The muscles were, therefore, detached from their insertion into the sclera and the nerve cut close to its entrance in the large mass, and the ball and attached nerve removed in order to have a freer field for operation.

The removal of the large tumor was effected through the opening in the conjunctiva. The mass was found to be tightly pressed against the orbital walls but not adherent to them except, possibly, near the optic foramen, where the capsule of the tumor gave way under the scissors, and a quantity of gelatinous material escaped. The optic nerve itself could not be distinguished as a distinct cord at the posterior wall of the tumor nor at the foramen. There was a free but not excessive hemorrhage. The patient bore the anæsthetic well and rallied promptly. A sponge was applied over the closed lids and held rather tightly in place by a simple bandage and was to be kept moist with an antiseptic liquid. This dressing was removed by the resident physician that evening, and when a fresh sponge was applied the bandage was not drawn sufficiently tight, and as a result, there was a hematoma of the orbit and considerable ecchymosis of that side of the face in the vicinity of the orbit. Temp. 100.6°.

The case progressed well, and the boy was up and playing around the ward on the 3d day, ate and slept well, and the hematoma was gradually subsiding. On the afternoon of the 28th, he complained of feeling badly, and an examination revealed a temperature of 103.4°. This was the beginning of an attack of pneumonia of the left side for which he was treated by Dr. Acker. The course of improvement in the condition of the orbit was not in any way checked by this intercurrent affection, a connection of which with the operation could not be established. When he was discharged from the hospital on the 22d of August, there remained very little swelling of the orbital tissues, and there was a fair amount of movement in the stump.

The boy did well and had no untoward symptoms until Nov. 2d, when he was seized with what his father described as "inward spasms," which have continued ever since at intervals. These attacks come on at periods varying from 2 to 4 weeks, and usually last all day, during which time he has had as many as fifteen of them. They begin with nausea, seldom accompanied with vomiting, some twitching of the mouth, but no general convulsions, and end in unconsciousness, lasting for a few minutes. In the intervals he has as good or better health

than he has ever had. It should be said that he is allowed unrestricted indulgence in an appetite for all kinds of indigestible things. I saw the boy on May 9, 1894, and found the stump smooth, of good motility, and not any larger than it was on complete healing three months after the operation.

The eye and the tumor were put first in 50 per cent. alcohol. Fig. 3 gives the actual size and form of the eye and the attached optic nerve after they had been hardened in

Fig. 3.

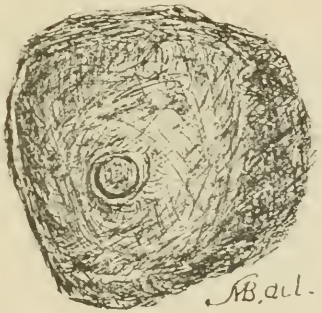


Fig. 4.

absolute alcohol. Fig. 4 shows the anterior and part of the lateral aspect of the tumor with the section of optic nerve where it enters it, of actual size, after it had been hardened in absolute alcohol. It measured, at that time, 36 mm. vertically, 25 mm. transversely, and 15 mm. antero-posteriorly. At the time of its removal it was at least 20 per cent. larger. In shape it represented almost exactly a cast of the walls of the apex of the orbit at that locality.

The eye was cut by Dr. Wm. M. Gray, Director of the Lionel Laboratory at the Emergency Hospital. The sections show that the pathological process originated in and is limited almost entirely to the intervaginal space, and that in the main, both the pial and dural sheaths are intact. A section through the globe at the optic nerve entrance (Fig. 5) shows that the new growth comes close up to the nerve entrance, dilating the intervaginal space to its utmost, and occupying it, but not passing beyond it in any direction. Moreover, the optic nerve at this point does not appear to suffer from

pressure, being of approximately normal size and shape, and entirely free from invasion of any pathological process from the outside, though in a state of atrophy. The central retinal vessel which is cut at the papilla appears of normal size. The relations of the nerve trunk to the growth are shown probably still better in Fig. 6, which is a cross section of the nerve near the distal end of the portion attached to the globe. It occupies a very nearly central position of the almost perfect oval, and its inner sheath is intact though some fibres run towards and con-

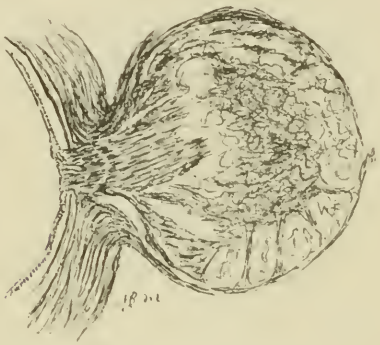


FIG. 5.

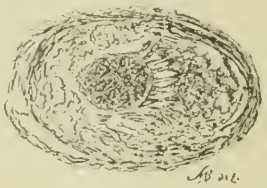


FIG. 6.

nect it with the mass of morbid tissue at one end of the oval. It is not compressed, and the vessels (probably those of the central retinal group) here, as everywhere where the nerve was examined anterior to the large mass, are at least up to the normal in number. The same conditions and relations are present after the entrance of the nerve into the large mass (Fig. 7). Both sheaths are intact and the state of the nerve is approximately the same as at its anterior part, except that it is not vascular, being posterior to the entrance of the central retinal vessels. At the more posterior portions, however, the nerve and the morbid tissue appear to mingle until the one is lost in the other, and the nerve is no longer to be clearly distinguished.

It is apparent, then, that the growth has had its origin in and is entirely confined to the intervaginal space and that whatever invasion of the nerve we may have is only secondary, and occurs at the latest periods of the pathological development

or degeneration. A most interesting fact in connection with the tumor's growth is that it should be divided into two parts so sharply defined from each other. It is quite common, it is true, to find in such tumors inequality of size at different parts, but in none described in the literature I have examined has the demarcation been so close. The inference is that the growth began about midway of the length of the nerve — that is, about

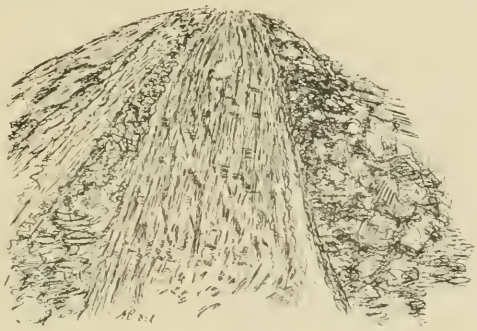


Fig. 7.

the point of entrance of the central retinal vessels, as has been noted in a number of cases,— and traveled backward, and that the anterior part is of more recent origin, as, indeed, its structure would indicate.

The structure of the tumor itself is far from uniform in all its parts. In the anterior portion, from the optic nerve entrance to the large tumor, it is composed of a net-work of fibres, most of which have nuclei at some part of their course. The fibres in some portions of the growth are very fine (*a*, Fig. 8); others are broader and almost hyaline (*b*), and some are very long (*c*). Scattered among these are hyaline plaques (*d*), and here and there are small nests of cells, mostly nucleated (*e*). In some portions of the growth one of the elements predominates; in others another. This anterior portion is much less vascular than the larger mass. Sections of the large tumor show it to be much firmer in texture and highly vascular, and the walls of the vessels in some portions are distinctly hyaline. It is composed of short fibres, which in some parts are reduced to typical spindle-shaped cells, which are nucleated (*f*, Fig. 8).

In some parts hyaline plaques of various sizes and shapes (*g*) are very numerous. The nests of nucleated cells (*h*) are also very numerous in places, and are much larger than in its anterior part.

It is not necessary to discuss here in any detail the pathology of these tumors around the optic nerve, since it has been again fully gone over very recently by Braunschweig, and by

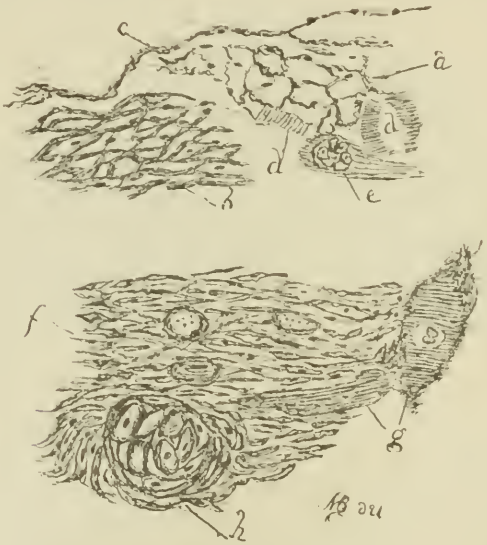


FIG. 8.

Salzmann in Band 39 (1893), Heft 4, of *Græfe's Archives*, and by Ugo Tailor in the *Annali di Ottalmologia*, Anno. xxvi, 1894, Fas. 1 and 2. The article by Braunschweig claims to be exhaustive as to its statistics of reported cases, which at that time were 94 in number; but they are rendered almost valueless by the unpardonable omission of the place of publication of the articles.

Histologically, the tumor belongs to the group to which the vast majority of such tumors as have been reported upon belong, and it is a fair assumption that they are all essentially the same in structure and development, the differences in their microscopical appearances, as described, being due to the different periods at which they were examined, the various stages of their growth or degeneration, and the personal equation of

the observer. They have been variously described as myxoma, myxo-sarcoma, fibroma, myxo-fibroma, endothelioma, and sarcoma. An examination confined to certain isolated parts of the tumor here described would justify the diagnosis of any one of the above-mentioned forms of morbid growth, since they are all typically represented. There is one clinical fact, however, which stands out with marked prominence, and that is that they are not malignant, and seldom show a tendency to recur, which they would certainly do were they of a truly sarcomatous character. The burden of evidence, from their clinical history and the manner of their development, seems to be in favor of an embryonal origin, since they are developed, with rare exception, very early in life, grow slowly, and show none of the tendencies of acquired pathological processes to rapid development and a spread to other tissues, either by contiguity or metastasis. The changes in the nerve are due entirely to the mechanical pressure of the growth upon the nerve trunk, and the pathological state being, most probably, that of choked disk.

As to operative procedures, the experience with removals with retention of the eyeball has not been such as to justify its attempt, except when the tumor is very small, and they are seldom seen or diagnosticated at that period. The suggestion of Braunschweig, that a portion of the temporal wall of the orbit be removed in order to facilitate the extraction of these tumors with preservation of the eyeball, I do not consider a justifiable one, since any growth connected with the globe that cannot be removed from an intact orbit had better carry with it the eyeball itself. In any such case the eye, even if preserved, is sure to atrophy, if not undergo suppuration; and an artificial eye is much to be preferred, so far as appearance goes, and is, on the whole, much safer than a degenerated stump.

DISCUSSION.

Dr. H. Knapp of New York. — I would like to touch upon the last part of Dr. Burnett's paper — that is, the removal of the outer wall of the orbit by osteo-plastic method, according to Krönlein. I have seen such a case operated on by Dr. Frederic Lange of New York. An orbital tumor was removed

about two years ago. There has been no recurrence, and there is scarcely a scar. I am, therefore, rather inclined to believe that this modern procedure of thorough surgery should not be ignored by oculists.

One word with reference to the preservation of the eye in the removal of tumors of the optic nerve. I think I was the first to attempt and perform this operation. It was 20 years ago, in a case of endothelioma of the sheath of the optic nerve, published in *Arch. of Ophthal.*, Vol. IV, p. 323, 1874. I desire to say that I saw this patient again about a month ago, and that there has been no recurrence, and the patient has had no evidence of any metastatic tumor. The eyeball is there, well but shrunken — certainly not so nice as an artificial eye would be, but, nevertheless, the operation has not given the woman any discomfort.

Shortly after that operation Dr. Gruening, in my clinic, removed another optic nerve tumor, with preservation of the eyeball — a myxosarcoma, much smaller than that of the case just mentioned. I saw the patient several years afterwards. Her eyeball was not disfigured in the least; there had been no reaction whatever. I tried it in another case, but the eye sloughed. It is certainly easier to remove optic-nerve tumors after the eye has been taken out. In small tumors, however, it is better, I think, to spare the globe, for the natural eye, even though blind, is much better than an artificial one.

DR. J. A. LIPPINCOTT of Pittsburgh. — One point in regard to a statement made by the reader of the paper in regard to the simple nature of the tumors. If I mistake not, he thought they were never actually of malignant character. Can they not assume a malignant character? Of course, myxomatous growths of the optic nerve are generally removed without evil consequences. I removed one ten years ago. I saw the patient two or three years ago, and found that there had been no recurrence; but in a case which I operated upon about a year ago, the issue of which, I may say, was fatal from meningitis, the tumor, which seemed to be originally a fibrous tumor of the optic nerve, slow in development and comparatively benign in character, suddenly began to progress very rapidly, with marked increase in the exophthalmos and other symptoms, which indicated the necessity for an early operation. This was performed, and the microscopic examination showed the fibrous character of the tumor, but with what seemed to be a recent development of round-celled sarcoma. I think this would account, in some cases, for the sudden exophthalmos — a symptom which might probably be correctly attributed, in the majority of cases, to disease of the cavities adjacent to the orbit.

DR. SWAN M. BURNETT of Washington. — In looking over the statistics prepared by Braunschweig, so far as it can be relied upon, I find that there are very few cases indeed in which there seems to be any tendency to malignancy. Of course, one could hardly say that all tumors of the optic nerve are benign, but the cases which are reported as typical cases of myxosarcoma and sarcoma, and which take their origin in the intravaginal space, from what I have been able to study of them, were not malignant. I think it is a question which it will be profitable to study, since we have a good deal to learn with regard to the pathology of these tumors around the optic nerve. It seems to me they are embryonic in their character, and that they are not essentially malignant. The cases which have been reported as malignant probably did not originate in the intravaginal space, but in some other part of the orbit.

A CASE OF MELANOTIC, GIANT-CELLED, ALVEOLAR, MYXO-SARCOMA OF THE EYELID.

By W. H. WILMER, M.D.,

WASHINGTON, D. C.

While the literature of ophthalmology is so rich in other respects, the reports of cases of primary sarcoma of the eyelids are comparatively limited in number.

A case of this nature is therefore presented without further apology, as it seems to me to possess features that are not common.

On April 15, 1893, a woman about thirty years of age consulted me concerning a small tumor of the right lower eyelid. This tumor was first noticed about six or eight months previous. Its growth had been gradual but steady. The patient was confident that the lid had never been injured in any way. In fact, she had never had any trouble whatever with her eyes except a slight attack of conjunctivitis in 1887.

The tumor was situated a little to the outer side of the median line of the lid, with its long axis parallel to the margin. It was hard and unyielding to the touch. Although the tumor projected toward the skin, the latter was freely movable, and

normal in all respects; there was not even the slightest discoloration. The conjunctiva, likewise, was normal in appearance. There was every indication of its being a primary growth, for there was no evidence of disease in any other organ.

On April 24, 1893, the growth was removed through an incision in the skin, parallel to the margin of the lid. The tumor was easily dissected out, owing to its extremely tough fibrous capsule. At its center, the tumor was loosely attached to the conjunctiva by a few adhesions. Apparently, the bulk of the tumor was in front of the tarsal cartilage, but, at the site of the adhesions, it seemed to have perforated the tarsus. The location of the tumor and its microscopical elements warrant our supposing that the growth originated in the tarsal cartilage. The bleeding was not more profuse than usual. The wound was sutured with fine silk. On the fourth day after the operation, the sutures were removed and the union was firm. In a letter received a few weeks ago, the patient writes that there has been no symptom of a return of the growth. At my advice, she had consulted an oculist in her city, who found only a mild granular conjunctivitis in either eye.

The tumor, after being thoroughly hardened in Müller's fluid, measured 12 mm. in length, 7 mm. in breadth, and 4½ mm. in thickness. Sections of the tumor were examined by Dr. C. L. Minor of this city, and by Dr. W. M. Gray of the Army Medical Museum. Dr. Gray has kindly prepared the following report of the microscopical examination of the tumor:

The tumor is composed of a framework of wavy bands of dense fibrous connective tissue, which run in all directions; these bands are composed of long and short elements, and form an alveolated structure through the growth. The pigmentation occurs in small patches irregularly distributed, and is composed of small masses of dense black pigment; the majority of the pigment masses are round or irregular in shape, with a few branching pigment cells. The giant cells are confined to one side of the growth, and are comparatively few in number; they are imbedded in islands of myxomatous tissue surrounded by alveoli of the dense fibrous connective tissue. Throughout the growth are numerous isolated patches of myxomatous tissue;

these patches are surrounded by the fibrous connective tissue stroma, and form a typical alveolar structure somewhat resembling cancer formation. The myxomatous tissue is composed of large round cells — epithelioid in character — medium-sized, and small round cells, and a few spindle and stellate cells. These cells are held in a fine meshwork composed of delicate connective tissue threads. The growth has a rich vascular supply; some of the vessels have fully formed walls, but the majority are without walls, typical of sarcoma.

In looking over the literature of the subject, I have found the histories of thirty-five cases of primary sarcoma of the eyelid. I had the opportunity to examine fully only twenty-five of these cases. In this number, I found the age of the patients varying from ten months to seventy-six years; the duration of the tumor, before operation, from several weeks to thirteen years; the size ranging from that of a pea to a large apple. In 12 per cent., all four lids were involved. In 16 per cent., it was necessary to remove the eye with the tumor. In 16 per cent., all children, death is mentioned as having resulted from the disease. In 40 per cent., the return of the growth is mentioned; but in many other cases, the patients were last seen a short while after the operation. And some of the tumors were themselves recurrent, while others returned several times.

I was able to examine the microscopical reports of all thirty-five cases; and I found that 40 per cent. of these sarcomata were spindle-celled, 43 per cent. round-celled, 17 per cent. mixed, 11 per cent. presented myxomatous elements. In one case, which I have classed among the mixed sarcomata, the author mentions the existence of large cells "not unlike the giant-cell." The presence of pigment, in spots, was noted in 20 per cent., but a capsule in only 14 per cent., some of which were neither marked nor complete.

Among these thirty-five cases of primary sarcoma already mentioned, I found the histories of four very interesting cases due to traumatism. Two of these Dr. Knapp mentioned at the meeting of the American Ophthalmological Society in 1893. Both of the patients were children, and the tumors resulted from falls. Death ensued in each case. Dr. Lagrange has also

reported a case due to a blow, the patient being seventy years old. Dr. Samelson has given the history of a sarcoma that was due to a bit of coal which had lodged in the conjunctival cul de sac a year previous. The coal was found in the base of the removed tumor.

Although very interesting, certain cases of adenoma and congenital angio-sarcoma of the eyelids, have not been included among the above cases owing to the fact that the sarcomatous elements were meagre and therefore of secondary importance.

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THE HALO SYMPTOMS IN GLAUCOMA.

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Halo is classed among the prodomata of glaucoma; it may occur later in the progress of primary simple glaucoma. Some subjects of glaucoma, more observant than others, mention it without suggestion from the physician. In many cases it is not noted, or little importance attached to it. A few attempts have been made to explain it. DeWecker thinks it "due to very slight alterations in the epithelial layer of the cornea, produced by temporary increase of pressure." Wolfe suggests that it "may be owing to dilatation of the pupil, to change in the lens, or to disturbance in the circulation." Neither disturbance of the circulation nor dilatation of the pupil, when they exist under other circumstances, seem to cause the phenomenon. Alterations in the epithelial layer of the cornea, and

change in the lens, are phrases of vague significance, the exact meaning of which may be only surmised, except that Dr. DeWecker qualifies his statement by the expression "is analogous to a similar phenomenon witnessed in most cases of conjunctival catarrh, where there is irregular desquamation of the epithelium.

In conjunctival catarrh the peculiarity is rather due to diffraction of rays of light by globules of secretion on the surface of the cornea, as it disappears when they are removed; moreover, cocaine, which disturbs the corneal epithelium, lessens conjunctival secretion, and dilates the pupil, does not seem to produce the halo. Let it be farther suggested that constant slight changes in the corneal epithelium are physiologically present without the phenomenon; therefore we must look for some other explanation.

Dobrowolski of St. Petersburg (*Archiv. of Ophthalmology*, Vol. XV, 1886, p. 267) assumes that the glaucoma halo "depends upon irritation of the retina and optic nerve by hyperæmia," in support of which he cites a personal experience while in a Russian bath. The rainbow rings became even more intense and distinct when he entered a *cooler* room. He continues, "for the last few months I have constantly seen these rings around the lamp light in the evening. There is no noticeable increase of tension, and the visual acuteness is 25/20. Tension of accommodation always rendered them (the rings) more distinct."

As the cause of glaucoma must be in action previous to increase of tension, or diminished acuteness of vision, as the halo is a prodrome, Dr. Dobrowolski's eyes must rest under suspicion of inherent tendency.

The halo is rarely constant, but appears and disappears, to recur again; and with increasing frequency as the disease develops.

At one time it may be a corona; at another, it appears in the shape of vari-colored *sparks* of light. This intermittence and change of form would indicate that the cause is not persistent; that, at times, it lacks force and distribution. Pressure *upon* the globe will produce a ring of colored light, or a

luminous spot, always opposite to the point of pressure. The halo may be present in glaucoma with seeming normal intra-ocular tension, and may be absent during increased tension; gradual, steady pressure will not produce sparks of light.

The cause of halo would seem to be not in the retina itself, but in the media anterior to it. Its variability suggests the aqueous humor, or some surface in contact with the aqueous humor, for it is in the serum of the blood that the chief deviation from the healthy standard is perceived; products of excretion which have not been eliminated (Garrod).

The laws of nature are undeviating; the law of gravitation, terrestial and celestial, is the same; so with the law of light. The lunar halo is a familiar object, the cause of which does not exist in ourselves, nor in the moon, but in the intervening media whose character changes. The Descartes theory of the encircling lunar halo was accepted by Marriotte, Dr. Thomas Young, and Sir Isaac Newton, and remains to-day the unquestioned explanation. According to Descartes, it is owing to the reflection and refraction of rays of light by minute snow and ice crystals in the upper strata of air, and occurs in the presence of the cirrus, or ice-cloud. Professor Cleveland Abbe explains the arrangement of colors in a circle of 22° radius, the inner edge red, and the outer edge blue, to be "light polarized in direction of tangent to circumference; it is formed by light passing through the alternate faces of hexagonal ice-crystals in the direction of minimum deviation, through the base and sides of right prisms."

The prevailing arrangement of colors in the halo of glaucoma is red in the outer margin, and bluish-green in the inner margin; the reverse of the lunar halo.* This difference in the arrangement of colors is owing to a difference in the position of the refracting crystals relative to the eye; in one case, posterior to the pupil; in the other, external to the eye.

"Sodic chloride + urea forms shining rhombic prisms" (Landois and Sterling, Text-book on Physiology, 2d Am. ed.,

* The transposition of colors in the halo is very strong evidence that the cause of the halo in glaucoma is to be looked for posterior to the iris, in accordance with the disposition of rays of light passing through the aperture of the screen.

p. 432). Acid sodic urate appears as a brick-red deposit, more rarely gray or white, in rheumatic or febrile conditions. Microscopically, it is completely amorphous, consisting of granules, which sometimes have spines on them. The potash salt is the same. They are easily soluble in warm water" (*vide supra*, p. 435). As the menstruum cools they are precipitated. When the urates in the blood are in excess (uric-acidæmia) the same influences which determine their presence in the synovial fluid of the joints, and their precipitation upon the serous surfaces, operate in the eye, which is more exposed to vicissitudes of temperature. Hence, variation in glaucoma halo with variation of urates in the blood might clearly occur without present change of intra-ocular tension. The glaucoma halo *might* "depend upon irritation of the retina and optic nerve," not caused by simple hyperæmia, but by precipitated urates; or it may be due to the presence in the aqueous, or vitreous humor, of urates in the shape of rhombic prisms, or amorphous granules (with or without spines) with power to cause diffraction of light. The prisms formed by sodic chloride + urea, at least, have this faculty.

A CLINICAL AND MICROSCOPICAL STUDY OF TWO CASES OF GLAUCOMA ASSOCIATED WITH INTRA-OCULAR HEMORRHAGES.

BY CHARLES A. OLIVER, M.D.,

PHILADELPHIA, PA.

In the early spring of 1890, through the courtesy of Dr. Isaac Barton, of Philadelphia, S. T. C., aged sixty-two years, of New York city, was seen for the first time. The patient, a cultured and well-informed man, though with all the physical appearances of chronic alcoholic abuse and excess, stated that during the previous summer he had had a sudden, though temporary, attack of dimness in the right eye, as if he "saw

PLATE I.

RIGHT EYE

through holes, especially up and out, with a smoky area directly ahead." This peculiar symptom repeating itself about four weeks before his first visit, and having persistently remained, induced him to apply for relief.

At the time of the primary examination, the right vision was reduced to one-fiftieth of normal; this amount of acuity being best obtained when the test-type was placed excentrically down and out. Uncorrected left vision equaled $\frac{5}{10}$, which could be brought to $\frac{5}{5}$ by the employment of + S. 0.62 D. ⌒ + C. 0.25 D. ax. 90°. Accommodative action in each eye seemed to be normal for age and refractive condition; that in the right eye being studied objectively by means of a retinoscope.

As shown in the accompanying sketches, kindly made by Miss Margaretta Washington of Philadelphia, the ophthalmo-

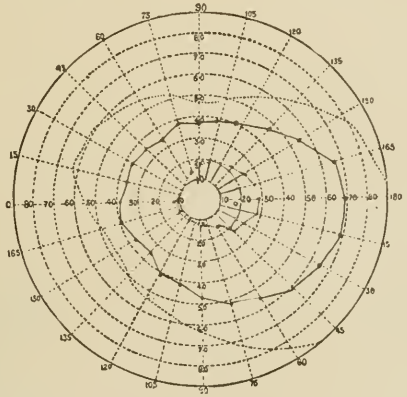


Fig. 1. — Right field for white and green.

scope revealed a well-marked perivasculitis with numerous hemorrhagic extravasations, especially in and around the macular region, scattered throughout the right eye-ground. In addition, there were swelling, œdema, and extreme pallor over a large retinal area just below and in the macular region of the same eye. Both nerves, though, of course, better seen in the left eye, were slightly, though glaucomatically cupped. The right field of vision, as here shown in Fig. 1, was somewhat limited to the nasal side, and gave evidence of a faint negative dimming throughout the green-field area. The left field of

vision, as here reproduced in the four miniature sheets 2, 3, 4, and 5, proved to be quite interesting. Contracted, and with a large central absolute scotoma for both form and color, it seemed filled with innumerable small, irregular areas of faultily-named

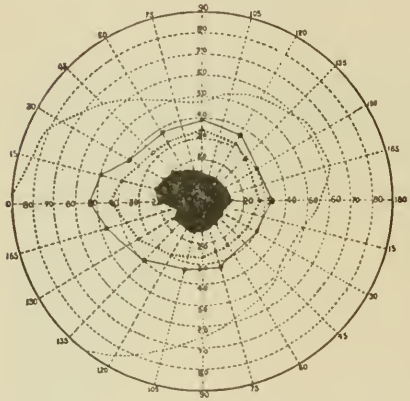


FIG. 2. — Left field for white and yellow.

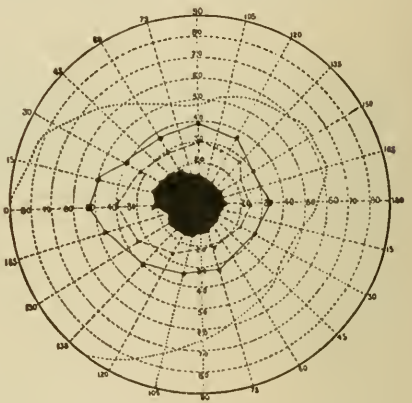


FIG. 3. — Left field for white and blue.

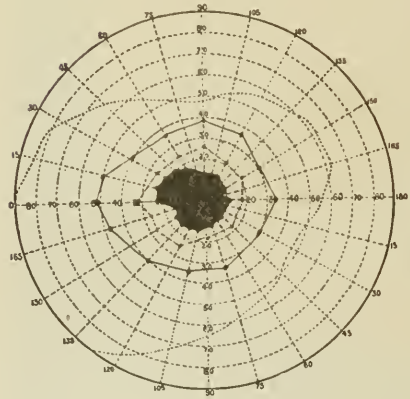


FIG. 4. — Left field for white and red.

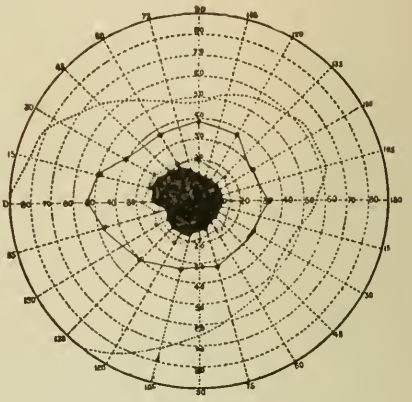
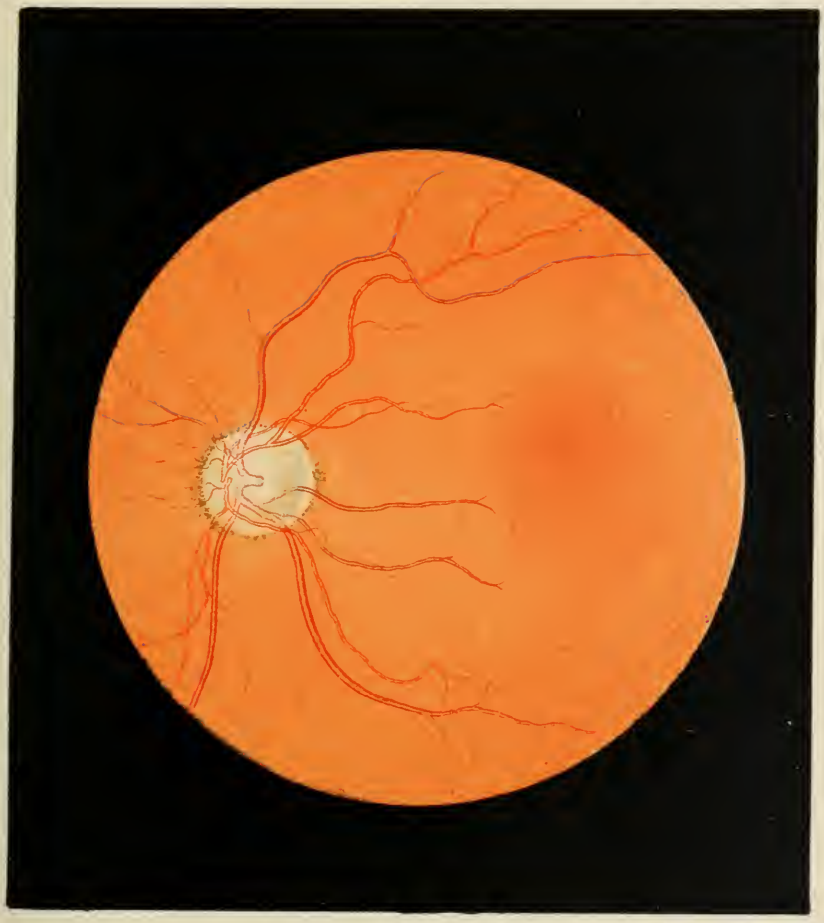


FIG. 5. — Left field for white and green.

colorations. Thus, for instance, the red field was broken into numerous "brownish spots" on a red ground. Green was seen at many points as a dim "blue," while blue and yellow at times, especially in the lower outer quadrant, appeared "faded and bleached." *

* Patient states that he has always had difficulty in differentiating between purple and blue.

PLATE II



LEFT EYE.

Examination with worsteds, while evidencing a slight green-blindness with the left eye, showed some very interesting peculiarities of color-sense in the right eye. While being absolutely unable to see any object placed in the position of the positive central scotoma, he could, at times, when the wools were situated peripherally, make color-differentiation between yellow and blue, though he was always able to grade the entire series into a system of intensities of tint that was remarkably correct.

Upon monocular exposure, the left pupil was found to be somewhat the larger; the irides, especially the right, responding

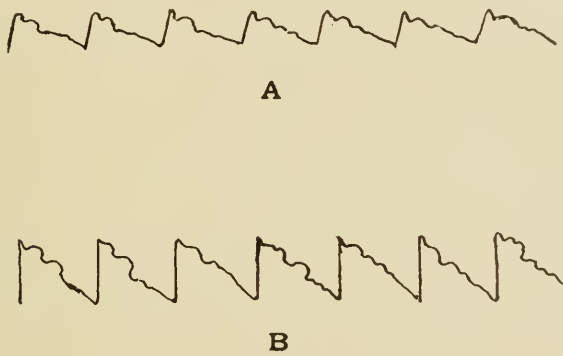


FIG. 6. — Sphygmographic tracings: A, hand at rest on knee; B, hand above shoulder. Tracings taken May 8, 1890.

freely and promptly to light-stimulus, accommodative impulse, and efforts for convergence. Extra-ocular motion, both separately and combinedly tried, was intact in all directions. Intra-ocular tension was not apparently increased, though the scleras were somewhat rigid.

On the following day, our fellow-member, Dr. B. Alex. Randall, kindly made a series of rough pencil sketches upon prepared backgrounds, from which, with reference to an extended verbal description made at that time, the present water-color drawings of the fundus-lesions have been evolved.

Careful repeated chemical analysis and microscopical examination of the urine failed to reveal the existence of any gross morbid animal or mineral deposit.

A systematic and extended physical exploration by my friend, Dr. J. P. Crozer Griffith, showed the want of any gross organic lesion, except a moderate degree of aortic regurgitation without discernible aortic stenosis; a faint systolic murmur that was present, being possibly organic, though without any evidence of any considerable degree of mitral regurgitation. The accompanying sphygmographic tracing (Fig. 6) shows the effect of the cardiac disturbance upon the radial pulse.

On the 3d of May, 1890, Dr. Wharton Sinkler kindly examined the patient and gave a diagnosis of chronic myelitis. At that time, the patient's gait was spastic, his toes dragged in walking, and he was obliged to use a cane to support himself. Loss of muscle-power also existed. The knee-jerks were greatly exaggerated, but there were no clonus. The plantar reflexes were exaggerated, and the front-tap reflex was present. Girdle-pain was complained of. Sensation in both feet was so greatly impaired that he could not differentiate compass points no matter how widely they were separated. In this region, a superficial touch could not be felt, but he perceived a deep prick. Sensation in both hands was good. The dynamometer registered eighty-five for the right and but fifty-two for the left.

The case was daily watched throughout the first weeks of the month, the hemorrhages slowly absorbing, the edges of the nerve-head becoming more and more visible, and the original shallow cupping, which at first, by reason of the slight neuritis, was only seen to the temporal side of the disk, gradually, though perceptibly, deepening and broadening. Vision, which increased to $\frac{3}{50}$ excentrically, remained persistently lost in the arge area around the fixation point.

On the 27th day of the same month, there appeared such a curious series of irregular beadings in the temporal distributions of the retinal veins, that Drs. William F. Norris and George C. Harlan were asked to look at the case. These beadngs, which were spontaneous and slowly-moving by a series of erks towards the disk-head, could be stopped, and a similar series of mobile beadings given to the nasal branches of the retinal veins by artificial increase of intra-ocular pressure obtained by slight though firm palpation with the finger upon the upper ciliary region through the half-closed upper lid.

In each instance, the impulse of the "beads" appeared to be synchronous with the heart's action. At this visit, the right radial pulse seemed to be the stronger and the firmer.

Two days later, the beaded currents in the entire venous series, with the exception of the upper nasal branch, were in motion; this current becoming broken and mobile upon the slightest external pressure upon the globe.

On the following day, the hemorrhages were almost gone and the swollen retina in the macular region seemed to have regained its proper level. The disk-surface was sunken and the nerve had become greenish-gray in tint to the temporal side. A spontaneous beaded current was visible in the upper nasal vein. On the disk there appeared to be a small, though well-pronounced aneurismal dilatation of the central artery just before its primary retinal bifurcation. This arterial enlargement could be thrown into a violently pulsating mass by artificial pressure. The arterial currents, though narrow, could not be broken by any degree of pressure that was compatible with visibility of the eye-ground. The perivascular thickenings and opacifications of the lymph-sheath walls seemed to have become perceptibly broader and denser during the time that the patient was under observation.

Careful attention to the general condition of the patient, the best of hygienic care, and entire rest to the eyes, kept him perfectly comfortable until the 16th of September of the same year, when he returned with the statement of immediate loss of sight and sudden pain in and around the same eye upon the previous day. He was now in a state of acute hemorrhagic glaucoma. Numerous hemorrhages into the vitreous chamber hiding the entire fundus could be seen through the semi-dilated pupil. The cornea was anæsthetic, and there was marked increase of intra-ocular tension. The eye appeared to be absolutely blind. Eserine, localized heat, and morphine, with immediate recourse to enucleation should iridectomy fail to relieve the neuralgia, were ordered and agreed to.

Two days later, there being sufficient anterior chamber though the eye remaining hard, a broad, clean-cut iridectomy was safely accomplished without any accident or apparent

rupture of a blood-vessel by a bent keratome; precaution being taken to remove the instrument slowly and deliberately so as to allow a gradual escape of the aqueous humor.

The wound healed rapidly, the pain immediately ameliorated, and tension fell to normal. This continued for six weeks, when, without apparent increase of tension, a slight but fresh hemorrhage was found in the anterior chamber, only to daily increase, causing the eye to grow more and more painful until the 20th of the month, when, after the greatest persuasion, the patient was finally induced to be relieved of the painful and irritating organ by an enucleation.

Exercising the greatest care of the patient's general health, which unfortunately had become more and more shattered until now he has been compelled to abandon all active pursuits, and to rest and be cared for both at the seashore in summer and at his own home during the winter months, the left eye which has been seen within a few weeks, has been kept in excellent working condition.

The specimen was carefully prepared and cut into a series of sections by Dr. Mary Morey of Philadelphia. Examination of this showed in a great number of irregularly broken and unsequentially mounted sections, all the evidences of old perivasculitis and retinal disintegration mostly limited to the inner layers at the posterior pole and around the optic nerve entrance. No thrombolic or embolic remains could be found, though carefully searched for over many specimens. Sequelæ of both old and new hemorrhagic extravasations were found both in the larger cavities and thrust in between the more compact tissues. The ciliary bodies, folds, and muscles were markedly engorged, and the remnants of loose fresh blood-clots in and around the vessels could be seen. The angle of the chamber seemed to be open though choked, as in the second case, with pigment *débris* and pigment corpuscles. The colobomatous edges of the iris were clean, though laden with pigment. The iris stump, as far as could be determined by the association of several small pieces of separately mounted contiguous tissue, was quite short and evenly edged. The corneal wound was coapted throughout, without any apparent over-

riding of its extremities, and the track of the incision was smooth and even.

The second case is of much greater clinical interest.

On the 9th of March, 1892, through the recommendation of my friend, Dr. George H. Halberstadt of Pottsville, Pa., H. McG., an apparently healthy man, without any family history of eye trouble, came to my service at Wills' Eye Hospital. The patient, aged forty years, an engineer by occupation, stated that the sight of the left eye had been gradually growing increasingly "misty" for three years' time, this being accompanied by attacks of inflammation and pain in and around the organ. A slowly increasing failure of the right vision, which had become primarily noticeable in December of 1891, and which, in spite of both local and general medication, had been associated with intense localized neuralgias, especially in the temporal region, had caused his physician to seek for further advice. At the time of the examination, both corneæ were hazy and quite anæsthetic, with a few fine deep-seated infiltration areas. The iris tissue appeared degenerate and discolored. Both pupils were irregularly dilated. The media in the right eye were so hazy that it was impossible to obtain any view of the fundus, either with the direct or with the indirect image, while the ground of the left eye could be but dimly seen, showing a deeply-cupped disk. Intra-ocular tension was markedly increased, this being the more pronounced in the right eye. There was intense engorgement of the episcleral veins, giving the globes a bluish-purple tint. The anterior chambers were almost annihilated. Vision was reduced to perception of light in the area shown in the sketch No. 7. The left eye was absolutely blind.

As the patient stated that he could plainly differentiate large objects with the right eye up to within a few days, and as the necessities for prompt radical interference seemed so urgent, an immediate broad upward iridectomy was made, without any unfavorable complication except a slight oozing of blood from the enlarged vessels of the iris stroma. Next day the wound had healed.

Forty-eight hours later the eye was perfectly quiet. There

was a large, broad, clean-cut peripheral coloboma. The cornea was much clearer, the anterior chamber was re-established, and the hemorrhage had almost disappeared. The patient could readily count fingers at six metre's distance, and voluntarily asserted that his field of vision had become larger. Pain had almost gone, and he was enabled to enjoy his night's rest.

Both the local and general conditions steadily improved under appropriate treatment until the 25th of the month, when he was enabled to see the fifty diopter type at one metre's distance, and he had retained the fields taken on the 11th of the month, as shown in Fig. 8. Intra-ocular tension had now fallen to normal.

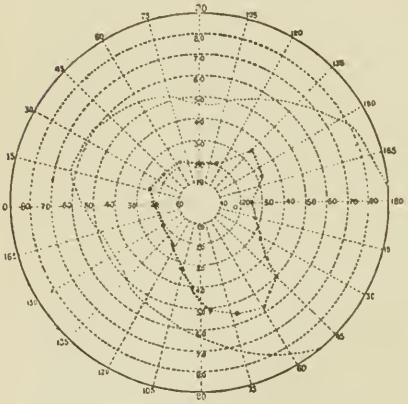


FIG. 7. — Right candle-field when patient first seen.

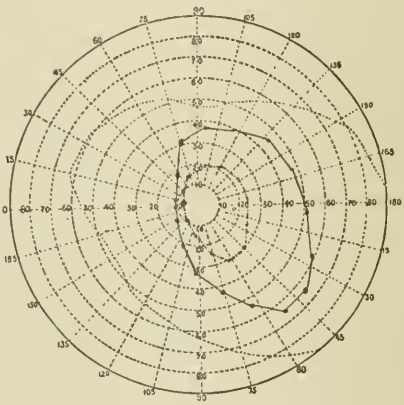


FIG. 8. — Right white and red fields after first iridectomy.

On the 18th of April, with a central vision of $\frac{2}{50}$ which could not be bettered by lenses, a large central field for red and white, no pain, and a quiet, properly-toned eye, he was sent back to his physician with directions for the local employment of eserine, etc.

Under this treatment he did well all summer. In the early fall, however, he found that the right vision began again to persistently fail until he was only able to distinguish light.

On the 16th of November of the same year he was again brought to the hospital. The appearance of the eyes had materially changed. Though still blind in the left eye, the right field of vision was reduced, as shown in Fig. 9, to a small heart-shaped area of faint light-perception in the lower outer periph-

ery. The left pupil was irregularly dilated to at least seven millimetres width in its longest diameter. The episcleral veins were engorged. The lens had become partially opaque and greenish in tint. The iris tissue continued degenerate and the corneal haze seemed to be the greatest slightly down and in from the summit of the membrane. Intra-ocular tension had become raised to + 1, that of the right eye seeming to be slightly supernormal. The large artificial colobomatous area remained free up to the periphery, but the lower portion of the iris appeared to be attached by a rather broad posterior synechia

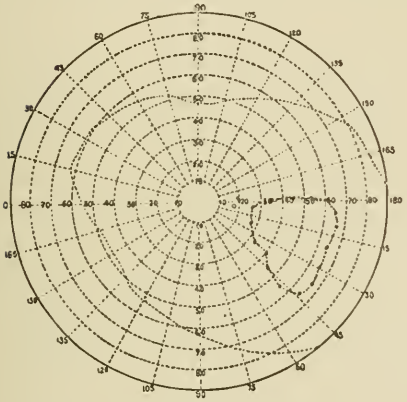


FIG. 9. — Right candle-field before second iridectomy.

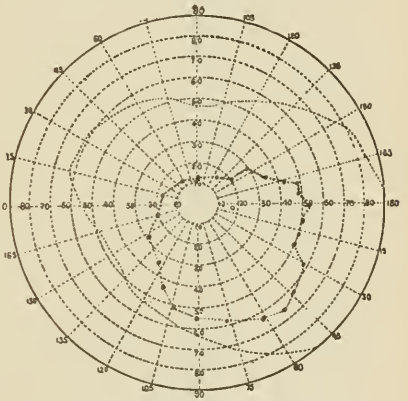


FIG. 10. — Right candle-field after second iridectomy.

to the anterior capsule of the lens just below its center. The lens itself was milky white and somewhat swollen. Little or no anterior chamber existed.

After consultation, an anæsthetic was administered and a diametrically-placed broad and free iridectomy without injury to the lens was readily obtained by means of a bent keratome. As before, there was some oozing of blood into the anterior chamber from the iris tissue. Eserine was instilled immediately after the operation. In less than two days' time the wound had perfectly closed, the hypemia had disappeared, and the anterior chamber was restored. The lower coloboma was clear and broad, extending directly up to the lower inner angle of the chamber. This, with some broken remnants of a few synechia upon the anterior capsule of the lens with the original

iridectomized area, made a broad hour-glass-like pupil. The lens was undisturbed and intra-ocular tension had fallen to normal.

One week after the operation, the patient could count fingers at twenty centimetres' distance, and the field of light-perception, which included the fixation object, was enlarged to the size shown in Fig. 10. Intra-ocular tension remained normal.

In consultation with Dr. Norris, it was then decided to wait a few weeks, to continue the local and general treatment, and to endeavor to extract the right lens. This was done on the 15th of February, 1893, without any difficulty, while the patient was under the influence of a general anæsthetic. The drug (ether), curious to state, even at the time of the patient's most profound insensibility, and, in fact, during the entire operation, seemed to set his entire muscular apparatus, including the extra-ocular groupings, into a series of gross and rapid clonicisms, which made some of the steps of the operative procedure rather awkward of performance. During this condition, after free capsular division, the lens was delivered safely and completely, without the loss of any vitreous, through a superiorly-situated broad corneal incision, the synechia giving away without any trouble. Neither primary nor secondary hemorrhage took place.

The recovery from the operation was uneventful. In five days' time, the pupil was clear throughout the large upper coloboma and in most of the smaller lower one. After various changes in the degree of both central and peripheral vision, showing $\frac{3}{50}$, by the use of a + S. 10. D. ⌔ + C. 2.50 D. ax. 180°, a series of form and color fields (the one here chosen (11) taken nine days after the operation) were obtained, which again embraced central fixation.

With the above correction, the picture of a deep and an almost complete glaucomatous cupping with a marked green-gray degeneration of the optic nerve-head tissues, and marks of old blood extravasation into the deeper-lying tissues of the retina, with diminution of retinal vessel calibre, could be plainly seen.

Eight months later, after a quiet and comfortable summer, during which time the patient voluntarily more or less discon-

tinued the use of eserine, he returned with the statement that his blind eye had become suddenly painful a few days previously, and that he desired its removal. Examination showed a stony-hard globe that was almost violaceous in tint, the shallowed anterior chamber being half filled with freshly extravasated

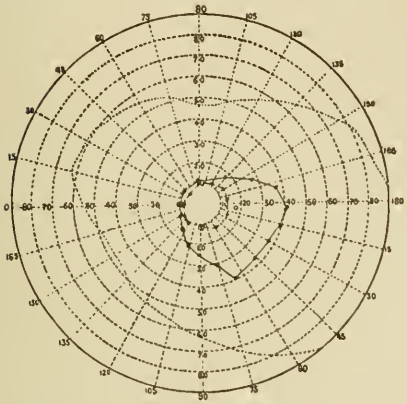


FIG. 11. — Right white and red fields after extraction of lens.

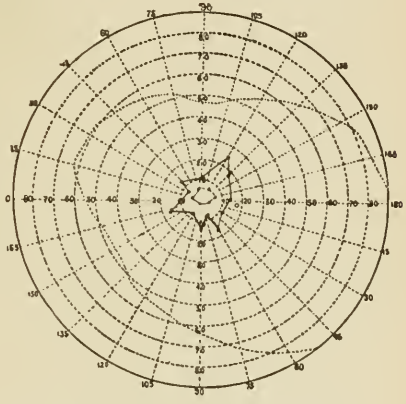


FIG. 12. — Right white and red fields.

blood. The next day, enucleation was done under ether, the patient having the same peculiar muscle-tremor as before. Vision in the right eye taken by a different chart, and practically under the same conditions as before, had now increased to nearly $\frac{4}{5}\frac{}{0}$. The eye was quiet and the field of vision, though slightly more irregular in outline, remained central and about the same size as before.

The patient was lost sight of until one month ago, when, through the kindness of Dr. Wendell Reber of Pottsville, one of my former assistants at the hospital, into whose hands the patient fell, he was again referred to me to decide whether any further operative measure might be necessary.

A consultation with Drs. Norris and Harlan decided in the negative. At that time, his local condition was practically unchanged. The fields of vision, charts of which were carefully taken by Dr. Reber, but which unfortunately have been misplaced, presented a much greater diminution in area, with quite a zigzag periphery, though here as before, central fixation was preserved as when taken in November last. This is well

shown in Fig. 12, which is a copy of the field as taken at this time by one of my assistants, Dr. Krause. The intra-ocular tension was normal and the eye was painless.

After the specimen had been properly hardened and cleaned by Dr. Samuel S. Kneass of Philadelphia, Adjunct Professor of Bacteriology in the Philadelphia Polyclinic, antero-posterior sections through the median horizontal plane, so as to include the optic-nerve entrance, were carefully cut by him. Here, the corneal tissue does not seem to be involved, there being but a few pigment depositions on the endothelial layer, these being most marked to the temporal side and thickest and densest in the angle, — at which place there are the remains of a few blood-corpuscles. The temporal side of the iris is slightly infiltrated, especially towards its base, at which point there is a broad line of blood pigment and scattered blood-corpuscles. The nasal portion of the iris is similarly studded with pigment deposits. Between the ciliary bodies and the posterior angle there is a large aggregation of blood-corpuscles, many of these being adherent to the uveal pigment. In the ciliary folds there are similar fresh hemorrhagic extravasations. The ciliary muscle is rather long and wedge-shaped, somewhat similar to that found in emmetropia. In the body of the muscle itself and in the overlying sclerotic, there are numerous engorged blood-vessels. In the region of the ora serrata there are numerous blood-corpuscles situated on the retinal tissue next to the vitreous. The larger retinal vessels themselves are engorged with blood. In many instances, the surrounding lymph-channel walls are thickened and the lymph-spaces are enormously dilated at places and engorged with pigment *débris*.

Between the limiting membrane of the retina and the inner granular layer, there are numerous alveoli; these, which increase in size and become more and more aggregated as they approach the nerve-head, break through the internal nuclear layer at points and distribute the nuclei between them. Near the disk, the innermost layer of the retina turns in towards the vitreous to abruptly turn back again. The retinal fibres themselves at this point are forced out against the choroid and the sclerotic to again incurve and pass into an enlarged degenerate

mass representing the nerve-head, where they are soon lost in the degenerate tissue. A second projecting mass of nerve-fibres, passing more deeply into the nerve-head tissue, also turns abruptly backward and is lost. A third, though somewhat smaller portion, passes directly backward without much distortion and interruption. The involution of the second series corresponds in position with a depression in the summit of the enlarged nerve-head. The temporal fibres of the retina, thus irregularly squeezed into an extremely narrow area, produce a small external depression which mainly affects the external and the bacillary layers of the membrane. These two series of projections tend to produce a large triangular area in the temporal portion of the enlarged nerve-head mass.

The fibres to the nasal side of the retina seem more compact and are less degenerate until they reach the nerve-head, at which point a few are allowed to pass irregularly into the tissue of the nerve-head itself. These, which are at the extreme edge, pass outward far into the optic nerve as a narrow wedge.

The entire intervening portion of the nerve-head, between the temporal and the nasal series, is occupied by a grouping of irregular whorls and cavities that are densely pigmented in places, and at the center show the remains of the central artery of the retina.

In the central and most degenerate portion of the optic nerve itself, numerous hemorrhagic areas are distributed.

Remarks. — These brief histories and the results of the post-mortem findings have not only been of great interest to the writer, but have served to teach him a most important lesson. With this latter fact in view, he has brought them before the Society, hoping by the striking contrast between the two cases to offer an extremely rare type of the disease, in which some hope may be vouchsafed to the patient for deferring at least the almost universal fatal issue.

The first, a well-cared-for though dissipated man, suffering from grave nerve disease, suddenly evidences a right-sided thrombolic and embolic process in an eye that has evidently been the subject of retinal hemorrhage, and already shown signs of increased intra-ocular pressure. In him, we find a

victim of pronounced vascular disease, both cardiac and peripheral, in whom the renewed breakages of vessel-wall and the consequent extravasation of blood have been most sudden and violent. Here, each hemorrhage, as shown by the specimens, did not confine itself to the larger lymph-stream channels, but actually forced its way into the interstices of important nerve and nutrient structures. Here, the disastrous pressure with probable disintegration of contiguous tissue by the presence of disorganizing and possibly irritating blood and lymph material, soon rendered the structures of the organ not only increasingly weaker in their physiological acts, but progressively less able to cope with the constantly-augmenting vascular disorder.

Unable at last to withstand the exquisite neuralgia, which was temporarily relieved by a carefully-performed and uncomplicated iridectomy, the entire nidus of pain had to be removed for both the patient's comfort and safety.

How different, however, is the second case. Here, an apparently healthy middle-aged man, without any other evidences of gross organic vascular lesion or general disturbance of the secretory or excretory system, gradually develops, during the course of three years' time, a comparatively painful blindness in the left eye, with an almost complete annihilation of vision on the more neuralgic right side. Brought to necessary operation by an acute exacerbation of pain, the procedure is safely accomplished upon a degenerate and, fortunately, probably but slightly vascular tissue, from which there was but little hemorrhage. Relieved for several months' time, another attack with its necessary accompaniment of lowered functional power only appeared as the result of indiscretion. By a similar uncomplicated operation, again the process was checked, care being taken this time to keep the patient's general regimen, diet, etc., under the strictest surveillance. The eye then being quiet and all visible hemorrhage having been absorbed, the last hope for useful sight was given to him by the extraction of a cataractous and swollen lens. Safely accomplished, with no accident of any nature, central vision was brought to a higher acuity than during the entire time that he was seen. This degree of visual power has been held in an eye whose tonus is seldom,

if ever, above normal; an eye, however, that too surely is showing the slow, steady, and irregular contraction of the field, as seen in the increasing pathological excavation of simple and chronic glaucoma.

The question may be asked, and properly too, Does the second case strictly belong to the category of secondary glaucoma dependent upon intra-ocular hemorrhagic extravasations? That it does can hardly be doubted when it is considered not only that distinctive marks of past retinal hemorrhage could be seen in the right eye after the media had become clearer and the opaque lens had been removed, but that the method of termination of the fellow blind eye was occasioned by a marked intra-ocular hemorrhage. Again, the microscopical study of the enucleated organ, where not only loose hemorrhagic aggregations in the large fluid cavities and vascular infarcta in the tunics of the organ could be seen, but where clump-like masses were to be found interposed throughout the interstices of the more loosely-meshed portions of the ocular coats, furnishes similar evidence. Further, the pictures of vessel-wall thickening and commencing disintegration, both point towards chronic vascular disturbance.

The comparative youth of the patient, however; the relatively better condition of the vascular coats in this case as compared with that of the more advanced stage of the disease in the other older subject; the method pursued during the operative interference; and the careful regimen instituted while the patient was under control, all show why here the local disease has been so long stayed in its downward progress.*

* The same question may be as consistently asked of the first case. Here most observers, with much less study and without post-mortem verification, could have easily asserted from the first clinical findings and the later history of the case with its fatality, that it belonged to the category of glaucoma that is secondary to retinal hemorrhage; but how, in the absence of any certain traces of past disturbance, could it be certain that the retinal hemorrhages preceded the glaucomatic process, except that absolute dependence be placed upon the patient's assertion in giving but one of the characteristic subjective expressions of previous retinal extravasation? So, in most of the recorded instances, there has been an element of uncertainty as to which was the initiative factor. The first stages of so-called glaucoma are so complex, so evanescent, and in many instances so unlike the latter degenerative ones, that many observers might be led astray and deny the presence of the glaucomatic process. In reality, the main question simply resolves itself into the compensatory

Unfortunately, as a rule, the generality of such cases are seen when the vascular degeneration is more advanced and the ocular tissue are more congested. Here any form of operative interference, when vascular structure is divided, is dangerous, and recuperation from the most successful procedure is at times apt to be slow and tedious.

That a few rare examples do exist where the usual function may be usefully prolonged for varying periods of time, there can, from the teachings of the second case, be but little doubt.

As expressive of this almost isolated grouping,† the conclusion resolves itself into the fact that in some extremely rare case of glaucoma that is secondary to slight recurrent attacks of intra-ocular hemorrhage, especially in young and comparatively sthenic subjects in whom the vascular system is not greatly involved, the organ may be kept for much longer periods of time than ordinary in such cases in a condition of usefulness by appropriate hygienic and general therapeutic measures; care being taken to slowly perform operative procedures whenever there is urgent necessity to relieve increased intra-ocular pressure by rendering patulous the most important outlets for the intra-ocular fluids.‡

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powers of the globe in its resistance to a certain morbific process. Granted that this process practically consists in a primary disturbance in the vascular system from disordered nutrition with extravasation of a foreign and irritative substance into the contiguous delicate structure of the eye, the work of mischief to the free circulation of the intra-ocular fluids has begun. Each attack, proportionately greater by reason of increasing vascular trouble and diminished resistant force of the gradually weakening ocular structures, at last allows, as one of the most important and terrible results, the soft neural tissues at the posterior pole of the eye to lose their vitality and thus to render the organ hopelessly blind. Still continuing, ruptures of vessel structure in a more and more degenerate organ in association with all the pathological changes that are produced by tissue cicatrization continue, and at last produce such violent outbursts of pain that finally it becomes absolutely necessary to remove the organ.

† Out of some eight thousand cases of eye-disease personally seen by the writer, in both public and private practice, during the past four years, this is the only one out of eight that have been confirmed by autopsy, where the patient (this the youngest of all in the series) so persistently retained this modicum of vision.

‡ Since writing this paper, Dr. George E. de Schweinitz has kindly given the writer the following history of a most interesting and instructive case in the person of J. M., aged fifty-seven, residing in Newark, Delaware. The patient, who was

a native of America, applied for treatment on the 8th of April, 1893, with the following history: He is a night-watchman, losing much sleep. Has always had trouble with the left eye, owing to obstruction of the lachrymal duct, which was opened eighteen years ago, but from which a slight purulent discharge has never ceased to flow. Five weeks ago he noticed a red spot before this eye, which gradually increased in size, and was followed by violent pain. Consultation at that time with some one in his own neighborhood is said to have shown hemorrhages in the retina. The violent pain in the eye increased and was succeeded by inflammation, and in about five days the sight is said to have entirely disappeared. He has had various drops for his eyes, and within the last few days has been using a solution of eserine prescribed by Dr. William F. Norris at Wills' Hospital. He is a short, rather dark-skinned man, with grayish hair, of reasonably good habits, and without severe illness since his youth, except chronic dyspepsia. He has had rheumatism, but never severely. The arteries are perhaps a little stiffer than normal at his age of life, and the facial and neck veins somewhat turgid. There is no cardiac murmur. The urine is practically normal, the specific gravity being, however, rather high, 103°; no albumen, no sugar, no casts, and no sediment of importance.

Right Eye.—The pupil is small, the anterior chamber normal, the lens strongly reflecting, the disk an irregular vertical oval of good color, without cup, the nasal edges of the disk being veiled. The general fundus of good condition, and the retinal vessels of normal size and carrying normally-tinted blood. V. = $\frac{6}{6}$ with 1 D.

Left Eye.—No reflex from the fundus; the anterior chamber shallow but not obliterated; the cornea steamy; the iris atrophic, discolored, its stromal vessels enlarged, and the pupillary margin firmly bound to the lens capsule. There is intense injection of the eyeball and a special violaceous color depending upon the congested perforating and non-perforating episcleral veins. There was practically no perception of light, except a faint shimmer detected in the lower and outer quadrant when a ray was condensed upon this portion of the eye with a two-inch lens. T + 2. The field of the opposite eye was entirely normal.

The patient was treated by the local application of eserine and cocaine, free leeching from the temple, iodide and bromide of potash, full doses of chloral, ergot, and hop compresses, and up to the 20th of the month was remarkably relieved. Then the pain was renewed, the tension which had somewhat diminished became + 3, and the pain was so excruciating that the patient begged for enucleation. This was performed on the 24th of the month without accident, except that there was a good deal of ecchymosis of the cellular tissue of the lids for several days after the removal of the eyeball. One month later an artificial eye was ordered, and there has never been any trouble since, so far as known.

Microscopic specimens of the eye presented the following lesions: Numerous hemorrhages in the deeper retinal layers and small, irregularly-disturbed ones in other parts of the tunics. Iritic angle closed and infiltrated. Nerve-head shrunken and excavated. Retinal tissue degenerated in many places, and the middle third of the iris markedly atrophic.

DESCRIPTION OF A CASE SHOWING THE LATE OPHTHALMOSCOPIC APPEARANCE OF SUPPOSED EMBOLISM OF THE CENTRAL RETINAL ARTERY.

BY CHARLES A. OLIVER, M.D.,

PHILADELPHIA, PA.

On the 2d day of October, 1893, a sixty-four-year-old man, C. K. of South Bethlehem, Pa., applied to Dr. George C. Harlan's clinic at Wills' Eye Hospital. The patient, a worker in steel, stated that nine days previously, while knocking off clinkers from a grating, he noticed a sudden loss of vision in the right eye which lasted about two hours. Three days later, the blindness repeated itself, lasting this time but thirty minutes. During the following forty-eight hours, his vision remained good, when, without any apparent cause, he experienced periodical attacks of dimness of vision and blindness.

At the time of examination, the eye was blind, the pupil was dilated, and the iris was immobile. Marked œdema, especially in and around the macula lutea, existed. A typical cherry-colored spot could be seen in the foveal region. Both the retinal arteries and veins were small, the arterial currents being thread-like and even invisible in places. The peri-vascular channels were thickened and opaque. No arterial pulse could be produced upon pressure.

The left eye was unaffected. No fundus-lesion could be detected, and vision could be brought to normal by the employment of a proper correcting lens.

The patient was lost sight of until the month of May, 1894, when he voluntarily re-appeared that he might obtain a glass for an increasing presbyopia. At this time, through the kindness of Dr. Harlan, the accompanying sketch of the fundus

The Late Ophthalmoscopic Appearances
of Supposed Embolism of the Central Retinal Artery.

LEFT EYE

details, by Miss Margaretta Washington of this city, was obtained.

The eye was blind and the pupil was undilated and fixed. The media were clear and the fundus details as here shown, were those of optic nerve atrophy, gross perivasculitis, and retinal degeneration.

Verbal descriptions of the late ophthalmoscopic appearance of this variety of disease are so rare in ophthalmic literature and the visual changes in the present instance are so characteristic, that they have been deemed worthy of an accurate and faithful graphic representation.

A FAMILY HISTORY OF IRIDEREMIA AND COLOBOMA IRIDIS:—CATARACT OPERATIONS ON TWO MEMBERS (BROTHERS).

BY DAVID DeBECK, B.S., M.D.,

CINCINNATI, O.

In May 1893, Dr. L. F. Laudick of Salt Lake City (now at Lima, O.), a graduate of the Medical College of Ohio, sent on to me two brothers by the name of Kemp, who lived at Lehi, Utah county, Utah, some 40 miles south of Salt Lake City. I was to examine these brothers, and, if possible do something for the relief of their blindness. The two brothers presented the following interesting conditions; and from them, and other sources, I obtained the, in some respects, unique family history given below.

These two brothers I presented before the Cincinnati Academy of Medicine, May 22, 1893; but no report of the cases was published.

John D. Kemp. Aet. 42. Spare man, rather below medium height; not very strong; but of fairly good general health. Of very good intelligence considering his early lack of advantages. No other malformations.

Both eyes are affected with a form of *irideremia partialis*, that just lacks being *totalis*. The two eyes are exactly alike. At the upper margin there remains a very narrow strip of iris, looking like a pair of thin outspread wings (Fig. 3). This strip was hardly visible to a casual inspection; but clearly shown by oblique illumination. The cut really shows it much too distinctly, for the semi-opaque corneal margin practically covers and obscures it. There is no nystagmus. Vision has always been rather poor; but sufficient to carry on his work as a miner. At this work under ground, in a dim light, he always got along better than at any work above ground in daylight.

Fig. 3

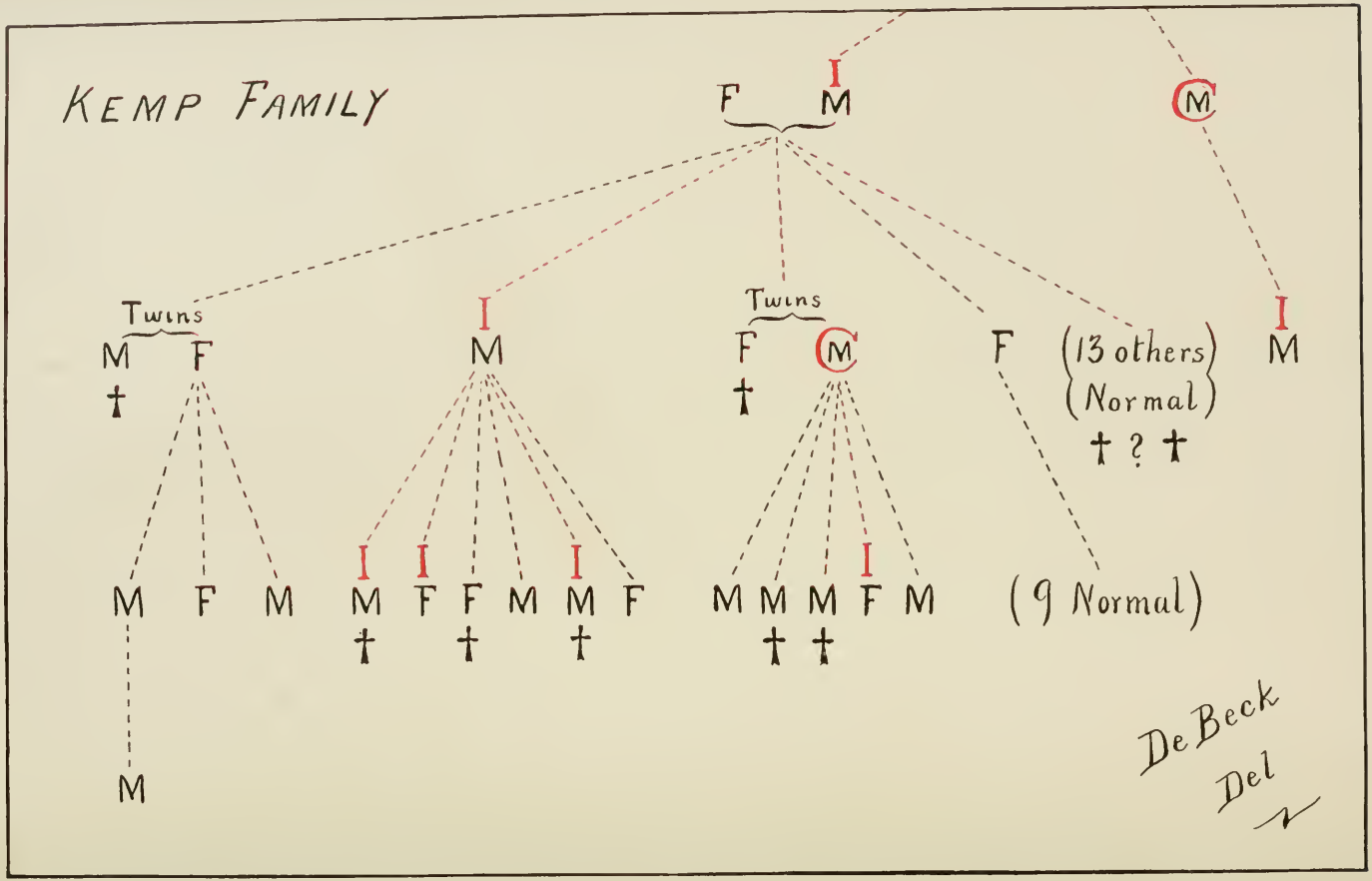
Vision had failed in the right eye about three years before. In the left eye about ten months before; failing in this eye very rapidly. In both eyes there were glistening white, nuclear cataracts, apparently nearly or quite mature. Vision was now reduced to good perception of light; and the light projection was accurate over a normal field.

Henry Kemp. Aet. 36. Small of stature; fair general health; not so intelligent as his brother. No other malformations.

Both eyes are affected with the ordinary form of *coloboma of the iris*. The coloboma is of moderate width, with the sides nearly parallel. It is directed downwards, and just a trifle inwards, and is complete to the margin. (Fig. 4). The iris is gray, and the pupil shows some little response to light. Both eyes exactly alike.

Fig. 4

Vision was formerly not first-rate; but was good enough to follow the same occupation as his brother, that of miner. Vision had failed in the left eye about eight years before; and in the right eye, about seven or eight months before, failing rapidly. Both his eyes present well-marked, white, nuclear cataracts. Both are apparently nearly mature, and look ex-


KEMP FAMILY
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actly alike notwithstanding the great difference in time during which they have been opaque. Perception of light is good; and projection is normal, except upwards in the left eye, which is doubtful.

Neither brother gave any history of pain or congestion in the eyes. There were present no evidences of any previous uveal inflammation. The tension in both was normal. The urine showed nothing abnormal.

FAMILY HISTORY.

Of the grandparents of these patients, and of the ancestors further back, nothing positive is known; although there are no family traditions that would imply the existence of this so easily noticed defect in the generations prior to those still alive.

First Generation.

In this generation there are *two* affected members.

John Kemp, the father, had irideremia, both eyes. His eyes are described as being like those of his son John. Whether his defect was really irideremia *totalis*, or this peculiar variety of *partialis* (see fig. 3) is impossible to tell owing to the fact that the laity would certainly not recognize any distinction between the two. And this same doubt applies to all the other cases of irideremia given below. He died past middle life; and there had been no marked impairment of vision prior to his death.

The mother. Eyes normal. Still alive.

William Kemp, an uncle. Aet. 62. He has coloboma iridis, both eyes. His eyes are described as being exactly like those of our patient, Henry Kemp (see fig. 4). This description is probably exact, for anyone could note this resemblance without room for error. He has become blind of late years; like his nephews by the development of cataract, both eyes.

Second Generation.

In this generation there are *three* affected members, in two branches.

John had 19 children, with two affected.

William, now dead. Eyes were normal.

Caroline, twin with William. Alive. Eyes normal.

John, our patient. Irideremia. Both eyes.

Henry, our patient. Coloboma iridis. Both eyes.

Grace, twin with Henry. Dead. Eyes normal.

Elizabeth. Still living. Eyes are normal.

There were thirteen other children who all died young. According to what information is now obtainable these seem all to have had normal eyes.

William has one child, a son, affected.

William, Jr., has irideremia, both eyes. He is living, aet. 28; seems to have fair vision. He is unmarried — at least no children are noted.

Third Generation.

This generation presents *four* affected members; all children of our two patients.

Caroline has three children. Eyes all normal.

John has had six children. Three alive.

John, Jr., would be 11 years old if living. He had irideremia, both eyes. "Eyes just like his father's."

Elizabeth. Aet. 9. Has irideremia, both eyes. The eyes are like the father's. The child has fair vision, and has made some progress at school.

Caroline would be 7 if living. Eyes were normal.

William. Aet. $3\frac{1}{2}$. Eyes are normal.

Richard would be $2\frac{1}{2}$ years old if living. He had irideremia, both eyes, like the father.

Jeanette. Aet. 18 months. Eyes are normal.

Henry has had five children. Three are alive.

John. Aet. 10. Eyes are normal. Vision good.

Nathan would be 8 if living. Eyes were normal.

James would be 6 if living. Eyes were normal.

Jane. Aet. 4. Has irideremia, both eyes. She thus has the defect not of her father, but of her uncle. Her vision seems fair.

George. Aet. 2. Eyes are normal.

Elizabeth has had seven children. The eyes of all, so far as known, were normal.

Fourth Generation.

This generation is represented so far by but one member: a little grandson of Caroline's. His eyes are normal.

The entire family history is represented graphically in Chart 2. The males are indicated by M, the females by F. The two members with coloboma are enclosed by the large red C; the seven cases of irideremia are indicated by the large red I. The affected lines of descent are shown by the dotted lines in red; the unaffected by the dotted lines in black. Those that have died are marked †.

THE OPERATION.

On May 30, 1893, I made the cataract extraction in both eyes of each of these brothers:

Henry. Nature having provided me with a ready-made iridectomy, I concluded to make the lower incision. I recognized the probability that the suspensory ligament was weakest at this part, and the danger of escape of vitreous greater; so that rapid manipulation conjoined with delicacy and absence of undue pressure would be required. I used the Graefe knife as being easier to work across the anterior chamber without entangling the edges of the coloboma. The incision was the ordinary corneal-border incision, only reversed. In the *left* eye there was a prompt escape of vitreous as the cystotome was used. In the efforts at rapid removal of the lens with the Bowman scoop the lens was broken up and extracted in fragments, some cortex being left, and considerable vitreous being lost. In the *right* eye there was also a loss of vitreous, but less than in the other. The lens was quickly extracted with the scoop, and the cortex well worked out. Atropine was dropped into each, and the ordinary dressing and bandage applied.

John. There being practically no iris to be considered, the upper corneal-border incision was used. In the *right* eye the edge of the lens presenting in the incision almost as the cystotome was used, and it being thought safest to absolutely refrain from all pressure, this presenting edge was grasped with a pair of fine forceps. These cut through the nucleus in a very unexpected manner. I succeeded in getting out the pieces except

one which sank down out of the way and was left. There was also an amount of cortex to be coaxed out that was unexpected, as the cataract had appeared quite mature. There was a slight loss of vitreous, but not much considering the manipulation. In the *left* eye the nucleus was nicely removed entire with the scoop, and the cortex well cleaned out, no vitreous being lost. The unusual shape of this nucleus was at once remarked. Instead of being lentil-shaped and practically a reduced model of the lens as is customary, it was exceptionally broad and at the same time remarkably thin.

This peculiar disc-like shape is represented in Fig. 5 where the black inner line shows it; while the usual shape and relative size of the nucleus is indicated by the dotted line. Atropine was dropped in, as a routine sort of procedure, and the usual dressing applied. This peculiar broad, flat sort of nucleus explained several points. It was this that gave the impression that the cataracts were much more nearly mature than was really the fact. This gave the broad expanse of opacity; and at the same time completely cut off vision. As there was no iris the control-test of the shadow cast by the pupillary margin was lacking. This thin and rather soft nucleus also explained why the forceps cut through it so readily. This peculiar nucleus will be referred to again below.

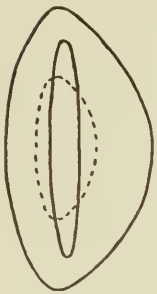

FIG. 5

RESULTS.

In all four of these eyes there was severe reaction, and irido-cyclitis or cyclitis set in. In the brother Henry (coloboma) this was very marked in each eye. In the brother John (irideremia) with only this narrow strip of iris we can hardly speak of an iritis; the inflammation here must have been a pure cyclitis. In the eye where the lens had broken and a piece dropped out of reach the inflammation was particularly severe. This inflammation in an aniridic eye would suggest that probably in some, if not in many, cases of ordinary cataract operation where an irido-cyclitis ensues, that this complication is really due to fragments of lens material which have dropped back of

the iris, and press upon the ciliary body. If this be probably true it adds an additional weight to the views of those who maintain the necessity of as thorough a removal as possible of all fragments of cortex. This may be secured by the see-saw pressure; by coaxing out with the spoon; or by the irrigation of the anterior chamber. This point that it is irritation of the ciliary body rather than the iris that brings about this post-operation reaction is further supported by the well-known fact that a clean cut, simple iridectomy is rarely followed by any reaction.

This inflammation proved rather stubborn, and was combatted for some four weeks by the ordinary remedies. Enough anodynes were given to secure sleep; the bowels were kept loose; very hot fomentations were occasionally used, they themselves using frequent cold applications for the comfort they gave; a 1 per cent. solution of atropia was regularly instilled; at one time when increased tension was feared a 1 per cent. solution of eserine was used for a few days; a five per cent. solution of cocaine was frequently resorted to when it gave local relief; and at one time there was a local abstraction of blood.

The inflammation finally subsided, and with remarkable good fortune left one very good eye in each brother; while in the other in each the result was practically nil.

Henry (coloboma) had V. = $\frac{20}{70}$ in the right eye with + 13.00 D. The other had a blocked pupil and coloboma, and no record of V. was made. It was certainly not better than perception of light. I suspected a choroidal coloboma in this eye; but an ophthalmoscopic examination was not possible. In the right eye there was no choroidal coloboma; but an extremely broad "underlying conus."

John (irideremia) had V. = $\frac{20}{100}$ in the left eye with + 16.00 D.; and when this glass was provided with the opaque disc with the small round opening V. rose to $\frac{20}{30}$ sharp. The other eye had the whole anterior part blocked up with capsule, lens-remnants, exudates, etc., and V. was mere perception of light.

He was provided with a pair of spectacles with straight temple bars and $\asymp$ nosepiece; on one side + 16.00 clear, and

on the other + 16.00 ground opaque except a clear, round, central opening left about 3 mm. in diameter. These he could thus reverse as he desired; the clear one he used ordinarily; only when he wanted to see more sharply in the distance he turned to the other, which for habitual use did not give him sufficient visual field.

I gave them no reading glasses then, as they expressed themselves as perfectly satisfied to be able to go about, and do common rough labor.

I have a letter dated March 20, 1894, from them, in which it is expressly stated that their vision is even better than when they returned home last summer. (That was ten months after the operation).

I only fear that this good visual result will probably not be maintained permanently. I regard these eyes as very likely to suffer in the future from chronic degenerative inflammation in the uveal tract.

Lately the uncle, affected with coloboma iridis and secondary cataract, and encouraged by what to them seemed the excellent result in the nephews' eyes, went up to Salt Lake City and had the cataract operation made upon one eye. They write that it was successful, but I have no details as yet from the operator himself.

REMARKS ON THE CONGENITAL DEFECTS.

This family history points towards the view that there is a closer genetic relation between irideremia and coloboma iridis than is generally indicated in the most recent views promulgated. They are usually clearly separated, both as regards causal factor, and period of development. It is certain that clinically they are sharply separated, and hitherto no connection has been noted (among *late* writers). Following Manz, most authors place the causative period for irideremia at the time of separation of the involution thas has formed the primitive lens; and that of coloboma iridis at the time of the closure of the fœtal optic cleft.

But the remarkable way in which these two defects alternate in this family shows that in this instance at least there is some

sort of connection, however obscure; and that at any rate the hereditary influence must be much the same.

In the first generation there are two brothers: one with irideremia, the other with coloboma.

In the second generation the brother with irideremia has one son with irideremia and another with coloboma; while the brother with coloboma has a son with irideremia.

In the third generation, while the son with irideremia has three children, also with irideremia, the son with coloboma has a daughter who has irideremia.

Thus these two defects alternate in successive generations in this family quite as often as the defect irideremia reappears directly in successive generations. Still the tendency is towards irideremia, for the later cases in the younger generations are all of this defect.

In this alternation of these congenital defects this family is certainly unique, and forms a striking and (so far as I know) solitary exception to the rule that in all of these family histories that have been tabulated in the literature the same defect (whatever it may be) reappears in the different members and the successive generations.

The objection will of course arise at once as to whether this form of nearly total irideremia should really be classed with the group of true cases of aniridia, especially if any general arguments are to be based upon it. It might be held that this should rather be regarded as a sort of exaggerated coloboma. For if we study the two cuts above (figs. 3 and 4) and then in imagination suppose the coloboma spread out, much as a lady would close one of these two-handled fans, we can readily see that the edge of the one would eventually coincide with the edge of the other (Fig. 6). While there is, of course, no embryological evidence to show any such mechanism in the genesis of irideremia; still this analogy, associated with the peculiar alternations of these two defects in this family, invites the conclusion that these defects are more closely allied than is generally held.

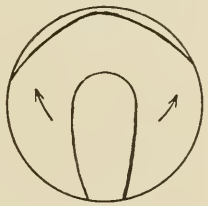

FIG 6

This peculiar form of partial irideremia must be extremely rare, even allowing for the probability of its being occasionally overlooked. I recall but one analogous case in recent literature. Francke (Zehender's *Klinische Monatsblätter für Augenheilkunde*, March, 1889) reports and gives cuts of a similar case. In his case the strip is somewhat broader, and extends much further around the corneal border, including about two-thirds of the entire circumference in one eye, and over one-half in the other. They also presented some peculiarities of iris structure and pigmentation.

This peculiar form of broad, flat nucleus (Fig. 5) demands further attention, and is very suggestive in one respect. If we can regard it as representing in shape somewhat the original involution that was the basis of the lens, it supplies some ground for an interesting hypothesis. We may regard the usual involution as a round or ovoid ingrowth which interferes with none of the adjacent developing structures, and a normal development ensues. If, however, this ingrowth should chance to take on a form much expanded laterally, and flattened in its antero-posterior axis, we may readily imagine that its border may reach out far enough to interfere with the little fold that is starting in to form the iris, and actually prevent its development. This broad nucleus we have found gives considerable weight to the view that this is the actual mechanism concerned in the causation of this defect. It would certainly be advisable to watch for any and every opportunity to make anatomical examinations of aniridic eyes and see if this peculiar form of nucleus is constant with them.

There is another unusual feature in these cases that is worth noting. The majority of such cases reported have very poor vision, often have nystagmus, and usually are myopic. But neither of these brothers showed nystagmus; cataract lenses of +13.00 and +16.00 D. certainly show no previous myopia; and V. = $\frac{20}{50}$ and $\frac{20}{70}$ is very fair after any cataract operation.

The absence of nystagmus is interesting when we remember that these brothers were *miners*.

REMARKS ON THE CATARACTS.

This family history still further emphasizes the fact to which I have before called attention: that is, that in these cases of congenital anomalies of the uveal tract there is a strong tendency to the development of blindness in later years; and this usually from these secondary cataracts. In this family the uncle develops cataract late in life; and these two brothers develop it, one at about 40 years of age, and the other in one eye when hardly 30 years of age, and in the second eye when but 35 years old.

In the Payne family, which I reported in the *Archives of Ophthalmology*, March, 1886, the three affected members who reached old age all became blind late in life; and probably all by the occurrence of a chronic glaucomatous process, or the development of this secondary cataract. This is probably due to a slow, insidious form of chronic inflammation or degeneration of the uveal tract. This sequel is frequently mentioned in the literature of this subject; especially with reports of irideremia.

The cataract extraction has been so seldom performed on cases of this character, that a short reference to the other cases on record may be instructive.

Higgins reports (*Lancet*, Dec., 1877) a case of a man, aged fifty-seven, with iris-coloboma and cataract in both eyes. The right had been blind for forty years, the left since a few months. After extraction a choroidal coloboma was found in each eye. The right set up iritis and the pupil closed; the left had a subsequent hemorrhage into the vitreous, but finally secured V. $= \frac{1}{6}$ with + 12 D.

Badal reports (*Gazette des Hôpitaux*, Mai, 1880) the case of a man with iris-coloboma and cataract. He had been operated upon in one eye twenty years previous, and lost it by irido-cyclitis supervening. In the other eye was a fully developed cataract, which had possibly been a congenital zonular cataract; at any rate, it had become completely opaque in later years. After extraction a large choroidal coloboma was found.

I have not quoted here the cases of cataract operation in

eyes with true aniridia; as they only bear indirectly on the subject here under consideration.

There is one point deserving attention in these reported cases. In my first case the eye that had been blind for over three years was the one lost; the eye blind but a few months was saved. In my other case the eye blind for eight years was the one lost; the eye but recently blind was saved. In Higgins's case the eye blind for many years was the one lost; the eye blind but a few months secured a fair result. This would indicate that in similar cases the operation should be made as soon as possible after the development of the cataract. It also indicates how bad the prognosis is in the old cases of longer standing.

If we include the case of the uncle of my patients, who was recently operated upon, and as they claim successfully, we have a total of nine eyes operated upon. Four of these were lost by irido-cyclitis supervening at once after the operation. One had a hemorrhage into the vitreous, but finally secured V. = $\frac{1}{6}$ with +12.00 D. One of my cases in one eye secured V. = $\frac{2}{7}\frac{0}{0}$ with +13.00 D. The other case of mine secured in one eye V. = $\frac{2}{5}\frac{0}{0}$ with +16.00 D. One case (the uncle's) is merely given as "successful." Finally in one case the exact results are not given, but the assumption is that they were at least fair.

Thus of the nine eyes there was 44 per cent. of immediate failures; and 56 per cent. of good results for a short time at least subsequent to the operation. We cannot, however, help entertaining the doubt whether even these good results would be maintained.

This is a proportion that would make operations upon such eyes present rather a gloomy outlook; still it is the only thing to be done, and certainly better than leaving them blind without any attempt at relief.

UNUSUALLY LARGE LOSS OF VITREOUS IN CATARACT EXTRACTION. RECOVERY WITH USEFUL VISION.

By J. A. LIPPINCOTT, M.D.,

PITTSBURG, PENN.

W. H. S., aged 31, presented himself May 29, 1893, showing the following condition: R. E., vision 1/cc. Immature cataract. L. E. totally blind from an injury received at 7 years of age. Globe of normal size. Pupil small and bound down to a dense membrane. Tension practically normal. In the following October, the cataract in the right eye having matured, a preliminary iridectomy was made upwards. On making a small corneal incision for this purpose, some very thin vitreous slowly escaped. Seven weeks later, *viz.*, Nov. 21, 1893, patient was taken into hospital to have the cataract removed. The tension of the eye at this time was normal, and light perception and projection were good. The coloboma previously made was small and symmetrical, and the pupil was free from adhesions. The incision was made with perfect ease and smoothness, but immediately on its completion the vitreous began to ooze out. At first the escape of the fluid was almost imperceptible, because the vitreous was so watery that it diffused itself in a thin layer over the whole surface of the eyeball. Very soon, however, the eyeball began to collapse, and in a few moments deep wrinkles showed themselves in the sclera. As these wrinkles grew deeper and deeper, I did not hesitate long in attempting to extract the lens. Pressure being out of the question, I introduced a spoon and removed the lens, but was compelled to leave a pretty dense capsule behind. The eye by this time looked like a complete wreck. Its contents would not have filled a globe much more than 1 cm. in diameter. However, the eye was closed with isinglass plaster, and protected, according to my custom, with a pasteboard shield. The subsequent history need not be detailed. The patient had several attacks

of iritis, resulting in adhesion of the iris to the capsule. A small opening, however, remained at the upper inner part of the pupil, and through this opening fingers could be counted four weeks after the operation. The sight gradually improved, until at the last examination, April 16, 1894, with + 11 D. it had reached 15/c. I am informed that the visual improvement has continued, and that the man is at work.

A CASE OF PANOPHTHALMITIS SUPPURATIVA FOLLOWING DISCISSION OF A CAPSULAR OPACITY.

By SAMUEL THEOBALD, M.D.,

BALTIMORE, MD.

Absolute asepsis in eye operations is something that we may aim at, but shall never, probably, completely attain. If, as has been proven, it is impossible, by any amount of scrubbing and application of germicidal agents to rid the *skin* entirely of septic organisms, it is hardly to be expected that we should meet with better success in dealing with the conjunctival sac. Indeed, in most respects, the conditions are much less favorable for obtaining asepsis of the conjunctiva than of the skin, for the antiseptic solutions which are permissible are many times weaker, and the mechanical means which may be employed much less efficacious.

On the other hand, it is undoubtedly true that, in some way which we do not as yet fully understand, Nature assists us in our operative work upon the eye, so that with comparatively imperfect antiseptic precautions we obtain far better results than might, *a priori*, be expected. Consider, for example, the difference in the behavior of stitches in the skin and in the conjunctiva or in the external eye muscles. In the skin, stitch abscesses are of frequent occurrence, in spite of the most rigid antiseptic measures; in the conjunctiva and eye muscles, on the other hand, even in the absence of all antiseptic precautions, they are almost unknown.

It is evident that the organisms which induce suppuration do not, as a rule, find in the conjunctival sac conditions which are favorable to their development, and the comparative immunity from infection which we enjoy in our eye surgery is, in all probability, due in a greater measure to this fact than to the, at best, imperfect antiseptic measures which we all, at the present day, feel it incumbent upon us to employ.

The antiseptic precautions which I practice in all operations involving penetration of the globe, such as iridectomy, cataract extraction, discission, etc., and which were used in the case I am about to relate, I recognize are by no means perfect, yet, for practical purposes, they seem to me to be as good as those in general vogue: The conjunctival sac is flushed repeatedly with a 1 to 8,000 sublimate solution (the flushing being begun, when practicable, several hours before the time for the operation) and the lids are washed with the same solution, a pad of absorbent cotton wet with it being also applied over the closed lids. The cocaine solution contains 4 per cent. of boracic acid, and the particular solution employed for major operations is not used for any other purpose. Just before being used, all instruments, or rather those parts of them that are likely to come in contact with the eye, such as the blades of knives, scissors, forceps, etc., are sterilized by being immersed in boiling water, and at the same time are washed clean with a bit of absorbent cotton, which has been boiled in the water, and which is held for the purpose with the fixation forceps. After being so treated, the instruments are not laid in an antiseptic solution, but are simply so placed, or held, that their sterilized parts shall not come in contact with any other object. The operators' hands are simply washed clean with warm water and soap. To cleanse the eye during and after the operation, a 1 to 8,000 sublimate solution is employed and a bit of new sponge or absorbent cotton.

The case of suppurative panophthalmitis following discission which I wish to bring to the notice of the society occurred in a negro boy, Harry B., aged 14, whose physiognomy is characteristic of inherited syphilis. He had had in each eye a soft cataract, probably congenital, with attendant nystagmus. By

repeated needlings, the left eye being operated upon first, and none of the operations having been attended by unusual inflammatory reaction, I had brought about the absorption of both lenses, and had restored fairly good vision (the retina being, probably, imperfectly developed) in the left eye. The relatively poor vision of the right eye seemed to be dependent upon some remaining capsular opacity, and it was to get rid of this that I determined upon the needling which resulted so disastrously.

The operation was a thoroughly satisfactory one, a good rent being easily torn in the opaque membrane, without undue traction. Previous to the needling, the pupil was dilated by atropia, the solution of which contained 1 per cent. of boracic acid; the eye was flushed with 1 to 8,000 sublimate solution in the manner I have described, except that the flushings were begun only a short time before the operation, as the patient had just come from his home, and a solution containing 4 per cent. each of cocaine and boracic acid was instilled. The only instruments used were a speculum, which was thoroughly boiled, a cataract needle, and fixation forceps. The two latter instruments were sterilized, and washed in boiling water in the manner I have described. No sponging of the eye, of course, was required, so that nothing came in contact with it except the sterilized instruments just mentioned. As soon as the operation was completed, the patient was made to close the eye, and over the lids a compress, wet with a solution of opium and boracic acid, was applied, this being the dressing which I have invariably employed in such cases for years.

I did not see the patient on the following day, but, on the morning of the next day word was sent me that the case was not doing well, and when I examined the eye early in the afternoon, about forty-seven hours from the time of the operation, the whole of the cornea was in a necrotic condition, there was excessive chemosis of the conjunctiva, and it was evident that the eye was doomed beyond peradventure.

As the patient did not suffer much pain, the question of enucleation was allowed to remain in abeyance, and, after a rather tedious convalescence, he left the hospital with a smooth, partly atrophied bulb, which, for him, was better than an empty socket.

What is the most probable explanation of the untoward result which occurred in this case, is a question to which I have not been able to find a satisfactory answer. That a diminished vitality and resisting power in the fluids and cells of the body, due to the inheritance of syphilis, was an important factor in determining the result, is altogether probable, and we should, moreover, not lose sight of the fact that, especially in such a subject, auto-infection may have been the cause of the whole trouble.

DISCUSSION.

DR. A. G. HEYL of Philadelphia. — Within perhaps sixteen or eighteen months I lost an eye after discission of soft cataract. A couple of days after the operation, which was a very easy one, around the point of the puncture the cornea became a little cloudy, with the ultimate formation of hypopyon and the loss of the eye. I have no doubt that the cause of the loss in this case was chronic nasal catarrh, which was discovered after the operation. The infection of the eye, I thought, occurred in that way. A common cause of hypopyon ulcer is, in my experience, a mycotic inflammation of the nasal mucous membrane, the essential for the infection of the cornea being a fissure in its epithelial covering. It is easy to see how the introduction of a discission needle may open the way for infection of the cornea.

DR. H. KNAPP of New York. — I would like to say a few words with regard to suppuration following the operation of discission for secondary cataract. I cannot speak from experience, for I do not remember a single case of suppuration, though I have done this operation in from 1,500 to 2,000 cases. I fully believe that suppuration may follow discission, for cases are reported everywhere, and some oculists consider the operation more dangerous than the primary extraction. It may be my luck and not my merit that thus far I have escaped bad experience. Yet, I do this operation not only frequently but also extensively.

With regard to the traumatism. I use no particular antiseptic precautions. I wash the eye outside even less than in extraction. I wash it inside with a $\frac{1}{5000}$ solution of corrosive sublimate, especially the upper lid. Then I introduce a needle. I irrigate the cornea with corrosive sublimate, and I commonly make a horizontal incision, which is followed by a vertical one from below upwards, so as to have a nice triangular opening in the center. I have seen in some cases irritation which seemed to be purulent but which was nothing but puriform; those cases

were very exceptional, half a dozen in number, perhaps, showing a thickening of the capsule afterwards. There evidently was in these cases more or less capsulitis, something which formerly when I practiced excision of the anterior capsule I had also found. In the ordinary discission of secondary cataract I have seen it also; in some cases there even was some slight hypopyon, but it disappeared, and the sight of those cases became good. I remember a case where the patient left the city and was absent for four weeks. During the entire period of his absence his sight was rather poor, and when he came to me I saw he had capsulitis and also some iritis, not very much, but the vitreous was cloudy. In a month or two it completely cleared up and vision rose to 20/30; and this good result was permanent.

Now, how to explain the cases of suppuration. They are not due to mechanical injury; they are infective inflammations. As to the immediate cause, I think that the pyogenic germs are carried along with a needle from the surface of the cornea, an accident which, I think, cannot be obviated, but which, happily, is extremely rare. Another explanation of such cases is, undoubtedly, that during the healing of the extraction germs get into the eye, but are not powerful or numerous enough to produce destruction of the eye. They lie dormant in the globe, but are brought to activity and produce more or less rapid destruction of the eye when the needling operation stirs them up. This dormant position of pathogenic germs is not a fiction; we have a number of cases in evidence, and I have seen several myself.

In Heidelberg, many years ago, I operated upon a boy for congenital cataract. Both did nicely. Fifteen years later, when the boy had grown up, he received a blow on one of his eyes without any visible lesion, and no immediate pain. Purulent inflammation developed, and that eye went to ruin by panophthalmitis. Furthermore, we see foreign bodies in the eye lying quiet for years; then they work loose and produce more or less destructive inflammation.

Another point which Dr. Theobald has advanced is evidently in our favor. It is, that in the eye we get suppuration much less frequently than it seems to us we should get, for there is no conjunctival sac free from pathogenic germs. The agencies which protect our operated eyes are: 1. The bathing of the eye in tears; 2. the irrigation of the wound with blood and aqueous humor.

EPITHELIOMA OF THE LOWER LID; EXCISION; TRANSPLANTATION OF SKIN WITHOUT A PEDICLE; RESULT ONE YEAR AFTER THE OPERATION.

By G. E. DE SCHWEINITZ, M.D.,

PHILADELPHIA, PENN.

Clara B., aged 40, presented herself for treatment at the Jefferson Medical College Hospital, April 14, 1893, on account of a morbid growth occupying the lower lid of the right eye.

The following history was obtained: She has been twice married. Her first husband was syphilitic, but appears not to have infected the patient. Her second husband is a healthy man; there have been no children from either marriage. The patient is a strong, wiry, hard-working woman, in perfectly good physical condition, and without history of illnesses that bear upon the present condition.

The growth occupied the whole lower lid, presenting the appearance of a grooved ulceration bounded on each side by slightly elevated walls. The center of the ulceration was covered with a crust, the removal of which caused slight bleeding. The tumor had been slow in growth, having first been noticed eight years ago. Some attempt to remove or absorb it by means of salves had been attempted without good result.

The patient was etherized and the diseased area removed, together with a triangular flap of tissue, the upper incision passing just below the margin of the cilia and extending the entire length of the lid. From either end of this incision the lateral cuts were made until they met at a point three centimetres below the ciliary margin. Three sutures, introduced from below upwards, closed the angle, but left a flattened triangular gap without covering. This gap was 2 cm. long and 1.5 cm. wide. Upon it was grafted a piece of integument taken from the thigh of the patient, so cut as to include only the true skin and none of the subcutaneous fat or tissue. This graft overlapped

the margins of the gap by about five millimetres all around. The wound was dressed with a layer of thin antiseptic protective, and a gauze pad moistened in bichloride solution, 1–5000, the whole held in place by a light sterilized roller. The dressings were undisturbed for forty-eight hours, and then replaced with the exception of the piece of protective. The graft became firmly united, after the usual necrosis of the superficial epithelial cells and the overlapping margin had occurred.

The accompanying photograph, taken one year after the operation, shows the line of union, the very good position of the lid, and the graft, which can be distinguished from the surrounding skin by its paler color. The measurement at present is 1 cm. in length, and 8 mm. in breadth.

Sections of this growth under the microscope reveal the following conditions:

Typical epithelial new-formation, consisting essentially of finger-like, cellular prolongations which penetrate deeply into the fibrous tissue. The epithelial cells are rather small, closely packed together, and here and there form the so-called cancerous cell nests. There is nothing in the sections differing from the ordinary and characteristic appearance of a cutaneous epithelioma.

The chief disadvantage of transplantation of skin without a pedicle, in the form of the so-called Lefort or Wolfe graft, is the subsequent shrinking which takes place. Perhaps this may be avoided by Dr. Gifford's recent ingenious suggestion to remove the superficial epithelial cells as soon as necrosis occurs, and replace them with a Thiersch's skin graft. The present case is briefly reported because it illustrates that occasionally flaps of this character serve a very useful purpose and become incorporated with the surrounding tissues without too much shrinking. Perhaps the support given to the graft by stitching the angles of the original gap may have had something to do with the good result.

EPITHELIOMA SIMULATING ULCERATED MEIBOMIAN CYST.

By G. E. de SCHWEINITZ, M.D.,
PHILADELPHIA, PENN.

A laborer, aged about 40, was brought to the Jefferson Medical College Hospital on account of an injury. He was a Scandinavian, spoke no language except his own tongue, and consequently clinical history was not readily obtained. Attention being directed to his eye, a small elevation on the upper lid was apparent, exactly like that produced by an ordinary Meibomian cyst. On everting the lid, there protruded from a rupture in the conjunctiva a mass about the size of an ordinary pea, slightly nodulated like a mulberry, and grayish-red in color. This appeared to be attached to a small pedicle, which in its turn was fastened at the bottom of the cyst. At first sight it appeared to be a mass of granulations springing from an ulcerated chalazion. The growth was carefully dissected out from the under surface, the cavity thoroughly curetted and cauterized with a solution of chloride of zinc. The wound healed rapidly and only a slight puckered scar remained to show its presence. By this time the patient had recovered from his injuries, left the hospital, and there has been no trace of him since the date of his dismissal, during the last week of December, 1893.

Sections of this growth show that it is an epithelioma which evidently had its start in glandular structure. The following are the main microscopic features: Portions of the integument exhibiting proliferation of the papillary layer, hypertrophy of the sweat glands, which are surrounded by massing of the external epithelial layer. Still deeper the epithelial cells lie in masses within spaces in the connective tissue, and further within there is a typical alveolar arrangement, the alveoli containing carcinoma cells arranged precisely as one sees them in an ordinary glandular cancer.

A recent contribution from the laboratory of Professor

Panas by Gilbert Sourdille reviews the previous literature of the subject of primary epithelioma of the Meibomian glands, and contributes a case very analogous to the one which I report to-day. In this instance a small tumor had protruded through the conjunctiva and was regarded as an ulcerated chalazion. After curetting, however, there was return, and finally the patient was relieved by the removal of the external half of the upper lid, which was repaired by a plastic operation.

It will be remembered that Fuchs* has described glandular carcinoma of the lids which he believed arose either from the Meibomian or from Krause's glands. An interesting paper by Conrad Rumschewitsch† bears upon this topic, particularly his observations on adenoma of the Meibomian glands, and in the present instance the evidence of glandular origin seems complete.

SOME TYPICAL CASES OF "SUBNORMAL ACCOMMODATIVE POWER."

By SAMUEL THEOBALD, M.D.,

BALTIMORE, MD.

Three years ago, in a paper read before this society, I endeavored to show that a not infrequent cause of asthenopia in young persons, by which was meant persons under the presbyopic age, is a condition for which I suggested the name "subnormal accommodative power." Whether this condition is due to a feeble, poorly developed ciliary muscle or an inelastic, unresponsive lens I did not then, nor do I now, feel competent to determine. Either of these conditions seems adequate to explain the phenomena observed, and it appears probable that sometimes one and sometimes the other may be the efficient cause. Rules were laid down for the detection of this anomaly and for its correction by means of glasses, and several illustrative cases were related.

* *Archives f. Ophtalmologie*, XXIV, 2.

† *Monatsbl. f. Augenheilk.*, 1890, p. 387.

In the interval which has elapsed since the presentation of this paper these rules have been my constant guide in dealing with similar cases, and I have had many opportunities of testing their practical value and trustworthiness, and I may add that the additional experience thus gained has but served to convince me that the condition to which I called attention is one which the practical ophthalmologist cannot afford to ignore.

As to the frequency of its occurrence, I may state that recently, in tabulating 1,615 consecutive cases of refraction and muscular anomalies met with in private practice since this condition first attracted my attention, I found that the presence of subnormal accommodative power, more or less marked, was noted 155 times, or in about 9½ per cent. of the total number of cases.

The whole doctrine of subnormal accommodative power, as explained in my previous paper, is based upon the observation that, while the normal balance of the lateral muscles of the eyes, as shown by the vertical diplopia test, is, in distant vision, one of orthophoria, in near vision (at the usual reading distance) the normal position is exophoria, the relative divergence amounting, as a rule, to from 3° to 5°. In other words, with induced vertical diplopia, the *true* orthophoria at the reading distance is exophoria, and orthophoria (using the term as it is commonly employed) when it exists in near vision (with vertical diplopia) is a departure from the normal. Expressed in another form, the vertical diplopia test at the reading distance, with normal eyes should show, as compared with the result at 20′, a difference in favor of the external recti muscles of from 3° to 5°. When this is not the case, as set forth in the paper to which I have referred, subnormal accommodative power exists.

As might be supposed, subnormal accommodative power may exist apart from, or be associated with, refractive errors. I have met with it in emmetropic, hypermetropic, myopic, and astigmatic eyes, and also in association with other muscular anomalies. In glasses we have the means of remedying the defect. If emmetropia be present, convex glasses, for near

vision only, are indicated. In hypermetropia, stronger glasses for near vision than can be worn in distant vision may be called for, and in myopia weaker glasses must be prescribed for reading than would otherwise be given. The vertical diplopia test will afford us important indications as to the strength of the glasses which must be prescribed for near work. Whether convex or concave, they should be of such a strength as to give, at least, the minimum amount of normal exophoria for the reading distance — say 2° to 3°.

Among the 155 cases referred to in which I have noted the presence of subnormal accommodative power, a considerable number exhibited the condition in so slight a degree as not to make it of much clinical significance. From among the more marked cases, I have selected the following as typical of the anomaly and illustrative of the measures adopted for its correction.

Case I. Miss G. I., act. 23, complained of asthenopia, severe and persistent headaches and poor near vision. She lived in the neighborhood of New York, and had received from a a well-known oculist of that city astigmatic glasses, + .25c ex. 90° for each eye, from which she had derived little or no relief. My tests did not reveal the presence of astigmatism, nor did they show even a quarter diopter of Hm. The ophthalmoscope showed marked negative symmetrical aberration of each eye (a condition, it may be remarked, which I have found frequently associated with subnormal accommodative power), but indicated less than .50 of hypermetropia. The vision of each eye was 20/xv — and was somewhat variable, the left eye once getting all the letters of 20/xv. The vertical diplopia tests were also variable in their results at different sittings, but usually gave from 2° to 3° of esophoria at 20′, and at 13″ never gave less than 8° of esophoria, and sometimes showed as much as 22°. The binocular near point for J., No. 1, was 9″, at which distance it was read with much difficulty. With + 1.50s there was still esophoria at 13″ of 3°, with 2.s orthophoria at that distance. Glasses, for near vision only, were prescribed, + 2.s for each eye, center out 3 mm. They proved entirely

satisfactory and gave complete relief, but after twelve months required to be changed to +2.25s = Prism 1° base out.

Case II. Mrs. A. C. S., aet. about 26, mixed astigmatism, asthenopia, especially in near vision. With accommodation paralyzed by the liberal use of homatropia the full corrective was: Left eye —.25s = +.37c 90°; right eye —.25s = +.50c 90°. She had previously received from an oculist in Baltimore —.50c 180° for the left eye, and —.62c 180° for the right eye, but had derived no relief from them. With her refractive error uncorrected the vertical diplopia test showed exophoria at 20′ of ½°, orthophoria at 13″, indicating subnormal accommodative power of at least 3½°. Glasses were prescribed for distance corresponding with the total correction under homatropia, except that —.37s was substituted for —.25s. In near vision, in order to obtain 2° of exophoria at 13″, it was found unnecessary to add +1.37s to the glasses decided upon for distance. For near vision, therefore, the following corrective was ordered: Left eye +1.s ⌒ +.37c 90°; right eye +1.s ⌒ +.50c 90°.

Case III. Mr. I. R. B., aet. 19, a student at the Johns Hopkins University, had in left eye M. = 5.5 D.; in right eye M. = 5.50 D., with right hyperphoria 2½° at 20′. A return of asthenopia compelled him to consult me a second time in June, 1891. He had previously been wearing, for far and near, — 1/10s, with upward decentering of right lens. With his M. half a diopter under-corrected, and with correction of his hyperphoria, as follows: Left eye —4.50s; right eye — 5.s ⌒ Prism 2½° base down; he had V. = 20/xxv — and orthophoria at 20′, but at 13″ the vertical diplopia test showed with this same correction, esophoria of 13°, indicating a very marked degree of subnormal accommodative power. With the spherical correction reduced to —2.75 for left eye; —3.25 for right eye, leaving 2.25 D. of M. uncorrected, and reducing the tension of accommodation to almost nothing, the vertical diplopia test gave, at 13″, 3° of exophoria instead of the previous 13° of esophoria. As he had had no trouble with his old glasses in distant vision, and was satisfied with the acuteness of sight

which they gave him, he was permitted to wear them still for distance, and the following corrective was prescribed for near vision: Left eye —2.50s, center down 3 mm.; right eye —2.75s, center up 3 mm., and with these he was able to continue his studies with comfort.

Case IV. Mr. W. B. S., act. about 22, a student at the Johns Hopkins University, had Hm. 1.12 with V. = 20/XIII. With glasses which merely corrected his Hm., asthenopia in near work persisted or was relieved only temporarily. Owing to the presence of subnormal accommodative power, even with +1.75s orthophoria at 13″ was shown by the vertical diplopia test, exophoria of but 1° with +2.25s, and of 3° with +2.50s. For near vision +2.50s, and for distance vision +1.s were prescribed, and worn with relief to the asthenopia, these same lenses, for greater convenience, being afterwards combined as bifocal lenticulars.

THE OPHTHALMOSCOPE DOES NOT ALWAYS REVEAL LATENT HYPERMETROPIA, WITH NOTES OF A CASE STRIKINGLY ILLUSTRATIVE OF THIS FACT.

By SAMUEL THEOBALD, M.D.,

BALTIMORE, MD.

Although at the present day the doctrine of Mauthner, that the ophthalmoscope can be depended upon in every case of hypermetropia to reveal the total amount of the defect, without the use of a mydriatic, probably numbers among its adherents but a small minority of practical ophthalmologists. I have not thought it altogether a work of supererogation to bring to the attention of the Society a case recently met with which, more than any other I can recall, seemed to me to disprove the correctness of Mauthner's claim.

That in a large majority of cases the ophthalmoscope, in skilled hands, without the accommodation being paralyzed, reveals all, or nearly all, of the latent hypermetropia, I am fully convinced, and I might quote, as doubtless every one here present could, innumerable cases from my note-book illustrative of this fact; still, I am equally sure that there are exceptions to this rule, and that occasionally, as in the following case, only a comparatively small part of the total hypermetropia, as brought out by a mydriatic, is revealed by the ophthalmoscope.

I. S. J., a lad nine years of age, exhibited the usual symptoms of asthenopia. The ophthalmoscope showed marked miliary choroido-retinitis in each eye and revealed H = 1. D. in the right eye, and H = 1. D. (or slightly more) in the left eye, with a suggestion of astigmatism against the rule. The vertical diplopia test gave esophoria at 20′ of 4° to 5° and at 13″ of ½°. A two-grain solution of hyoscyamine hydrobromate was ordered to be instilled into each eye twice before bedtime, and on the following morning twice (or perhaps three times) before reporting at my office for examination. Although the ciliary muscles still showed some activity, the vision under the mydriatic was reduced to 9/cc for the left eye and 10/cc for the right, and the best vision was obtained by the following combination: L. eye +5. s◯+.37c (or +.50c) 105° (V. = 20/XLV+); R. eye +◯4.s+ .37c (or +.25c) 85° (V. = 20/XX−).

As the ophthalmoscope revealed only 1. D. of hypermetropia in the right eye, and slightly more than this in the left eye, it will be seen that it fell 3.D. short in the one eye, and somewhat more than this in the other, of revealing the total refractive error, or, expressed in another form, fully three-fourths of the hypermetropia made evident by the mydriatic was not discoverable with the ophthalmoscope.

SO-CALLED MUSCULAR ASTHENOPIA.

BY G. W. HALE, M.D.,

NASHVILLE, TENN.

The term muscular asthenopia is an exceedingly vague one from an ætiological standpoint. It may mean what its name would seem to imply, and it may not. All writers acknowledge that an unbalanced condition of the extrinsic ocular muscles may be the cause of asthenopia.

Many seem to feel satisfied that they have solved the problem when they have given directions for determining the muscular balance, and if found at fault, have laid down rules for prescribing the appropriate prisms for the correction of the same, or have explained the use of prisms for gymnastic exercise either with or without some form of tenotomy. Advancement of the apparently weak muscle is also advised and its technique described.

There are a few who seem to have had a vision at some time in their lives, which allowed them to look into the hidden workings of that mysterious organ, the brain. There they saw, or thought they saw, in the faulty action of the nerve centers which preside over the eye muscles, the cause of the trouble in a small per cent. of the cases. Only one author speaks of it as a frequent cause. At that point they also appear to have been satisfied and have suggested little for its relief.

For several years I have had a growing conviction that the real cause of muscular asthenopia was in the abnormal action of the nerve centers. Now I feel certain that it is central, in a very large proportion of those so suffering. When I make that assertion I am not unmindful of the writings and teachings of those gentlemen who would have us believe that nearly all our ills in this world are directly traceable to the fact, that one or more of our extrinsic eye muscles is stronger than its opponent, or else has an abnormal insertion.

It seems to me that Landolt is the only writer who has

given us a good definition of the cause of muscular asthenopia. He says, "that it depends upon the absolute or relative weakness of the adductors or upon their insertion or else has its origin in the *central organ*, and depends upon a disturbance of innervation or upon a weakness of the power of fusion."

While I consider the above to cover the whole ground, I would certainly make some transposition, so as to make it read something like this: Muscular asthenopia usually has its origin in the central organ, depending upon a disturbance of innervation, or possibly, in some cases, upon a weakness of the power of fusion. In a small per cent. of cases it depends either upon the absolute or relative weakness of the adductors or obliques, or upon their insertion.

My own observation teaches me that want of converging power is the chief cause of this form of asthenopia. I cannot agree with those who have found insufficiency of the external recti to be a much more frequent cause. I also feel that if they will assume that disturbance of innervation is at the bottom of most of these cases, and work them out from that standpoint, they will find that many of their cases which they had supposed to be dependent upon weakness of the externi, will fall very naturally under the reverse head.

My reasons for believing that the cause is usually central and not peripheral are these: They have been set forth by others, so I can only repeat. Make a patient, who is suffering from exophoria, converge to his nearest possible point, by that means putting all possible strain on the supposed weak interni. Now while his eyes are fixed on the near object, with his head held rigid, command him to follow the object, as you move it to one side or the other. You will observe that his eyes follow easily, no matter, as a rule, to which side you carry it. In one case, or the other, you have, providing he follows the object, put a much greater strain on one or the other interni, and it finds no difficulty in responding. How could it possibly do that, were it an actual weakness of the muscle?

Again, many hyperopes, either with or without astigmatism, who have exophoria, find their exophoria disappearing soon after their error of refraction is corrected. Or, what is quite as

common, an exophoria which is causing marked asthenopia to-day, while the eyes are being used for continuous near work, may have entirely disappeared a few weeks later, especially if the eyes are relieved of near work.

Once more: When esophoria is associated with hyperopia or hyperopic astigmatism, of low degree, and the adduction is weak, the esophoria and asthenopia will frequently disappear without correcting the error of refraction, simply by increasing the adduction.

The test of carrying the weighted convergence-stimulus to infinity, is to me another convincing argument.

All the above facts seem to me to point to a central origin.

In order to better understand what we mean by disturbance of innervation, let us look a little more at the action of the eye muscles. We have been taught from all time that convergence and accommodation go hand in hand. On those premises did Donders base his theory of the production of convergent squint in the hyperope. Fortunately for him, nearly all those afflicted with convergent squint chanced to be hyperopic. Not till he struck a myope who converged did he find any trouble with the theory.

That convergence bears a certain relation to accommodation is understood by all, but that relation is fixed and unchangeable is not by any means a certain thing; in fact, I believe the reverse to be the truth. If it were not so we should always have esophoria with every case of hyperopia, whereas the opposite, or exophoria, is quite as common. Now, if exophoria ever develops in an hyperope, one of several things must take place: either the interni becomes exhausted, from the continual stimulus which has been applied to them, through the constant tax on the accommodation, or there is a true weakness, or abnormal insertion, of one or both muscles, or else the relation, which we have been taught existed between those two functions, has been changed. If either of the former were true, a few minutes' appropriate exercise could not possibly restore to the weakened interni the needed strength. Such a result can, however, almost always be brought about in a few moments, and is just what we would expect on the latter hypothesis. The moment

you can separate these two functions it seems to me that we must acknowledge that they are presided over by separate nervous centers, which in some mysterious manner act conjointly, but still admit of having that action changed. If that is true, and I firmly believe it to be, all our cases of muscular asthenopia, dependent upon exophoria, should be amenable to treatment.

That, from my point of observation, would do away with more than half of our cases of muscular asthenopia at once.

The development of esophoria in cases of hyperopia might be explained on the theory of the relation between convergence and accommodation. That, however, does not explain them all, as many do not improve after correction of the hyperopia, which they theoretically should do, were the hyperopia the cause. So again we are driven to the conclusion that that relation is not fixed and unchangeable.

Now for mode of cure or relief, whichever you choose to call it. It goes without saying that all forms of ametropia should have accurately adjusted glasses. As to what portion of the error of refraction should be corrected, it is not the province of this paper to discuss only in the most general manner.

Where esophoria is associated with hyperopia or hyperopic astigmatism, the whole error should be corrected and glasses worn constantly. Where esophoria is associated with myopia or myopic astigmatism, it is also my belief, that the whole error should be corrected. If the esophoria still gives troublesome asthenopia, then some appropriate exercise for the relief of the former should be instituted.

Where exophoria is associated with hyperopia or hyperopic astigmatism, the whole error may or may not be corrected and glasses worn constantly, or only for the near, as each case may seem to dictate.

Where exophoria is associated with myopia or myopic astigmatism, the whole error should be corrected and glasses worn constantly. The preceding are the four great classes with which we have practically to deal. If we are able to meet and successfully relieve all the above conditions, only a very few of

our patients will suffer much in our hands, or be obliged to seek relief elsewhere.

The remaining cases of hyperphoria, and unbalanced obliques which cause asthenopia, I believe to be few in number when compared with all who suffer from muscular asthenopia, and quite a portion of these two classes can be met successfully by one or more means, which we always have at our disposal.

If I am right in the theory, that most of the cases of muscular asthenopia are dependent upon a faulty innervation of the eye muscles, than any means which would so change that faulty innervation as to restore the apparent want of muscular balance should give our patients relief. As I have said before, prisms combined with the glass correcting the ametropia have been prescribed for years, and when they are a success, the patients considered them a great one, though of course they are nothing more than crutches. We all know how wonderfully comfortable and satisfactory prisms are on certain patients, and how completely they fail on others, who are, in some respects, in a like condition.

The above is of easy explanation when you admit the central theory for most cases, and the muscular weakness or abnormal insertion for the few. On no other grounds is it so satisfactorily explained.

Prisms for exercise, either with or without tenotomies, are in certain cases and by certain men considered a *sine qua non*, and I am willing to acknowledge, give relief, either temporary or permanent, in many cases, especially in the hands of wise and careful men.

While, as I have said, one may have fair success with prisms, tenotomies, and exercise, providing he is judicious, and his patient is careful, painstaking, and faithful; nevertheless, as soon as he admits the central origin of the trouble, he must abandon the application of all of the above, except in a few cases, or where he uses prisms for exercise, with the distinct idea that he is changing the innervation, and not strengthening the muscles.

In June, 1889, Dr. Deady of New York read a paper before

the "American Institute of Homeopathy," in which he described the carrying of the weighted convergence-stimulus from the *punctum proximum* to infinity for the relief of exophoria. As far as my observation goes, the most of writers, even Deady, supposed they were strengthening one of the extrinsic muscles. No one supposed he was changing the innervation of these same muscles. While Dr. Deady, now nearly five years ago, spoke of carrying the weighted convergence-stimulus to infinity, it was reserved for Dr. Gould of Philadelphia to put it in such a shape as to attract the notice of the profession at large.

I presume Dr. Gould's investigations were *de novo*, and he deserves full credit for all he has done for suffering humanity; still priority must be conceded to Dr. Deady. I am of course speaking within my knowledge simply; some gentlemen within the sound of my voice may have suggested it years ago. I can only say I never heard of it, prior to the article above referred to. The details of carrying the weighted convergence-stimulus to infinity for the relief of exophoria, and its reversal for the relief of esophoria, have been so fully described, that it would be a piece of presumption on my part to repeat them here. I only wish to say a very few words concerning the cases to which they are applicable.

We all know that the tests for muscular equilibrium are very unreliable. They vary from day to day, or from hour to hour of the same day. We also know that many patients suffer from apparent muscular asthenopia, whose muscles appear to be in balance by equilibrium tests. I think Landolt has given us the explanation of such cases. His experiments seem to prove that in order for one to work easily at the near point, he must use only one-fourth, or at most one-third, of his positive convergence, the other three-fourths or two-thirds being held in reserve.

Now one may have positive convergence enough to satisfy the equilibrium tests, but which is really so small in amount that it is practically all needed for near work, allowing none to be held in reserve. Such a person will, of course, show weak adduction which should be brought up, no matter what the equilibrium test may show. These cases are, I believe, very

responsive to the convergence-stimulus exercise. Nearly all cases of exophoria respond equally as well to the same exercise.

In a word, I would say, that whenever the adduction is found weak no matter what the state of the abduction may be, the case is an appropriate one for the treatment referred to. If the adduction does not respond in a few weeks, you may have a true insufficiency and some surgical procedure may be instituted.

My observations as regards the application of the principles to esophoria have been limited, simply because I have not had enough cases to work on. The few which I have had have all responded well, but they are only four in number, so they amount to nothing.

I have observed this, that in many cases which show one or two degrees of esophoria, with weak abduction as well as adduction, as soon as you put them on the exercise for the weak adduction, the abduction commences to increase as well; so by the time the adduction has risen to 36 degrees, say, the abduction is up to what may be considered about normal, and all asthenopia has disappeared. Such cases I formerly considered to be due to want of diverging power, but as they have all been getting well under exercise of adduction, I have been forced to change my opinion. The above probably accounted for the few cases of esophoria which I have encountered in the last six months.

I desire to present in a short and succinct manner the histories of a few cases which have fallen under my care of late. All errors of refraction corrected under a mydriatic.

Miss R. 16. Had asthenopia for years. Been under the care of many oculists.

Error of refraction corrected:

R. + .5 + .75, 75 deg.

L. + 1 + .5, 90 deg.

Abduction, 5 deg. Adduction, 15 deg.

Exophoria, 1 deg. in acc., 8 deg.

Has had tenotomies, various kinds of exercise with prisms. No relief, not even temporary.

On November 29, 1893, commenced exercise with innervation prisms. In three weeks, abduction, 7 deg., adduction, 32

deg. All asthenopia gone. Remained comfortable up to present, May 10th.

The patient had an apparent want of balance of the oblique, which disappeared as soon as the adduction came up.

Miss S. 26. For five years has had asthenopia. Worn glasses constantly all that time.

R. + .5 − 1.25, 180 deg.

L. + .5 − 2, 180 deg.

Abduction, 7 deg. Adduction, 15 deg.

Equilibrium. Exophoria in acc., 12 deg.

No change in glasses.

On March 9, 1894, commenced exercise with innervation prisms. In two weeks, abduction, 8 deg., adduction, 40 deg., asthenopia gone. Only time will tell the final result.

Mrs. C. 40 yrs. Asthenopia for years. Tenotomy of Lt. int. rectus five years ago. Since then has worn:

R. + .5 + .5, 165 deg. Prism, 2 deg. Base out.

L. + .25 + .75, 15 deg.

February 1, 1894, first consulted me.

Abduction, 3 deg. Adduction, 20 deg.

Esophoria, 10 deg., in acc., 2 deg.

Allowed to retain the same lenses minus the prism. Innervation exercise commenced. On May 23d: Esophoria, 4 deg. Abduction, 6 deg. Adduction, 26 deg. No asthenopia.

Mrs. K. 25. Almost an invalid for years. Always has headache, scarcely able to use the eyes for any near work. Abduction, 4 deg. Adduction, 12 deg. Esophoria, 1 deg. Exophoria in acc., 10 deg. Given for constant wear:

R. + .5, 135 deg. L. + .25, 45 deg.

March 13, 1894, commenced exercise of the interni. In four weeks, abduction, 6 deg. Adduction, 38 deg.

All headache and asthenopia gone. Digestion improved, gaining flesh, so she thinks, though has not tested by weight. Expresses herself as being an entirely different person.

Mrs. P. 35. For nine years had asthenopia and headache. Always had dysmenorrhoea, for twelve years menorrhagia and metrorhagia as well. Seven years ago, was for six months in a private hospital for their treatment. No benefit. Always in

bed from two to four days at menstrual period. Room dark, not able to use the eyes for anything.

Various lenses, either with or without prisms, have been worn for the last eighteen months. Benefit only temporary.

First seen February 14, 1894, just able to walk two blocks to my office. Equilibrium, exophoria in acc., 5 deg. Abduction, 6 deg. Adduction, 16 deg. Rt. hypophoria, 5 deg.

Innervation prisms for increase of adduction, used three times a day on 14th and 15th, made her very ill first day, vomited quite a portion of night, but felt better on the 15th. Menstruation commenced during night of the 15th and 16th, unattended by any pain, which she affirms is the first painless menstruation she has ever had. No photophobia. Up and about all the time. No menorrhagia or metrorhagia, menstruation lasted five days, in place of nine, as has been usual for twelve years.

Innervation exercise continued daily. In six weeks, abduction, 6 deg. Adduction, 38 deg. Rt. hypophoria, 2 deg.

Given Rt. .5, 90 deg. L. .75, 90 deg. Prism, 1 deg. Base up, as it was Lt. superior rectus which was at fault, to be worn constantly. Second, third, and fourth menstrual periods have been normal in every respect.

Little asthenopia or headache, unless she uses eyes excessively hard. I present this for what it may be worth; time will tell.

Miss B. 10. In April, 1893, adjusted these lenses. R. —5, —2, 10 deg. L. —.75, 10 deg. Abduction, 6 deg. Adduction, 10 deg. Exophoria, 3 deg. in acc., 10 deg. Glasses gave some comfort for nearly a year, when they became almost useless, as headache and asthenopia seemed to be increased by them.

On April 19, 1894, consulted me again. Abduction, 6 deg. Adduction, 10 deg. Under innervation prisms, in three days, abduction rose to 12 deg. Adduction to 32 deg., and glasses were worn more comfortable than ever. I understand this may not last.

Miss O. 20. Asthenopia and headache for several years. Been patient of several good men. Since December, 1891, I

have had charge of her. Been wearing R. +.5 +.75, 90 deg. L. −.5 +.5, 90 deg. for distance.

Esophoria, 1 deg. Exophoria in acc., 10 deg.

Abduction, 4 deg. Adduction, 15 deg.

Tenotomies have been done, which gave temporary relief only. All kind of exercise with prisms. Various combinations of prisms with above correcting lenses have been prescribed. With none could she read or work more than a few minutes at a time.

On November 2, 1893, commenced exercising with innervation prisms.

In four weeks the muscular balance was as follows, and has remained so till to-day, May 24, 1894:

Esophoria, 4 deg. Equilibrium in acc.

Abduction, 4 deg. Adduction, 36 deg.

All asthenopia and headache gone, uses eyes for anything and everything she chooses with absolutely no discomfort.

THE PRACTICAL VALUE OF LOW-GRADE CYLINDERS IN SOME CASES OF ASTHENOPIA.

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On February 3, 1894, an editorial appeared in the Journal of the A. M. A., entitled "Superfluous Spectacles," the caption of which was a most timely one, although its contents and conclusions were not in keeping with it. It utilizes two recent contributions to ophthalmological literature,* to support the editorial dictum of an influential medical journal, "that low-grade cylinders were only of mythical value." I found nothing in these articles to warrant this assumption, and my experience

* "Prevalence of Corneal Astigmatism in Eyes of Normal Acuity of Vision and without Asthenopia," by Dr. St. John Roosa, N. Y. Med. Rec., Nov., 1892, and "Asthenopia not Dependent upon Errors of Refraction or Insufficiency of the Ocular Muscles," Dr. Thos. R. Pooley, N. Y. Acad. Med., Dec. 13, 1893.

compels me to take issue with the conclusions thus mistakenly drawn. Dr. Roosa's article was written to prove that, as an optical instrument, the eye lacks much of the perfection so often claimed for it, and also that a considerable departure from this ideal was not inconsistent with normal vision and perfect working ability; Dr. Pooley's to prove that asthenopia is not infrequently independent of refractive or muscular errors. There is no question that both authors are eminently correct. Every oculist whose view is not limited to the narrow groove of a contracted speciality by his ignorance of its collateral domain in medical science must have necessarily recognized hundreds of such cases in his experience. Every sensible practitioner of ophthalmic surgery knows that the eye is only a small part of the human economy, liable to frequent variations of its working power, from all causes that make or mar the general health; that it is not only an optical instrument inherently more or less defective, but an integral and delicate part of the nervous system, subject for good or ill to the same influences that affect this latter. But a thorough knowledge of these facts is not inconsistent with the employment of even the simplest means of relief, whether that means is to be used temporarily or permanently, whether the trouble is due to local defect or general causes. This applies equally to glasses and to remedies. Glasses can be and should be frequently prescribed for a few weeks, just as we order a bandage, splint, or crutches for a disabled limb. As soon as the cause of the temporary optical disability is removed, and the eye resumes its former vigor, the glasses are thrown aside, as the bandages, splint, or crutches are dispensed with. This is sound and healthy therapeutics. Take, for example, the very class of cases referred to in the articles above mentioned. In the series of eyes that never manifested the slightest asthenopia and showed perfectly normal vision, although 91 per cent. exhibited decided refractive errors, suppose any of them did show symptoms of asthenopia, or recurring headache after eye-work. Would not the natural presumption that the refractive trouble was one of the causes of these symptoms be legitimate? And would not the correction of the optical error, however slight it might be, be scientific therapeu-

tics? The glasses might be needed for a short time only, it is true, and be discarded when the asthenopia no longer gives annoyance. The necessity for the glasses may have arisen because of some constitutional trouble which lowered vitality and temporarily impaired the individual ability to overcome the refractive error; but the latter was, just the same, a potent factor in developing the complaint, as without it the eye symptoms might never have been manifested.

That it is not necessary to correct all refractive errors, even when perfectly normal vision is not present, unless subjective annoyance demands it, is a proposition ophthalmologists have always admitted, and Dr. Roosa's paper only strengthened an old and accepted truth. Still, the fact that he found 91 per cent. of defective eyes in one hundred apparently perfectly healthy and perfectly normal ones, does not prove that 91 per cent. of our fellow citizens have decided hyperopia or astigmatism; it only means that the 100 persons examined exhibited rather a preponderance of optically defective eyes. Nor does it prove that, when needed, spectacles should not be prescribed, although it tends to show that all refractive errors do not need correction.

Dr. Pooley's paper treats of asthenopia from causes extrinsic to the eye, from exhaustive diseases and bad habits, from pathological conditions of distant organs, as the liver, stomach, kidneys, uterus, etc.; from irritation of the fifth pair, due, *e. g.*, to nasal troubles, to dental caries, etc.; and especially from nervous exhaustion, neurasthenia, so-called, or from any constitutional or local disturbance of the human economy that could bring about, directly or indirectly, any impairment of the strength or vigor of the accommodation or muscular coördination of the eyes.

Such may also have refractive errors which have never caused trouble, and have nothing to do with the existing asthenopia, but is it not logical to correct such errors optically, while treating the real causes of the asthenopia, as a temporary aid to a more rapid recovery? With convalesence, such glasses may be discarded. Others may exhibit no optical defect, and yet the accommodation need the temporary help of a suitable convex glass, just as weak muscles elsewhere receive artificial

assistance under like circumstance. Is not this a common custom in the paresis of accommodation after an attack of diphtheria? Is it not also true, that we occasionally meet with cases of defective or subnormal accommodation requiring such assistance in persons of vigorous health and perfectly free from any optical error?

The accommodation is a very variable quantity, as different in different individuals as other forms of muscular force or nervous energy. No fixed law can be formulated in regard to its rehabilitation when defective, no certain plan of treatment can be laid down. In two exactly similar cases, glasses may be required in one, and be perfectly useless in the other, and as the result of such experience, I am as thoroughly in accord with Dr. Pooley that every case of painful vision is not curable by glasses, as I am with Dr. Roosa that all optical errors do not need correction.

But I am not in accord with the writer of the above mentioned editorial that hyperopia of less than 1D. or an astigmatism of less than 0.75D. rarely needs correction, and that the value of a cylinder as low as 0.50D. or 0.25D. is merely imaginary. There is no question that glasses are frequently prescribed uselessly, and in many cases with decidedly bad results, by oculists whose medical horizon is bounded by the eye alone, and who fail to recognize any etiological origin of asthenopia outside that organ. But this is no reason to condemn as useless any means that will give the desired result.

I am no advocate of promiscuous adaptation of glasses. I consider their necessity a serious drawback to anyone who is compelled to use them, and I think they should never be advised unless the most thorough investigation demonstrates that they are absolutely requisite; but I prescribe any glass in a case of asthenopia, or headache following eye work, that will improve the vision, relieve the eye strain, and do away with the discomfort.

My own experience has taught me not to condemn the outcome of another's experience until I have given it a fair trial. I had no faith whatever in the practical value of a cylinder as low as 0.25D., and not much in one of 0.50D., as this amount

of astigmatism might be considered as a physiological, not a pathological, condition; but a fair and unbiased trial in suitable cases has convinced me that I was wrong, that even a physiological defect must sometimes be corrected, and I wish to submit the result of my experience.

Persons differ in respect to their receptibility for glasses or appreciation of correction; especially in astigmatism. Some will refuse any correction, even of a decided astigmatism of 1D. to 2D. Others will accept with joy a glass as low as 0.25D., *if the axis is inclined from the vertical meridian*, but I have never found a single case (and I have examined hundreds), of hyperopic astigmatism of 0.25D. ax. 90 or of myopic astigm. ax. 180 that could appreciate the correction of the defect, even when there were decided symptoms of asthenopia. In other words, I have never seen a case of asthenopia that could be referred to so low a grade of astigmatism *with the rule*, the axis being at 90 or 180, *both eyes being alike;* consequently, I have never prescribed such a glass, and don't believe that any appreciable benefit either to vision or comfort is to be derived from its use.

If, however, there is a difference in the refractive condition of the two eyes, or if there is an inclination of the axis from the perpendicular in hyperopic astigmatism, or from the horizontal in myopic astigmatism, I am satisfied that many cases of asthenopia derive great comfort from the use of cylinders as low as 0.50D. or 0.25D. This is more especially true of hyperopic than of myopic astigmatism.

I have taken the last 100 cases of asthenopia, headache, etc., for whom I thought it best to prescribe such glasses, all with one exception having hyperopic astigmatism, and in every case there has been satisfactory improvement, while a very large majority have been entirely relieved. I have divided them into six classes.

Class A. Astigmatism with the rule axis 90, the two eyes differing in refraction, 8 cases.

Class B. Astigmatism with the rule in one eye with axis at 90; the other with an inclination of from 15 to 40 deg. from the vertical meridian; 13 cases, of which two had compound astigmatism.

Class C. Astigmatism with axis inclined from 15 to 30 deg. from the vertical meridian, 33 cases, 12 of which had compound astigmatism.

Class D. Astigmatism against the rule with axis in horizontal M. 20 cases, 5 with compound astigmatism.

Class E. Astigmatism with axis inclined from 15 to 30 deg. from the horizontal M. 18 cases, 2 with compound astigmatism.

Class F. Astigmatism with the rule in one eye, and against the rule in the other, 8 cases, one with compound astigmatism.

The *ages* of these cases were as follows:

Fourteen were between 10 and 15 years,						
Thirty	"	"	15	"	20	"
Forty	"	"	20	"	30	"
Fourteen	"	"	30	"	40	"
Two	"	over			40	"

The vision before correction was 20/20 in 53 cases; 20/30 in 38; 20/40 in 9.

The cylinders prescribed were in 53 cases 0.25D. for both eyes; in 28 cases 0.25D. for one eye, and 0.50D. for the other; in 19 cases 0.50D. for both eyes, or, 0.50D. for one eye and 0.75D. for the other.

Spherical lenses in addition to the cylinders were worn by twenty-two of these cases, but in only three did they exceed 1D.

Sex:— There were 60 males, and 40 females.

Twenty-two cases applied for treatment of headache, without being able to trace its causation directly to the eyes; seventy-eight complained of difficulty of vision, eye-ache, etc.; six of these had blepharitis, three chronic conjunctivitis, and four spasm of accommodation.

In all cases every precaution was taken against error. Each case was examined carefully with the ophthalmometer and test-lenses; the accommodation was then thoroughly paralyzed, an examination by retinoscopy made, and the test-lenses used again. Any change from the first record was noted. When the accommodation was re-established, the previous examinations were verified, or any discrepancies reconciled. The muscles were tested, any radical defects treated by orthopœdic

exercises or operation. Very few of these cases had any marked muscular errors, and most of them disappeared after the glasses had been worn awhile.

Careful inquiry into the personal and family history of the case was always made and any apparent extrinsic cause for the asthenopia recorded. When necessary, treatment for the same was instituted by myself or the family physician, who was invariably informed of my opinion and my reasons for it. No glass was ever prescribed unless it improved distant vision. I always see such cases again in two weeks, if possible, and in this series I saw a large majority of them, and heard from the others.

If two or three weeks does not prove the glasses of some service, they are discarded. Sometimes, a re-examination under continued mydriasis will show the axis of the cylinder to be wrong, and, this too, in spite of the apparent corroboration of the first result by the patient's statements and the ophthalmometer. In very few cases, however, have I been obliged to change or discard the lenses.

Results. To demonstrate results let me call your attention to one or more cases in each class.

Class A. Case (No. 1 of the table). Mr. S. C. C., 22 years of age, principal of a school at Hampton, Va., was so annoyed by uncomfortable vision that it seriously interfered with his duties. Careful examination failed to reveal any constitutional cause for the trouble. His vision was 20/20. Under a mydriatic it was R. 20/20, L. 20/30. No plus or minus glass improved it: with plus 0.25D. ax. 90 right, and plus 0.50D. ax. 90 left, V. = 20/15. For several months he has used these glasses for all eye work and has had no further trouble.

Class B. Case (No. 20 of the table). A. C. L., a dentist of Scotland Neck, N. C., 30 years of age, whose eyes gave him constant trouble when at work, and who suffered from frequent headaches. He came to consult me for recurrent and dangerous epistaxis, which I found to be due to a bleeding vessel on the septum nasi; with this exception, he was in perfectly vigorous health. His V. = 20/20, but his accommodation soon tired. Under a mydriatic he showed slight hyperopia, the correction of which gave him 20/20 only. The addition of the

cylinder plus 0.25D. ax. 90 right and plus 0.25D. ax. 75 left gave him a clean 20/15. I prescribed the cylinders only; in a year's trial he is thoroughly satisfied of their efficacy, being relieved of the headache and no longer annoyed by his asthenopia. If he dispenses with the glasses for a week, he has more or less recurrence of his old trouble.

Class C. In this class, comprising the larger number of cases, I have selected three, entirely different, to illustrate my point.

CASE 1 (No. 46 of the table). Miss F., 25 years old, a stenographer and typewriter, had been annoyed by asthenopia a long while. More than a year previously she had consulted an oculist, who ordered plus 0.75D. to be worn constantly, as she exhibited a hyperopia of a little more than 1D. under a mydriatic. These at first seemed to help her, but gradually all the symptoms returned in full force. Her vision with the glasses was 20/20; the eyes apparently normal and her general health perfect. Careful examination showed that the addition of plus 0.25D. ax. 105 right, and plus 0.25D. ax. 75 left, to her sphericals, gave her 20/15 in each eye, and 20/12 with both eyes. After several examinations, I ordered the compound lenses; for more than a year she has used them with absolutely no discomfort from her eyes.

CASE 2 (No. 40 of table). Mr. T., 21 years old, a book-keeper by occupation, was so much annoyed by painful vision he could not attend to his business properly. He consulted me last summer, stated that his trouble dated back several years, and that he was wearing glasses prescribed by an oculist in another city. I found these to be 1D. over each eye. With them his V. = 20/20. The addition of a plus 0.25D. cylinder ax. 75° right, and plus 0.25D. ax. 105° left, gave him a clean 20/15. As the sphericals had never been of much service, and as I wanted to see the value of such a low grade cylinder in his case, I made him discard them and use the cylinders only. Although much annoyed for the first few weeks, he has reported lately that he can work with comfort, has no head or eyeache, and thinks he cannot do without the sphericals.

CASE 3 (No. 53 of table). Dr. D. H. C., 25 years old, then

an interne of one of our hospitals and now a surgeon in the U. S. Marine Hospital service, consulted me about his eyes. He was in vigorous health. For years he had worn concave lenses, −2.50D. right and −3D. left. For some time, however, his eyes annoyed him considerably. With his sphericals V. = 20/20. The addition of a −0.25D. cylinder ax. 105 deg. right and ax. 60 deg. left gave him 20/15. I told him I did not think this addition could do much more than increase the expense of his glass and slightly sharpen his vision. However, he had the compound lenses made with the result that all of the discomfort disappeared and he passed the examination for another degree in medicine, at a medical college, and before the U. S. examining board for his commission, without any eye annoyance whatever. There was no question of the efficiency of low grade cylinder in the case, although it was one of myopia.

Class D. Case 1 (No. 61 of the table). Mrs. H. F., a young married lady of Richmond, had worn glasses for years of plus 2D. right and plus 3D. left, being a decided hypermetrope. For some months she had noticed, however, that headache and eyeache followed use of the eyes. She was of a decided neurotic temperament, among other evidences being an annoying reflex cough that was cut short by applications of camphor menthol to the nose. I was disposed to attribute the asthenopia and headache to reflex origin, but, as I found her vision improved by adding plus 0.50D. ax. 180 to her glasses, I suggested this alteration. Within two weeks all the annoying symptoms had disappeared. Her low grade cylinders, added to the sphericals which alone had not given satisfaction, did away with all trouble.

CASE 2 (No. 70 of table). Another one of this class I have selected was a young lady of Pulaski, Va., Miss P. S., 16 years old, who was brought to me because of headaches and painful vision. Her general health seemed perfect, and she had no complaint of any kind unless she attempted to use her eyes. Under a mydriatic she exhibited about 0.50D. of hyperopia combined with 0.25D. of astigmatism *against the rule* ax. 180. I ordered the cylinder, with perfect relief to the headache and painful vision, and with unlimited ability to use her eyes for all kinds of study and work.

Class E. Among these cases there are several of interest, but I will call your attention to three.

CASE 1 (No. 76 of the table). Miss V., of Richmond, Va., 22 years of age, has been unable to use her eyes for several months. Her health was not all it should have been, and I attributed the trouble to her condition. She had also blepharitis. I ordered hot applications to the eyes, massage of the lids with a weak ointment of yellow oxide, tonics to use internally, and outdoor exercise. Her health improved, but her accommodation did not regain its tone. I found her vision practically normal = 20/20; but with a plus 25D. cylinder axis 165 right and ax. 15 left, it was improved. I ordered these lenses, and now, nearly two years afterwards, she maintains her cure was attributable to the glasses, and says she can work indefinitely with them and not at all without them.

CASE 2 (No. 79 of the table). Mr. T. L. A., a prominent insurance agent of Richmond, 49 years of age, had eye trouble for years. They were weak and watery, with red lids and unable to respond to continuous work. For some time he had worn convex glasses to correct his presbyopia, but his asthenopia continued. I found he had an astigmatism of 0.75D. ax. 30 right and 0.50D. ax. 150 left. I advised him to wear these continuously and to add his sphericals when reading. For eighteen months he has followed this advice, with entire relief to all the annoying symptoms except the blepharitis, and that it is much improved. Here, low grade cylinders proved valuable in a case as unfavorable as could be found, where chronic asthenopia had existed for years, and the patient was nearly 50 years old.

CASE 3 (No. 91 of the table). W. F. E., 19 years old, of Lewisburg, W. Va., a student, who broke down in his studies and was obliged to suspend them because of painful vision. A superb picture of health, with every other organ performing its normal functions, no extrinsic cause for the asthenopia could be found. His refractive error was only a low grade astigmatism 0.50D. axis 15 right, 0.25D. axis 165 left. The use of these glasses enabled him at once to resume and complete his studies in perfect comfort.

Class F. Case 1 (No. 95 of the table). Miss Marie L.,

Sweet Springs, W. Va., 16 years of age, was compelled to give up her studies because of painful vision. I could find nothing the matter, either with her eyes or general condition, to account for the asthenopia, except an astigmatism of 0.25D. axis 15 right and 0.25D. axis 75 left. I ordered the cylinders, with perfect relief to all the symptoms, and perfect ability to work.

CASE 2 (No. 100 of the table). E. H. W., New York city, 42 years of age, had an annoying asthenopia for some months. He could not use his eyes for even a short time without great discomfort. He consulted me under such circumstances that I could not be positive about his trouble. I, however, approximated the optical error as an astigmatism of plus 0.50D. axis 90 right and 0.25D. axis 165 left and wrote for these lenses. I was in Philadelphia at the time, about to pay a visit to Dr. De Schweinitz: I suggested he should go with me and see what the ophthalmometer would show. Dr. S. and I both examined his eyes and corroborated the above result. This was about two years ago. The glasses gave him immediate and continuous relief until about two months ago, when he wrote he was annoyed again. I told him to consult some one in N. Y., as in all probability he needed sphericals, as he was 44 years of age.

Now if this series of cases demonstrates anything, it certainly shows that low grade cylinders have as practical a value in the treatment of asthenopia as have convex glasses, local or constitutional remedies, or any other form of therapeutics when used in suitable cases. Most of those presented to you are well educated individuals, perfectly competent to express a reliable opinion, and in every instance have worn the glasses long enough (anywhere from three months to three years), to enable them to judge of the result. If such testimony is worthless, if the cure and relief of the headache, asthenopia, etc., was imaginary, and the value of the glass mythical, what testimony are we to accept in proving the efficacy of any therapeutic measures?

(Appended find table of cases.)

TABLE OF CASES.*

	Name and Address.	Age.	Vision, etc.	Diagnosis.	Glasses.	Result.
	Class "A".					
1	Mr. S. C. C., Hampton, Va.	22	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.50D ax. 90	20/15 Cured
2	Mr. R. F. W., Basic City, Va.	17	20/30 Exophoria 5°	Asthenopia	R., 0.25D ax. 90 L., 0.50D ax. 90	20/15 Cured
3	Miss Carrie P., Petersburg, Va.	13	20/30	Asthenopia	R., 0.50D ax. 90 L., 0.75D ax. 90	20/15 Cured
4	Miss Bessie T., Liberty Mills, Va.	16	20/30	Asthenopia	R., 0.50D ax. 90 L., 0.75D ax. 90	20/15 Cured
5	Miss Mabel S., Richmond, Va.	10	29/30	Headache Asthenopia	R., 0.75D ax. 90 L., 0.50D ax. 90	20/15 Cured
6	Mr. Wm. H., Madison C. H., Va.	39	20/20	Asthenopia	R., 0.50D ax. 90 L., 0.25D ax. 90	20/15 Imprv'd
7	Mr. M. L. M., Petersburg, Va.	23	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.50D ax. 90	20/15 Cured
8	Miss Mattie P., Salem, Va.	17	R., 20/40 L., 20/30	Asthenopia	R., 0.50D ax. 90 L., 0.25D ax. 90	20/15 Cured
	Class "B".					
9	Miss Ellie W., Richmond, Va.	13	20/20	Blepharitis Asthenopia	R., 0.25D ax. 105 L., 0.50D ax. 90	20/12 Cured
10	Mr. Hugh M., Richmond, Va.	24	20/30	Nictitation Asthenopia	R., 0.75D=0.25D ax. 90 L., 0.75D=0.25D ax. 60	20/15 Cured
11	Mr. C. S., Loretto, Va.	18	20/30 R., Hyperpho. ½°	Asthenopia	R., 0.50D ax. 75 L., 0.50D ax. 90	20/15 Cured
12	Mrs. Barnwell, Burlington, N. C.	25	20/20 R., Hyperpho. ½°	Headache Asthenopia	R., 0.25D ax. 60 L., 0.25D ax. 120	20/15 Imprv'd
13	Miss Ellie B., Richmond, Va.	15	R., 20/20 L., 20/30	Asthenopia Blepharitis	R., 0.25D ax. 120 L., 0.50D ax. 90	20/15 Cured
14	Mr. J. B. F., Richmond, Va.	24	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.25D ax. 105	20/15 Cured
15	Mrs. A. H. G., Norfolk, Va.	30	20/30	Asthenopia	R., 1D=0.25D ax. 135 L., 0.75D=0.50D ax. 90	20/15 Cured
16	Miss Bessie F., Waynesboro, Va.	17	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.25D ax. 60	20/15 Cured
17	Mr. Frank R., Shenandoah, Va.	20	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.25D ax. 105	20/15 Cured
18	Miss Lita W., Radford, Va.	11	20/30	Asthenopia	R., 0.50D ax. 75 L., 0.50D ax. 90	20/15 Cured
19	Miss Lettie P., Petersburg, Va.	17	20/30	Headache, twitching of eyelids, etc.	R., 0.50D ax. 90 L., 0.50D ax. 75	20/15 Cured
20	Dr. A. C. L., Scotland Neck, N. C.	30	20/20	Asthenopia Headache	R., 0.25D ax. 90 L., 0.25D ax. 75	20/25 Cured
21	Mr. L. P. K., Richmond, Va.	22	20/30	Asthenopia	R., 0.50D ax. 40 L., 0.50D ax. 90	20/15 Cured
	Class "C".					
22	Miss Barbara S., Richmond Fem. Sem.	15	20/20	Headache Asthenopia	R., 0.50D ax. 105 L., 0.25D ax. 105	20/15 Cured
23	Miss E. P. T., Medlock, Va.	18	20/20	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured

* All these cases were hyperopic except No. 53, who wore minus glasses. Hence the plus sign is omitted.

TABLE OF CASES.—CONTINUED.

Name and Address.	Age.	Vision, etc.	Diagnosis.	Glasses.	Result.
24 Dr. H. L. M., Waynesboro, Va.	24	20/20	Asthenopia	R., 0.50D=0.25D ax. 105 L., 0.50D=0.25D ax. 75	20/15 Cured
25 Miss E. M. S., Richmond, Va.	24	20/30	Asthenopia Headache	R., 0.75D=0.25D ax. 105 L., 0.75D=0.25D ax. 105	20/15 Cured
26 Miss Olla W., Gordonsville, Va.	15	20/30	Asthenopia	R., 0.25D ax. 75 L., 0.25D ax. 105	20/15 Cured
27 Miss Virgie B., Richmond, Va.	25	20/20	Headache Asthenopia	R., 0.25D ax. 75 L., 0.50D ax. 105	20/15 Imprv'd
28 Miss Dalia W., Jacksonville, Fla.	25	R., 20/20 L., 20/30	Asthenopia	R., 0.25D ax. 105 L., 0.50D ax. 105	20/15 Cured
29 Miss Elsie D. W., Richmond, Va.	24	20/20	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured
30 Miss Ruth M., Lewisburg, W. Va.	22	20/20	Headache	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured
31 Mr. W. H. C., Stewart, Va.	30	20/20	Asthenopia	R., 0.25D ax. 75 L., 0.25D ax. 105	20/15 Cured
32 Mr. F. D. C., Richmond, Va.	34	R., 20/20 L., 20/30	Asthenopia	0.25D ax. 120 each eye	20/15 Imprv'd
33 Mr. Pemberton P., Danville, Va.	14	20/20	Asthenopia	R., 0.50D ax. 105 L., 0.25D ax. 75	20/15 Cured
34 Mr. G. M. H., Elkton, Va.	18	20/20	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured
35 Miss E. M., Clarksville, Va.	20	20/30	Asthenopia Headache	R., 0.75D=0.50D ax. 75 L., 1.25D=0.50D ax. 75	20/15 Cured
36 Mrs. R. A. R., Smoky Ordi'ry, W. Va.	28	20/20	Headache	R., 0.25D ax. 75 L., 0.25D ax. 105	20/15 Cured
37 Miss M. L. K., Richmond, Va.	17	20/30	Headache	R., 0.50D=0.25D ax. 75 L., 0.01D=0.50D ax. 105	20/15 Imprv'd
38 Miss N. C., Richmond, Va.	16	20/20	Eyeache Blepharitis	R., 0.25 ax. 60 L., 0.25 ax. 120	20/15 Cured
39 Mr. E. W. C., Walthall's Store, Va.	16	20/30 L., H. ½°	Eyeache Dim Vision	R., 1D=0.25D ax. 75 L., 1=25D ax. 105	20/15 Cured
40 Mr. W. H. T., Richmond, Va.	21	20/20	Asthenopia *	R., 0.25 ax. 75 L., 0.25 ax. 105	20/15 Great imprm't
41 Mr. J. H. W., New Glasgow, Va.	20	20/20	Asthenopia	R., 0.50D ax. 105 L., 0.50D ax. 75	20/15 Cured
42 Miss Mattie C., Hollins, Va.	30	20/30	Asthenopia	R., 0.50D=0.25D ax. 75 L., 0.50D=0.25D ax. 60	20/15 Cured
43 Mr. T. D. L., Radford, Va.	21	20/20	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured
44 Miss Carrie N., Port Republic, Va.	17	20/20	Asthenopia Spasm of Acc.	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Imprv'd
45 Mrs. J. H. W., Danville, Va.	29	20/30	Asthenopia	R., 0.75D=0.25D ax. 75 L., 0.75D=0.25D ax. 75	20/15 Cured
46 Miss F., Richmond, Va.	25	20/30	Asthenopia	R., 0.75=0.25D ax. 105 L., 0.75=0.25D ax. 75	20/15 Cured

* Was wearing 1D. Constant discomfort. Took glasses away, and substituted cylinders only.

TABLE OF CASES.—CONTINUED.

Name and Address.	Age.	Vision, etc.	Diagnosis.	Glasses.	Result.
47 Miss M. W., Richmond, Va.	20	20/20	Asthenopia	R., 0.50D=0.25D ax. 105 L., 0.50D=0.25D ax. 75	20/15 Cured
48 Mr. M. G. T., Petersburg.	19	20/20	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/15 Cured
49 Miss Julia C., Bowling Green,	13	20/30	Asthenopia	R., 0.75D=0.25D ax. 75 L., 0.75D=0.25D ax. 105	20/15 Cured
50 Miss Laura McG., Winchester, Va.	21	20/30	Asthenopia	R., 0.50D ax. 75 L., 0.25D ax. 105	20/15 Cured
51 Miss Susie L., Sink's Grove, W. Va.	13	20/30	Asthenopia	R., 0.25D ax. 105 L., 0.25D ax. 75	20/20 Cured
52 Miss A. L. C., Richmond, Va.	22	20/20	Asthenopia	R., 0.50D=0.25D ax. 75 L., 0.50D=0.25D ax. 105	20/15 Cured
53 Dr. D. H. C., Hampton, Va.	25	20/20	Asthenopia (with spherical only)	R., 2.50D=0.25D ax. 105 L., 3D=0.25D ax. 60	20/15 Cured
54 Miss B. L. H., Richmond, Va.	20	R., 20/30 L., 20/40	Asthenopia	R., 0.50D ax. 75 L., 0.75D ax. 105	20/20 Cured
Class "D".					
55 Mr. J. J. L., Port Republic, Va.	30	20/20	Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Imprv'd
56 Mr. Uriah H., Floyd Co., Va.	28	20/20	Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured
57 Mr. Hampton M., Charlottesville.	16	20/20	Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured
58 Miss Nellie H., Unionville, Va.	13	20/30	Asthenopia	R., 0.50D ax. 180 L., 0.50D ax. 180	20/15 Cured
59 Miss Virgie W., Richmond, Va.	21	20/20	Asthenopia	R., 0.50D ax. 180 L., 0.25D ax. 180	20/15 Cured
60 Miss M. S., Richmond, Va.	14	20/40	Asthenopia	R., 1.50D=0.50D ax. 180 L., 1.25D=0.25D ax. 180	20/20 Cured
61 Mrs. Harry F., Richmond, Va.	31	20/20 with sphericals.	Asthenopia Headache	R., 2D=0.50D ax. 180 L., 3D=0.50D ax. 180	20/15
62 Mr. T. J. H.,	19	20/30	Asthenopia Chr. Conjct.	R., 0.50D ax. 180 L., 0.50D ax. 180	20/20 Imprv'd
63 Miss Bertha C., Kyle, W. Va.	18	20/40 20/30	....	R., 0.50D ax. 180 L., 0.25D ax. 180	20/15 Cured
64 Miss Dixie S., Richmond, Va.	10	.....	Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured
65 Mr. E. T., N. Y.	31	20/20	Asthenopia	R., 0.25D ax. 180 L., 0.50D ax. 180	20/20 Cured
66 Mrs. M., Richmond, Va.	33	R., 20/30 L., 20/40	Asthenopia	R., 0.25D ax. 180 L., 0.75D ax. 180	20/15 Cured
67 Miss M. H., Oxford, N. C.	19	20/20	Headache Asthenopia	R., 0.25D ax. 180 L., 0.50D ax. 180	20/15 Cured
68 Miss R. M., Lewisburg, W. Va.	17	20/40	Headache Asthenopia Spasm	R., 0.75D=0.25D ax. 180 L., 0.75D=0.25D ax. 180	20/20 Cured
69 Miss Amanda M., Hartshorn Mem., Richmond, Va.	25	20/20	Asthenopia	R., 0.50D ax. 180 L., 0.50D ax. 180	20/20 Cured
70 Miss P. S., Pulaski, Va.	16	20/20	Headache Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured

TABLE OF CASES.—CONTINUED.

Name and Address.	Age.	Vision, etc.	Diagnosis.	Glasses.	Result.
71 Mr. J. W. H., Church Road, Va.	24	20/40	Chr. Conjct. Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured
72 Mr. E. P., Richmond, Va.	12	20/20	Asthenopia	R., 0.50D=0.25D ax. 180 L., 0.50D=0.25D ax. 180	20/15 Cured
73 Mr. R. H. B., Richmond, Va.	17	20/40	Asthenopia	R., 1.25D=0.25D ax. 180 L., 1.25D=0.25D ax. 180	29/15 Cured
74 Miss Lavinia C., Richmond, Va.	20	20/20	Asthenopia	R., 0.25D ax. 180 L., 0.25D ax. 180	20/15 Cured
Class "E".					
75 Mrs. M. F. K., Charlottesville, Va.	33	R., 20/20 L., 20/40	Headache	R., 0.25D ax. 30 L., 0.75D ax. 150	20/15 Imprv'd
76 Miss M. A. V., Richmond, Va.	22	20/20	Blepharitis Asthenopia	R., 0.25D ax. 165 L., 0.25D ax. 15	20/15 Cured
77 Miss Mary A., Petersburg, Va.	11	20/30	Headache	R., 0.75D=0.25D ax. 180 L., 0.75D=0.25D ax. 165	20/20 Cured
78 Miss H., Harrisonburgh, Va.	21	20/30	Asthenopia	R., 1D=0.50D ax. 135 L., 1D=0.50D ax. 165	20/15 Cured
79 Mr. Thos. L. A., Richmond, Va.	49	20/30	Blepharitis Conjunct.	R., 0.75D ax. 30 L., 0.50D ax. 150	20/15 Cured
80 Mr. J. W. S., Warren, Va.	28	20/30	Asthenopia	R., 0.25D ax. 15 L., 0.25D ax. 15	20/20 Cured
81 Miss Lucy S., Richmond, Va.	17	20/20	Asthenopia	R., 0.25D ax. 15 L., 0.25D ax. 15	20/15 Cured
82 Mr. W. C. C., Richmond, Va.	17	20/20	Asthenopia	R., 0.25D ax. 130 L., 0.25D ax. 60	20/15 Cured
83 Miss I. S., Richmond, Va.	14	20/20 L., H. ½°	Headache	R., 0.50D ax. 15 L., 0.50D ax. 165	20/15 Imprv'd
84 Mr. W., Danville, Va.	30	20/20	Asthenopia Headache	R., 0.25D ax. 180 L., 0.15D ax. 30	20/15 Cured
85 Mr. Tyler B., Richmond, Va.	18	20/30	Asthenopia	R., 1D=25D ax. 45 L., 1D=25D ax. 180	20/15 Imprv'd
86 Mr. L. F., Thornhill, Va.	18	20/30	Asthenopia	R., 0.50D ax. 15 L., 0.25D ax. 165	20/15 Cured
87 Mrs. D. H. S., Roanoke, Va.	23	20/20	Asthenopia	R., 0.25D ax. 30 L., 0.25D ax. 150	20/15 Cured
88 Miss Lucy T., Radford, Va.	24	20/20	Asthenopia	R., 0.50D ax. 30 L., 0.25D ax. 165	20/15 Cured
89 Mr. Elliott DeJ., Bowling Green, Va.	20	20/20	Asthenopia	R., 0.25D ax. 15 L., 0.25D ax. 165	20/15 Cured
90 Rev. J. B. A., Petersburg, Va.	35	20/20	Asthenopia	R., 0.25D ax. 165 L., 0.25D ax. 15	20/20 Cured
91 Mr. W. F. E., Lynchburg, W. Va.	19	20/20	Asthenopia	R., 0.50D ax. 15 L., 0.25D ax. 165	20/15 Cured
92 Mr. W. E. G., Richmond, Va.	20	R., 20/30 L., 20/20	Asthenopia	R., 0.50D ax. 15 L., 0.25D ax. 165	20/15 Cured
Class "F".					
93 Mrs. H. L. R., Winston, N. C.	25	20/20	Headache Asthenopia	R., 0.25D ax. 165 L., 0.50D ax. 75	20/15 Cured

TABLE OF CASES.—CONTINUED.

	Name and Address.	Age.	Vision, etc.	Diagnosis.	Glasses.	Result.
94	Mr. R. A. B., Bohannon, Va.	27	20/30	Asthenopia	R., 0.75D=25D ax. 105 L., 0.75D=25D ax. 165	20/15 Cured
95	Miss Marie L., Sweet Springs, W. Va.	16	20/20	Asthenopia	R., 0.25D ax. 15 L., 0.25D ax. 175	20/15 Cured
96	Miss Helen Q., Richmond, Va.	20	20/20	Asthenopia	R., 0.25D ax. 165 L., 0.25D ax. 105	20/15 Cured
97	Mr. H. B. S., Richmond, Va.	19	20/20 20/30	Asthenopia	R., 0.25D ax. 90 L., 0.50D ax. 180	20/15 Cured
98	Miss Bertie J., Waynesboro, Va.	14	20/20	Asthenopia	R., 0.25D ax. 90 L., 0.25D ax. 150	20/15 Cured
99	Mr. A. G., Roanoke, Va.	23	R., 20/40 L., 20/20	Asthenopia	R., 0.75D ax. 75 L., 0.25D ax. 15	20/15 Cured
100	Mr. E. H. W., New York City.	42	20/20	Asthenopia	R., 0.50D ax. 90 L., 0.25D ax. 105	20/15 Cured

A CLINICAL STUDY—THE RESULT OF TREATMENT AND OPTICAL CORRECTIONS IN ARRESTING THE PROGRESS OF MYOPIA.

BY S. D. RISLEY, A.M., M.D.,

PHILADELPHIA, PENN.

In some recent studies of progressive near sight and the etiology of the myopic eye I turned to my case books for lessons as to the probable value of correcting glasses in arresting the disease. It is not intended to weary the society with a complete analysis of the statistics resulting from the study, but to give an abstract of the results, which are regarded as of sufficient interest to place upon record in the annals of the society. I made, first of all, a complete analysis of all the recorded cases of myopia treated in private practice since January 1, 1874. With rare exceptions they were corrected under the more or less prolonged use of a mydriatic and usually with the internal administration of alteratives, as the iodides and chlorides, where well-marked choroidal disease was present. Since the patients were drawn for the most part from the more

studious and successful portions of the community, it seemed probable that the percentage of myopia to the whole number of cases of refraction treated might be higher in the resulting statistics than would be shown in the community at large, or in the hospital statistics. In order to avoid misleading conclusions from this cause I secured access to the prescription books of Queen & Co. and the Fox Optical Co., two large optical firms in Philadelphia, and culled from them all the prescriptions given for distance glasses by ophthalmic surgeons for the correction of errors of refraction. These formulæ were from all sources of practice, both private and public, and therefore furnish as accurate data as are obtainable from any source. I was greatly assisted in the collection and analysis of the resulting figures by Dr. John T. Carpenter, Jr., for the private case books and by Dr. James Thorington for the opticians' books.

During the twenty years covered by the statistics it has been the almost uniform habit of ophthalmic surgeons in Philadelphia to correct by glasses more or less accurately all errors of refraction found in asthenopic patients applying for relief, both in private and hospital practice. In the analysis of my own books only those cases which were corrected under the use of mydriatics are included. In the opticians' books this could not be determined. The work covers the analysis of refraction, as shown by the glasses ordered of a total of 195,754 eyes.

Since the examination of the eyes of the public school children in Philadelphia in 1878 to 1880 I have repeatedly urged the causative relation between the congenital anomalies of refraction, particularly astigmatism, and progressive myopia, or the increase of refraction, which has so frequently been demonstrated as occurring during school life. It seemed reasonable to expect that if this were true the uniform correction of these anomalies in the community for all asthenopic eyes, or even for any considerable percentage of them, would, during or after twenty years, reveal the beneficial results of such correction in a diminution, both of the percentage of myopic eyes applying for treatment, and in the grade of myopia found.

It is true that certain fallacies present themselves in such a

study, *e. g.*, it may be urged that in the beginning the accumulated myopia of former years would enter to swell the number of myopic eyes, and in the later years a relatively larger number of hypermetropic eyes would present themselves as the value of correcting glasses in relieving headache became more widely recognized by both physicians and the laity. But this is probably offset by the greater frequency with which in the later years the patients consult the surgeon for the correction of their myopia, while in the first years they went to the optician and simply selected the glasses which gave them clear distant vision, and hence did not fall under the notice of the surgeon. Barring possible errors of this class, the resulting tables and percentage curves are both interesting and instructive, not only as showing the analysis of approximately 200,000 eyes with errors of refraction, but as also substantially demonstrating the responsibility of congenital anomalies of refraction in the etiology of near sight, and the value of treatment and correcting glasses in arresting the disease.

As the design was to ascertain the percentage and grade of M. and M., as in the several years, the eyes with hypermetropic refraction were simply counted in order to show the percentage of the former to the whole number receiving correcting glasses.

The degree of myopia was carefully recorded from M. =.50 D. to the highest grades and grouped as follows: 1 D. or less; 1 D. to 3 D.; 3 D. to 7 D.; 7 D. to 10 D., and 10 D. or higher, and these were grouped for the years included in the study as follows: 1874 to 1880 inclusive, 1881–1883, 1884–1886, 1887–1889, 1890–1893. The whole number of eyes for which distance glasses had been furnished on physicians' prescriptions by the optical companies was 187,018, of which 21.6 per cent. were for myopic refraction. Of the myopic eyes, as revealed by the glasses ordered, 39.5 per cent. were for simple M. and 60.5 per cent. for myopic astigmatism.

In the private case books 8,736 had received careful correction under the use of mydriatics pressed to the paralysis of the accommodation. Of these 1,925, or 22 per cent. were myopic. Of the myopic eyes 9.67 per cent. showed only simple M., while 90.33 per cent. were astigmatic in varying degree. This

striking difference in percentages is accounted for in part by the fact that the corrections were made with paralysis of the accommodation, and the astigmatism was sought for in every case and corrected when found, while it is probable that in the formulæ taken from the opticians' books many of them were ordered without the use of a mydriatic, and also that the lower grades of astigmatism were neglected as unimportant, especially in the hospital work there included. Then, too, in the manifest correction of irritable eyes the low grades of astigmatism are readily overlooked. But even in the lower percentage of astigmatism found in the books of the optical companies the 60.5 per cent. is of much significance as indicating the important role played by this anomaly in these distending eyeballs with choroiditis. The full significance, however, does not appear, except from a careful analysis of the full refraction tables, and not even then, since the large number of patients with anisometropia are not tabulated separately, for they do not lend themselves readily to any tabulation which will portray successfully their important teaching as to the history of the myopic eye. This can be done only by the extensive report of individual cases. Thus the case books show a large number of patients with a mixed astigmatism on one side, while on the other the eye had already passed over into simple or compound myopic astigmatism, similar pathological conditions being present in both eyes. In other cases a simple myopic astigmatism was found on one side, and on the other a tonic cramp of the accommodation, simulating myopic refraction, but which, nevertheless, under the prolonged use of the mydriatic, gave place to a hypermetropic astigmatism, it being perfectly obvious that longer neglect would have resulted in myopic refraction in this eye also. This history is, however, strongly suggested in Table I, showing the percentage and grade of myopia in succeeding periods of years. It is there shown, in columns 5 to 9, and in the curves constructed from them, that all the higher grades of M. steadily decrease, while the lower grades, in which are included by far the larger number of the cases of simple and mixed forms of astigmatism, rise in percentage through the later periods of years, as shown in column 9. The increase is, however, relative

only, as there was here also an actual decrease in the percentage of these cases. The obvious lesson taught by the figures in columns 5 to 9 is that the progress of the myopia, both in percentage and degree, was arrested by the treatment and glasses received. The rise in percentage in column 9 is due to the fact that the low grades of M. were not allowed to pass into the higher grades, as in former years; hence a relative increase in their number and a corresponding diminution in the number of cases of high degrees of M., a process which was operative for all intermediate grades. In a word, we are here taught by large numbers of patients the lesson so obvious from any careful clinical study of individual cases, that we have first the asthenopic eye with hypermetropic astigmatism, then the mixed form which passes into the simple myopic, and finally into compound myopic astigmatism and progressive near sight.

The percentage of mixed and simple myopic astigmatism for each grade of M. is instructive in this connection as set forth in Table II.

TABLE I.

1	2	3	4	5	6	7	8	9
Years.	Myopic Eyes.	Simple Myopia.	Myopic Astigmatism.	M.=10 D.+	M.=7–10D.	M.=3–7 D.	M.=1–3D.	1 D. or less.
1874 } 1881 }	28.43	15.5	85.5	2.58	2.36	11.77	9.5	2.3
1881 } 1883 }	23.05	15.45	84.55	2.10	1.96	6.92	8.6	2.3
1883 } 1886 }	22.07	5.75	94.25	1.67	2.90	8.43	7.8	1.9
1886 } 1889 }	19.82	6.50	93.50	1.10	1.20	6.79	7.5	2.7
1889 } 1893 }	16.78	5.66	94.34	1.37	1.47	5.27	5.5	3.1
Ave.,	22.03	9.67	90.33	1.76	1.98	7.84	7.78	2.46

Table showing by years the steady decline in the percentage and grade of myopia.

TABLE II.

Grade of M. in Meridian of highest refraction.	Mixed Astigmatism.		Simple Myopic Astigmatism.	
	Case Books.	Optician's Books.	Case Books.	Optician's Books.
Less than 1 D.,	38.7	21.0	32.6	38.0
1 D. to 3 D.,	19.7	11.2	15.1	20.3
3 D. to 7 D.,	4.4	3.2	6.3	7.2
7 D. to 10 D.,	0.	0.	0.	0.
10 D. or higher,	0.	0.	0.	0.

Table showing the rapid decline in percentage of eyes with simple myopic and mixed astigmatism in grades of M. higher than 1*D. to* 3*D.* (*In mixed astigmatism the refraction of the myopic meridian was taken as representing the grade of M.*)

The marked difference in the per cent. of myopic and mixed astigmatism between the private case books and the optician's books is notable, and doubtless shows that without the mydriatic corrections the hypermetropic meridian is overlooked and the case passes for simple, or possibly compound, myopic astigmatism, *e. g.* there were found in the case books in M. less than 1D. 38.7% of mixed astigmatism, while in the optician's books only 21% were found. In simple astigmatism on the other hand the percentage is higher than in the private work. It is probable that here many cases with a hypermetropic meridian had passed for simple myopic astigmatism in the absence of thorough paralysis of the accommodation.

The main facts set forth in Table I are also graphically depicted in the percentage curves shown in Figures I, II, III, and IV.

FIG. I.

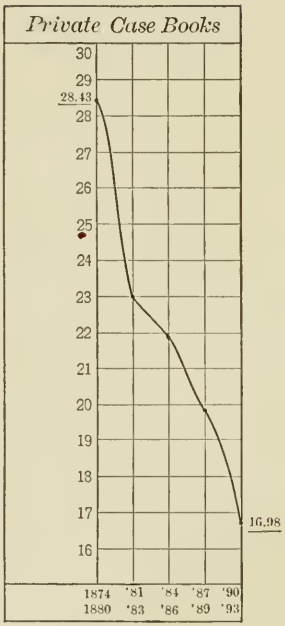
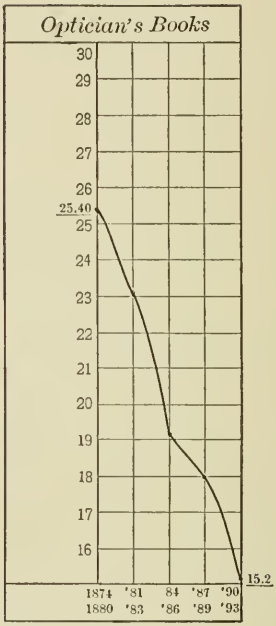


FIG. II.



Curves showing by years the steady fall in the percentage of myopia from 1874 to 1893 inclusive.

FIG. III.

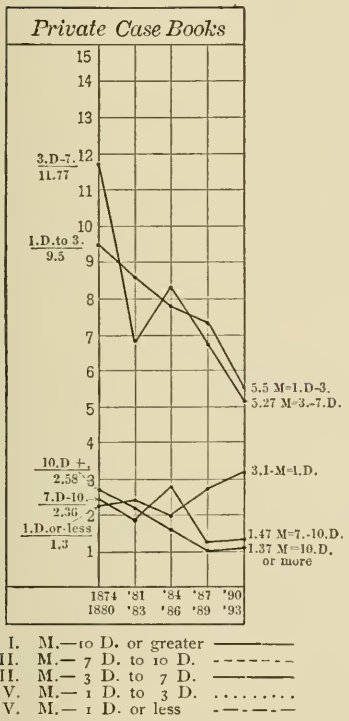
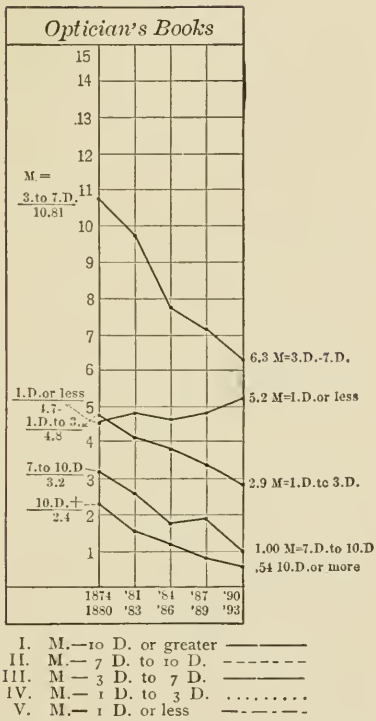


FIG. IV.



Curves showing by years the fall in percentage of the higher grades of myopia from 1874 to 1893 inclusive.

The tables from which the curves representing the work of the optical companies are drawn are omitted since they would have been a repetition of Table I. As was anticipated, the percentage of myopic is some higher in the private work, only 3% however; but it will be observed that the steady decrease in the percentage of near sight and also in the lowering grade is almost identical in both. The significance of the figures cannot be too strongly urged as setting forth the value of modern ophthalmological methods to the community in the prevention of near sight. Thus in Figure I the percentage of M. is seen to have fallen from 28.43% in the first period to 16.78% in the last period, a fall of more than 30% in the number of myopic eyes. Figures III and IV however, are, if possible, of even more importance, since they show a fall of approximately 50% in the patients applying for treatment with myopia, of 10D. or higher.

When we stop to consider the grave peril which ever waits on these high degrees of near-sight with their pathological conditions, not to mention the annoying discomforts and the serious extent to which its victims are handicapped in the race for success, we can but congratulate ourselves that such opportunity for a valuable service to our fellows lies within our reach. Of late years I have much less frequently been called upon to treat detachments of the retina and eyes which have been seriously impaired by macular hemorrhages and absolute central scotomata. Indeed, it was the impression I had received that this was true that first induced me to collate the figures which furnish the basis of this paper.

VALUE OF THE OPHTHALMOMETER IN PRACTICAL REFRACTION WORK.

BY EDWARD JACKSON, A.M., M.D.,

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In opening a discussion of this subject, as I seek to do by briefly presenting my own experience and some conclusions drawn from it, it may be premised that the practical value of such an instrument depends, first, upon what it does, and only secondarily upon the ease with which it can be used and the saving of time that it can effect.

The ophthalmometer measures the corneal astigmatism, and, speaking as I now do of the instrument of Javal used for practical diagnosis, this is all that it does. It measures this astigmatism to an accuracy dependent somewhat on the acuteness of vision and accuracy of observation of the user, but mainly upon the exactness of its adjustment and the excellence of its illumination.

In this matter of illumination, it should be remembered that we are seeking to study the reflection from the surface of a transparent medium, and this reflection depends both on the illumination of the object reflected from the surface, and on the illumination of the background seen through that surface. The better the illumination of the mires, the better the reflection from the cornea; the feebler the illumination of the iris, the less is the perception of the reflected image interfered with. On this account it is almost as important to shut off light from the eye under observation as to illuminate the instrument; and the best measurements are made with the pupil sufficiently dilated to give a black background. The best illumination I have ever seen was obtained by diffused daylight, the ophthalmometer being placed so as to receive the light from a large window.

With good illumination a person with accurate vision can measure corneal astigmatism to within 0.25 D., or even to within one-eighth of 1 D. But in practical work on refraction

the corneal astigmatism is of no interest whatever except in so far as it is an index of the total astigmatism.

How far does the corneal correspond to the total astigmatism? In five hundred (500) eyes measured with the opthalmometer and subsequently studied by other methods, with the aid in all cases under fifty years of age of full paralysis of accommodation, I find the following results:

In 6% of all cases the corneal astigmatism corresponded exactly with the total astigmatism, both as to amount and as to the directions of the principal meridians. In 16.6% additional, making 22.6%, the amount of corneal astigmatism exactly equaled the total astigmatism. The difference between the two was 0.25 D. in 21.6%; it was 0.50 D. in 20%; 0.75 D. in 11.8%; 1 D. in 4.4%; 1.25 D. in 2.6%, and from 1.50 to 3.50 D. in 2%. Of the 77.4% in which the corneal astigmatism did not correspond with the total, the former was in excess in 62% and the latter in 15.4%. In over half of these, 8%, the astigmatism was with the rule, and in 7.4% it was against the rule.

As to the correspondence of the meridians, taking all the cases of astigmatism, it was found that they corresponded exactly in 31%, and if to this be added 3.6% in which the direction of the total astigmatism was exactly the reverse of that of the corneal astigmatism, we have 34.6% of cases in which the instrument indicated exactly the direction of the principal meridians. In 4% there was no corneal astigmatism, but some total astigmatism; in 11% there was corneal astigmatism which was neutralized [presumably by astigmatism of the lens], and in 3% there was neither corneal nor lenticular astigmatism, and if these be added to the cases in which the meridians were correctly indicated, we find 52.6% of cases in which the indication of the ophthalmometer was not misleading as to the direction of the principal meridians of astigmatism.

In 17% the difference between the meridians was only 5°; in 9.6% it was 10°; in 5.4% 15°; in 8% from 20° to 45°, and in the remaining 7.2% the true meridians were from 5° to 40° from exact reversal.

With reference to the direction of the astigmatism, however, when this is less than 0.50 D., the determination with the

ophthalmometer is apt to be uncertain. The mires run up or recede — their axes correspond or break — from point to point as they are swept around the circle. Taking only eyes in which the corneal and total astigmatism each amounted to 0.50 D. or over, numbering 256, I find that the meridians of corneal and total astigmatism correspond exactly, or they were exactly reversed in 44%; they differed by 5°, or by 5° from exact reversal, in 22.4%; by 10° in 14.2%; by 15° in 8.4%, and from 20° to 45° in 11%. That is, in 89% the ophthalmometer showed the direction of the principal meridians of total astigmatism to within 15°, while in 11% it did not come nearer than 20° to 45°.

A careful study of my tabulated cases shows that it is quite impossible to adopt any rule of adding to, or subtracting from the corneal astigmatism, either a fixed quantity or a fixed proportion, to obtain the amount of total astigmatism with greater probability than by assuming an exact correspondence. Thus there was an exact correspondence in 22.6%. If 0.25 D. was subtracted from the corneal astigmatism, it would give the total astigmatism in 21.2%. If 0.50 D. were subtracted from the corneal astigmatism, it would give the total astigmatism in 20%. If 0.75 D. were subtracted from the corneal astigmatism, it would give the total astigmatism in 11.8%. If the total astigmatism were taken as three-quarters of the corneal, it would be correct in 15%. If a subtraction of 0.50 D. were made in cases of astigmatism with the rule, and the same amount added in astigmatism against the rule, as has been proposed by some, the total astigmatism would have been obtained in less than 21%.

It appears, therefore, that while the corneal astigmatism approximates the total in amount and in the direction of its principal meridians, in the majority of cases the approximation is not so close as may be rightfully demanded of the ophthalmic surgeon in his correction of ametropia; and that in exceptional cases, which are, however, by no means rare, the difference between the corneal and total astigmatism is so great that the former can hardly be regarded as in any proper sense a guide to the latter.

In practical refraction work, therefore, the ophthalmometer

is to be considered as a means for approximating the probable amount and meridians of astigmatism. As such a means of approximation it is, for certainty, to be ranked as superior to direct ophthalmoscopy, but greatly inferior to skiascopy among objective methods; and distinctly inferior to the subjective tests with the distorted point of light, the slit, or the parallel lines seen through spherical lenses.

What it does, then, places it clearly among the approximate tests. But among such tests the definiteness with which it indicates what it does indicate, the fact that its indications are entirely objective, and the rapidity with which they may be obtained, all give it high rank in this class of approximate tests. It is, too, an easy method of examination to master, requiring small experience and simply the same power of observation as is needed for the accurate use of a thermometer or a tape-measure. Indeed, so much of its value depends on the care of its original adjustment, and its illumination, and so little on the special skill or patience of the observer, that it is not unlikely at some time to become popular among counter-prescribing opticians.

It will be understood that in the foregoing remarks I referred simply to its value as a practical means of measuring ametropia for the adjustment of lenses. Of the scientific value of the simple determination of the corneal astigmatism, and of its practical value in the determination of astigmatism in the aphakic eye, either of which amply justify its routine use, I have purposely said nothing.

THREE CASES OF STRABISMUS WITH ANOMALOUS DIPLOPIA: — AN ORIGINAL AND AN ACQUIRED FIXATION-SPOT IN THE SAME EYE.

BY CHARLES HERMON THOMAS, M.D.,
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The development in certain cases of strabismus, in the squinting eye, of a spot to a great extent "identical" with the macula lutea of the straight eye has been described by Swanzy, Berry, and others. In the cases here presented attention is asked to the existence of two fixation-spots in the deviating eye — one the normal macula, used in monocular fixation only, and the other an acquired fixation-spot to which reference is made by the patient in binocular fixation only.

The first two cases were divergent strabismus, and were studied with me by my friend, Dr. Edward Jackson, before and after operation; the third was a case of convergent squint. All of them were treated by operation, successfully as regards cosmetic effect; but in none was orthophoria attained. In none, it may be added, did the ophthalmoscope reveal anything characteristic of the condition under consideration.

E. M. F., female, aged 11 years. Referred to me by Dr. W. H. H. Githens. V. = R. and L. = 6/6 + .H = .50 D. Marked divergent strabismus — intermittent. Generally fixes with the right eye, but occasionally with the left; is able to continue in binocular fixation for a considerable time.

With the eyes in a position of *divergence*, under a light-red glass, there is *homonymous diplopia*, requiring prisms 10° with their bases out to correct. Prisms aggregating 35° with their bases in arrest movements of recovery under the cover test — not complete cessation of all movement, but rather an irregular vibratory movement from side to side, lasting a few seconds, and aptly termed by my associate, Dr. Schneideman, a "search" movement. With vertical prisms, and also with red glass, the *eyes remaining in apparent divergence*, responses as to the char-

acter of the diplopia are *contradictory, changing from homonymous to heteromonymous.* P. P. of convergence, four inches. Apparent binocular fixation while reading; squint equals 25° to 30° prism measure.

Tenotomy of left externus complete; result, abolition of deformity; but there remained recovery from divergence neutralized by prism 17° base in and diplopia as produced by red glass is crossed, requiring prisms of like strength to correct.

The strabismus being no longer manifest, and in its latency giving no discomfort, by wish of the patient, further operation was postponed.

The alternating responses as to the character of the diplopia showed that the patient was referring at one instant to the macula and at another to the false fixation-spot, thus proving that the latter had not become predominant. After the operation the macula was alone referred to and the false spot abandoned, as was shown by the agreement between the responses of the patient and the position of the eye.

C. E. H., aged 14, male. Vision, R. 6/8 and L. 6/20; emmetropic. Has divergent strabismus, fixes with the right eye, but on covering this eye, fixes centrally with the left and can continue such fixation for a time after removing the cover from in front of the right eye, which, meantime, remains in divergence.

Tenotomy, left externus completely divided; result, lessened divergence, but it is still marked under cover test, notwithstanding which, he now has homonymous diplopia. Three days later, the condition of divergence under cover continued, except at the outer limit of the field of fixation on the left side — the side of the severed tendon — where there is recovery from convergence under the cover test. The diplopia has disappeared, except at the outer limit of left field, where it is homonymous. With the red glass, however, there is homonymous diplopia over the entire field. Though there is manifest *divergence*, the vertical prism test — photometer — indicates 7° *esophoria.*

At a subsequent examination divergence continued, requiring prisms of 14° base in to abolish visible recovery under the cover test. At the same time prisms base in — even 2° or 3° —

produced homonymous diplopia, making it plain that further correction of the exotropia would result in constant diplopia and, therefore, that the attainment of perfect parallelism was impracticable.

It may be thought that an attempt ought to have been made by perfect adjustment of the muscular balance to compel the use of the normal macula to the entire exclusion of the false fixation-spot. But the immediate effect of further correction, as shown by the use of prisms base in, would have been the production of an annoying diplopia (homonymous). This might or might not have been overcome in time by education; the probability of such result under all the circumstances involved being to my mind unfavorable.

E. P. C., aged 30, bank clerk, V.= R. 6/6 + L. 6/10; wearing low hyperopic correction. Has convergent strabismus, very marked; left eye deviating.

Tenotomy, left internus, complete section. Left externus advanced. Immediate result, improvement in degree of strabismus. Manifest limitation of movement inward with left eye.

Two weeks later, convergent strabismus of considerable amount remains; large recovery from *convergence* under cover test, but shows *exophoria*, Maddox rod test, 20°, but with prisms 20° base in, there is wide crossed diplopia. With prisms 20° base out, movement of recovery is abolished, and a search movement is seen, about equal in either direction.

Tenotomy of right internus, complete section. Result, abolition of apparent strabismus, slight recovery from divergence under cover test (6°) and wide crossed diplopia (30°) under red glass test.

The left eye being amblyopic and never having participated in binocular vision, the patient is not annoyed by diplopia, which, indeed, can only be elicitated under special conditions.

Thus, following operation the eyes in convergence to the amount of 20°, there was at the same time present an Ex. of a like amount (20°). The correction of this Ex. by prisms base in, instead of giving single vision, as was naturally to be expected from it, resulted instead in crossed diplopia.

The operation, by giving to the eyes a position more nearly

parallel than they had formerly held, disarranged the relation of the two retinæ to one another with the results here seen.

Here, again, the association of convergence with exophoria is only explicable by the assumption of an acquired fixation-spot in addition to the normal macula.

In all these cases, when either eye was used alone, the seeing eye was directed centrally, *i. e.*, either eye used alone fixed with the normal macula. On the other hand, when the two eyes were used simultaneously, the diplopia, if noticed, was seen to relate to the acquired fixation-spot. This was particularly true of the latter two cases. In the first case the alternating character of the diplopia showed that the patient could refer indifferently either to the mascula or to the acquired spot.

In view of the conditions present in the cases here described, the following inferences appear justified:

(1) Binocular vision — *œil cyclopienne* — involves an additional cerebral function above and beyond that involved in monocular vision.

(2) That corresponding points of the two retinæ are in binocular fusion correlated with the functional fixation-spot, whether that spot lies in the normal fovea centralis or not.

(3) That suppression of the macular image during the act of binocular vision may take place, the image upon the false fixation-spot only being regarded while the macula has its usual predominance when the eye is used alone, *i. e.*, the false fixation-spot has now no greater prominence than a similar region of the retina in a normal eye.

(4) The existence of an additional fixation-spot in strabismus is denoted when the affected eye, used alone, is seen to fix centrally, and yet when, with prisms corrective of the deviation, as shown by the abolition of movement under the cover test, there occurs diplopia contrary to rule, *i. e.*, crossed diplopia associated with convergence, and *vice versa*.

It will be seen that practical considerations of importance bearing upon the operative treatment of strabismus grow out of a recognition of the presence of two fixation-spots in the same eye.

DISCUSSION.

DR. FRANK W. RING of New York. — I noticed a unanimous smile passing over the faces of the gentlemen present at the narration of Dr. Hale's case of metrorhagia. I know that many of us have been in the habit of smiling for the past few years whenever partial tenotomies have been mentioned for the relief of insufficiencies. I happen to know considerable about this case referred to by Dr. Hale. She was under my care nine months ago, having previously consulted several oculists. I fitted her with glasses, combined with prisms, and gave her all the relief possible. She went to her home in Alabama, and in three months was in misery again. I advised her to consult Dr. Hale. A week afterward she wrote to me, describing the developments in her case very much as Dr. Hale has described them. What was this improvement due to? My experience in exercising the horizontal ocular muscles has given me the most gratifying results. Eye symptoms due to insufficiency or apparent weakness of the horizontal muscles have been quickly and I believe permanently relieved by this method of treatment. I have no hesitancy in assuring patients who come to me afflicted in this way that I can give them almost immediate relief. A high degree of exophoria indicates a weak adduction, but a weak adduction does not necessarily indicate exophoria. I have here a brief resumé of twenty-one cases which I have had under observation from two to four months. I have no idea of narrating these cases to the gentlemen present. I know how tedious these recitals are, but I want to call the attention of the society to three of them. My first case was a marked divergent strabismus. I did a tenotomy of the externus, which did little toward accomplishing the desired result. I then toiled with the patient three days, until I got her to see double; in twenty days she was able to carry the single flame from the near point to twenty feet. At the end of three months she overcame a prism of ten degrees, base out. I saw her in my office five days ago, and during the visit her eyes remained perfectly straight. I had changed with this method a permanent divergence into a periodical divergence.

There are two other cases which I will describe. One is the case of a man 47 years of age, who came to my office some months ago; he had severe headaches, nausea, inability to read for any length of time. I found him emmetropic, corrected his presbyopia with proper glasses, and still found the same symptoms. Upon an examination of the muscles, I was surprised to find an adduction of only four degrees, with the same abduction,

no apparent exophoria. In twenty days, by the use of the prism exercise, the adduction had become forty degrees, his headaches, nausea, and all asthenopic symptoms had disappeared; he has had no further trouble since, and reads with perfect comfort.

My last case is that of a lady, the wife of an eminent divine in New York, who came to consult me at my office some weeks ago. She had been suffering for some years from total inability to read without constant blurring of the letters. She had consulted eleven physicians, her ocular muscles had been cut fourteen times, yet she was, as she stated, nearly crazy with her eyes. I found no hyperphoria, only an exophoria of one degree, adduction of 23 degrees, abduction of 9, her vision was 20/20, the ophthalmometer showed over two dioptries of astigmatism, corroborated by cylinders. Upon adding the proper cylinders to her presbyopic lenses she read with perfect ease. I remarked that she had consulted eleven doctors; I did not say they were oculists. She had, however, been to some oculists, because her muscles had been cut fourteen times. I especially requested her not to tell me who these were, because life is too short to sndulge in hostile criticism of our confréres. The truth of her itatements I do not for one moment doubt. Did the patient have this astigmatism at first, or was it produced by the partial tenotomies? Was not the contour of the eyes changed from these persistent efforts to restore the equilibrium of the muscles?

DR. LUCIEN HOWE of Buffalo. — I think we have all been impressed with the character of the case that has been reported, which had received the attention of these 14 doctors, and we have heard of approximations to that story very frequently. I think, though, that the cases cited lead us to consider too much the question of the refraction and the condition of the muscles. While I appreciate thoroughly the importance of all that, and while I would be very far from underestimating the necessity of exact correction of the eye, yet I venture to occupy a moment in order to enter a mild protest against overlooking the condition of the general system. If we look at the cases reported by Dr. Hale, (all women,) I think we must be struck, here as elsewhere, by the comparatively large proportion of that sex who complain of asthenopia. They are, to a great extent, in such positions in life that their occupation does not require constant exercise; but if they belonged in a lower social scale, if they had more exercise and something else to think about, I believe the complaints would be less. I have found that in the patients of the higher class a great deal of relief is obtained after the

proper correction has been made, by sending these patients to a gymnasium, by insisting over and over again upon outdoor exercise and prescribing iron, cod-liver oil, and quinine; especially, in a very large proportion of these cases, after giving proper glasses, I find a better result can be brought about by sending the patient to some gynaecologist, or some general practitioner. I wish to say, finally, that we are largely inclined to overlook what we call asthenopia of central origin. This is the *terra incognita* that we must look to the general practitioner or the neurologist to explore.

DR. SAMUEL THEOBALD of Baltimore. — I would like to say a word in regard to the distinction drawn by Dr. White in his paper between the significance of low-grade cylinders for the correction of astigmatism against, and astigmatism according, to the rule. This is a point upon which I am fully in accord with the reader of the paper. My own opinion is that a low grade, say 1/4 D., of astigmatism according to the rule is only exceptionally the cause of a considerable amount of asthenopia, but that an astigmatism of 1/4 D. against the rule, or approaching that, whether myopic or hypermetropic, is almost certain, sooner or later, to give rise to asthenopia. This variety of astigmatism is doubtless to be regarded as a much wider departure from the normal eye, and, as Dr. White has said, is very much more likely to give trouble than an equal degree of astigmatism according to the rule.

Another point worthy of remark in Dr. White's paper is that he met with so large a proportion of cases of *simple* astigmatism. In the different cases mentioned by him a large majority were simple astigmatism. This is entirely contrary to my own experience. Cases of exactly simple astigmatism, in my own experience, are extremely rare. In the cases on my books the proportion is quite the reverse of that quoted by Dr. White. The small proportion would be cases of simple astigmatism and the large proportion compound astigmatism, with a certain number of cases of mixed astigmatism.

In regard to the extremely valuable results brought out in Dr. Risley's paper, I agree perfectly with him in thinking that astigmatism and muscular anomalies are most important factors in promoting the growth of myopia. I scarcely ever meet with cases of myopia of high grade in persons advanced in life, that I do not discover that a very considerable amount of astigmatism or heterophoria has been overlooked in the earlier adjustment of glasses. I feel convinced of the correctness of Dr. Risley's view, and his conclusions are very valuable, showing,

as they do, that when we get at the optical error early in life and correct it as it should be, the glasses being carefully adjusted not only as to the amount of myopia, but so as to take into account any astigmatism or disturbance of the muscular balance which may be present, the high grades of myopia appreciably lessen.

Apropos to the very interesting case mentioned by Dr. Thomas, of double fixation point in a squinting eye, I may say that within the past week I have met with a similar case in a young man who had originally a high grade of convergent squint. I had done a free tenotomy upon each external muscle and there was still a residual squint. I then redivided the internal and advanced the external rectus of the squinting eye, and got a good cosmetic effect.

I should mention there was a high grade of anisometropia, one eye being slightly and the other decidedly myopic. Although the eyes were perfectly straight, as far as one could see, he had at times diplopia. I made a test of the muscular balance with the cover test, and found that when fixation was with the right eye (the one which originally squinted) the left eye (under cover) squinted decidedly inward and upward; yet the vertical diplopia test gave exophoria. When both eyes were open, there was, as I have said, no evidence of squint. The explanation which suggested itself was that in regarding objects with the right eye alone, he fixed with an eccentric part of the retina, whereas in binocular vision the macular region of each retina was used.

DR. SWAN M. BURNETT of Washington, D. C. — I rise to say a word in regard to the paper just read. I agree very fully with the statement made by the reader of the paper, and with the greater part, at least, of the opinions expressed by Dr. Jackson in his paper with regard to the ophthalmometer, although my percentage, I think, of approximately accurate findings of the ophthalmometer would be higher than his. That might well come from the personal equation and the difference in the character of the patients. I have nothing to take back, of anything I have said heretofore in regard to the value of the ophthalmometer, but still it is not an instrument which can be relied upon to determine refraction as a whole, and certainly not for determination of the total astigmatism of the eye. It has shown us something that we have never known absolutely before — that there is quite a large proportion of cases where the difficulty is resident in the lens; it has given us more definite ideas in regard to lenticular astigmatism.

In this connection, in reference to a point raised by Dr. Theobald, and also by Dr. White, as regards the greater amount of asthenopia which is associated with astigmatism, contrary to the rule, I think it is due to the malposition of the lens which makes the effort to correct the astigmatism on the part of the ciliary muscle a much more difficult task than when it is according to the rule.

DR. B. ALEXANDER RANDALL of Philadelphia, Pa. — I should speak with great diffidence with regard to the occurrence of myopia, because the 15 years or less during which I have been able to follow cases, and the limited number of myopic patients which I have had, serve to make any observations of mine of probably small value. But I desire to corroborate, as strongly as I can, the findings of Dr. Risley, that myopia and its serious accidents are apparently less frequent than formerly. I have always agreed with Dr. Risley in his views in regard to this subject, since seeing his results when I was associated with him; and I believe that the minutely accurate and complete correction of myopia and close attention to the intra-ocular conditions are great factors in the control of the condition. Myopia in the hands of many others is frequently, if not ordinarily, a progressive process; but in our hands progressive increase has been exceptional. Myopia, we feel, from our incomplete knowledge of the matter, is rather a controllable condition, except in the rare cases of pernicious myopia. The studies which have been made by many of us — and I have tried over and over again to collate the data bearing upon the refraction of school children — would certainly indicate that these findings of predominant astigmatism and hypermetropia are the rule, and simple myopia the exception, not only in America but in Germany. This has seemed to be borne out by all we meet in practice, and to indicate that we must not expect these anomalies in low grade to be of necessity anything demanding glasses unless the conditions of general health and of the muscles force them into prominence. These conditions are partly normal or fall within the limits of physiological compensation. But to claim the occurrence of myopia to be physiological is as silly an idea, practically, as that the development in schools of scoliosis is such. When wry-neck or any of the spinal curvatures are regarded as elements in the development of the species, then we may regard myopia as being a physiological adaptation of the eye to its environment.

In relation to the case cited by Dr. Thomas, these cases are, so far as my observation goes, quite rare. I might mention one,

however, described by Dr. Agnew in a paper read before this society in 1880, upon the value of the ophthalmoscope in determining the errors of refraction. I showed such a case at the last meeting of the ophthalmic section of the Philadelphia College of Physicians, where a girl of 18 with hypermetropia of one and one-half and two diopters, respectively, in the two eyes, and vision 20/20, had a high divergence, which seemed to be due very largely to the presence of an upward deviation of the right eye; and in which, with the eye constantly deviating outward, the patient insisted upon the presence of homonymous diplopia. That is one of the cases where it is questionable whether it will be wise to force the correction, lest we develop a permanent and disabling diplopia.

With regard to the point raised as to the upward deviation of the squinting eye, it has always been insisted on by Dr. Norris in his teaching; and, I think, rightly ascribed by him to the insertion of the internal rectus muscle. If this be a matter of innervation of the third nerve, we cannot leave out of consideration the levator palpebri, which gives no sign of consensual action.

. . . . . .

DR. W. S. DENNETT of New York. — I desire to make one criticism of the paper read by Dr. Jackson, namely, as to his method of compiling statistics.

Taking this hat, by way of illustration, the radius of curvature is, at the center of the crown, as much as fifteen centimeters, while the general radius of curvature for the whole top of the hat is nearer one-half of that. The center and periphery of the cornea vary quite as much, and with the eye under atropine and examined by test type, we deal with the average curvature of a very large part of the corneal surface, and the correcting lens thus obtained is in general very different from the lens which the patient can see with or ought to wear after leaving the ophthalmologist.

In examining by the shadow test under homatropine we usually see, in corroboration of this statement, that the reversal is not at all the same for the center and for the periphery of the pupil. Now my criticism is that if all your test type examinations have been made with widely dilated pupils you have not obtained the right glasses, and the results ought not to be compared with records made by the ophthalmometer, which merely measures the three centimeters of surface at the center of the cornea.

DR. J. A. LIPPINCOTT of Pittsburg. — Anticipating a dis-

cussion on this subject, just before leaving home I looked over the records of the last 200 cases in which I used the ophthalmometer. In these 200 cases the astigmatism that I found by the ophthalmometer, according to the rule, had to be lessened by the subjective test in 30 cases. It had to be changed into astigmatism against the rule in 8 cases. In 9 cases in which there was no astigmatism, as shown by the ophthalmometer, there was an actual astigmatism against the rule. In astigmatism against the rule there were five cases in which it had to be increased by the subjective test; the ophthalmometer did not show enough. In 148 cases out of the 200 the results of subjective testing corresponded very closely (allowing an error of .25 D.) with the readings of the ophthalmometer. So that in 74% of the cases the findings of the ophthalmometer corresponded with the results of the subjective test; in 53 cases, or 26%, this correspondence did not obtain. The difference between the ophthalmometric reading and the results of subjective testing amounted to one diopter or less in 43 cases. In 9 cases the difference ranged from 1.25 D. to 2.25 D. If these 200 cases can be regarded as representative, the ophthalmometer has a little more value than it would seem to have from Dr. Jackson's paper. However, the conclusions of the paper are in the main corroborated by my experience, *viz.*, that there is a large percentage of cases in which the ophthalmometer does not show the exact amount of astigmatism, including those cases in which it showed no astigmatism whatever while astigmatism was actually present. This extra-corneal astigmatism — if I may call it so — is usually, if not invariably, against the rule. In none of my cases did the ophthalmometric astigmatism, according to the rule, have to be increased as a result of subjective testing, and in none did the ophthalmometric astigmatism against the rule have to be lessened as a result of such testing. The instrument always showed the entire amount of astigmatism according to the rule, but it did not always show all there was against the rule. Dr. Jackson and Dr. Burnett, in common with the text-books which refer to this subject, speak of the non-corneal astigmatism as residing in the crystalline lens. Probably this view may in general be correct, but it is certainly not invariably so. Not long ago I examined the refraction of an eye from which the lens had been removed. The ophthalmometer showed 2 25 D. of astigmatism, axis 58°, repeated tests always giving the same result; whereas the subjective test, repeated with equal frequency and care, showed the actual astigmatism to be only .75 D. In this case + 11. D. + .75 cy

58° gave sight =15/xv+, and no other combination gave as good vision, the patient being unusually sensitive to experimental changes made in the strength of the lenses. There was, therefore, in this case, somewhere outside of the cornea, an astigmatism which neutralized the corneal astigmatism to the extent of 1.5 D. Whether the extra-corneal astigmatism in this case is to be explained by an irregularity in the retinal surface or not I will not undertake to determine, but it is certain that it is not lenticular.

Notwithstanding the fact that the findings of the ophthalmometer are untrustworthy in so large a proportion of cases, the instrument, in my judgment, constitutes a most valuable addition to our armamentarium. It is a great time-saver. A few minutes suffice to determine accurately the amount and the axis of the corneal astigmatism. The advantage of this speedy determination are especially obvious when the astigmatism is of very high degree, causing marked diminution of the visual acuity, as we frequently see in children. Then there are cases of moderate degree, .75 or less, in which the astigmatism obstinately refuses to disclose itself by the subjective test. In such cases, to know that corneal astigmatism is actually present is of decided assistance in stimulating the sluggish perceptivities of our patients.

DR. SAMUEL D. RISLEY of Philadelphia.—Before the close of the discussion I desire to refer to one matter suggested in one of the papers — I think by Dr. Ring — that the astigmatism of one-seventh was found after these tenotomies. I suppose that an increase of astigmatism often occurs after tenotomy of the lateral muscles. I have seen that in cases of strabismus, and I have demonstrated it a few times with the ophthalmoscope. So, letting up the pressure, so to speak, of these lateral muscles by tenotomy seems to cause some increase in the lateral curvature. I have seen astigmatism of one-half diopter, proved by the ophthalmoscope and by subjective demonstrations by the mydriatic, increase in one eye from .5 to 1.5 D., and in another more so. I think that should be looked to after tenotomy.

I should also very much like to discuss, if time permits, the statements made in some of the papers regarding anomalous muscular balance. I want to say that, in my belief, one of the errors into which some of us have fallen is this misconception of what is a normal eye. It has seemed to me that the perfect eye of binocular vision is an emmetropic eye, with a normal innervation and a normal form of the orbit. Any departure

from this is very sure to set up conditions which may lead to asthenopia, and when we study the frequent anomalies which must determine the form of the orbit in which the eyeball is developed, we must anticipate *a priori* that there should be normal departures in the eyeball itself. Mathematically considered — taking into consideration the physiological difference between the innervation and the other conditions, mathematically considered, in a pair of eyes which depart from the model emmetropic eye, we must either have dim or double sight, and it is only because of the compensations of nature in those eyes that we are enabled to overcome anomalies and departures from the normal standard. Donders long ago pointed out — as long ago as 1846 or 1848 — long before the publication of his classical treatise — that there was a very marked difference in the relative range or region of accommodation, which he developed so beautifully in his subsequent treatise, and where there is hypermetropia, for example, or commencing presbyopia, there must be a disturbance of this normal relation. In the hypermetropic eye the individual has all his life long been learning to accommodate without converging, and has, therefore, required a region through which he can do this successfully and comfortably. When he reaches the point of commencing presbyopia, which, in his case, will depend upon the degree of his refraction error, in the interests of his vision, we must help him with a convex glass. We at once disturb the relation he has acquired and we therefore find these cases of exophoria. He must unlearn what experience has taught him all his life. We compromise this with him in the work he has done for so many years, and those who manifest asthenopia in the presence of hypermetropia are gradually taught by successively stronger convex glasses to acquire a new range of convergence accommodation.

SOME ADDITIONAL STUDIES UPON THE CLINICAL VALUE OF REPEATED CAREFUL CORRECTION OF MANIFEST REFRACTIVE ERROR IN PLASTIC IRITIS.

BY CHARLES A. OLIVER, M.D.,

PHILADELPHIA.

Since the publication of the writer's paper upon this subject in the TRANSACTIONS of this Society for 1892, he has been able by a number of fortuitous circumstances, both as to material and proper assistance, to make a series of additional studies in order to determine the causal factor of the apparent and transitory increase of ametropia in the same variety of cases as he had the privilege to previously study.

Ignoring, as he then did, any cases where there were objective evidences of corneal opacity, lenticular haze, or even the faintest visible disturbances in the aqueous or vitreous humors; excluding all instances where there were any perceptible tags of adhesion between the iris and the lens; and limiting the work to those eyes where the pupils were seemingly dilated *ad maximum*, a number of experimental studies were instituted to determine, if possible, the cause of the ametropic increase.

I. To discover whether there is a forward displacement of the lens. This was shown not to occur objectively in two ways: The first plan consisted in studying the plane of the iris by the use of ordinary inspection through a corneal loupe upon a brilliantly illuminated area. In this experiment, it was found that in nearly every instance the anterior plane of the iris was either vertically placed or was dragged backward. The second method was accomplished by means of the estimation of the relative position and sizes of the catoptric images, especially of the two lenticular reflexes. Here, it was found that by either roughly testing, by a candle-flame, or as in several instances, more scientifically, by recourse to an ophthalmometer of Helmholtz, that while the anterior capsular-reflex moved forwards and became smaller, the posterior one moved slightly backwards.

II. To endeavor to determine clinically whether the index of refraction or whether the actual amount of either the aqueous or the vitreous humor is increased during the inflammatory process. This in measure was shown not to be the case, first by careful and repeated study of the objective appearances of successive layers of these two media by both oblique illumination and the ophthalmoscope. No thickening, no visible sign of increase of density of the fluids as might be evidenced by planes of increased reflection, and even no distortion of any of the gradually deepening meridional reflexes could be conscientiously asserted. Second, by reference to the fact that in nearly every case which was carefully studied, the distance between the anterior and the posterior lenticular reflexes was, as before shown, unduly increased. Thus, these two plans to a great degree invalidate the possibility of either any increased amount of the density of the fluid-contents or augmentation of the contained material in the two large intra-ocular chambers.*

III. To make certain that the temporary increase of the index of refraction in the type of cases here under special consideration, is dependent upon either spastic tonicity of the fibres of the ciliary muscle or congestion with rigidity of the ciliary bodies. In addition to the great number of experiments pursued to formulate the conclusions given in the writer's first paper upon the subject, a number of control-tests with both mydriatic and myotic agents were made in such a manner as to set aside any confusing or disturbing influence that might be supposed to have arisen from the first two categories of cases. This was done by first obtaining the exact corrective lens that was necessary to bring a subnormal vision to normal, care being taken to choose intelligent patients with but slight refractive error. This done, three instillations of two drops each of strong solutions of either atropine, cocaine and atropine, or eserine were made at three-minute intervals, and the ametropia immediately re-examined, when in every case in which the inflammatory process had not absolutely subsided, the use of the cycloplegic

* *Vide* articles upon "The Proximate Cause of the Transient Form of Myopia associated with Iritis," by A. Schapringer, M.D., in the *New York Medical Journal* for 21st October, 1893, and editorial upon "Poor Vision after Iritis," in the 12th of May, 1894, number of the *Philadelphia Polyclinic.*

reduced the apparent amount of the refractive error (ordinarily one-fourth to three-fourths diopter) while the myotic, in every instance tried, increased the apparent amount of the ametropia. To recontrol these tests, all of the eyes, while in the condition of surcharged dosage as it were, were resubmitted to a few of the most important of the objective tests, when in every instance where the mydriatic was used, the lenticular reflexes were shown to be more greatly approximated; while in those cases where the myotic was employed, the lenticular reflexes became further separated.

The conclusion therefore is, that, consequently, in every instance of this variety of study, not only is so-called "spastic accommodation" proven, but the supposition of the forward displacement of the lens is in great measure denied, and both real and relative increases of aqueous and vitreous humors are confuted.*

A REFRACTOMETER FOR SKIASCOPY.

By Dr. W. E. LAMBERT,

NEW YORK CITY.

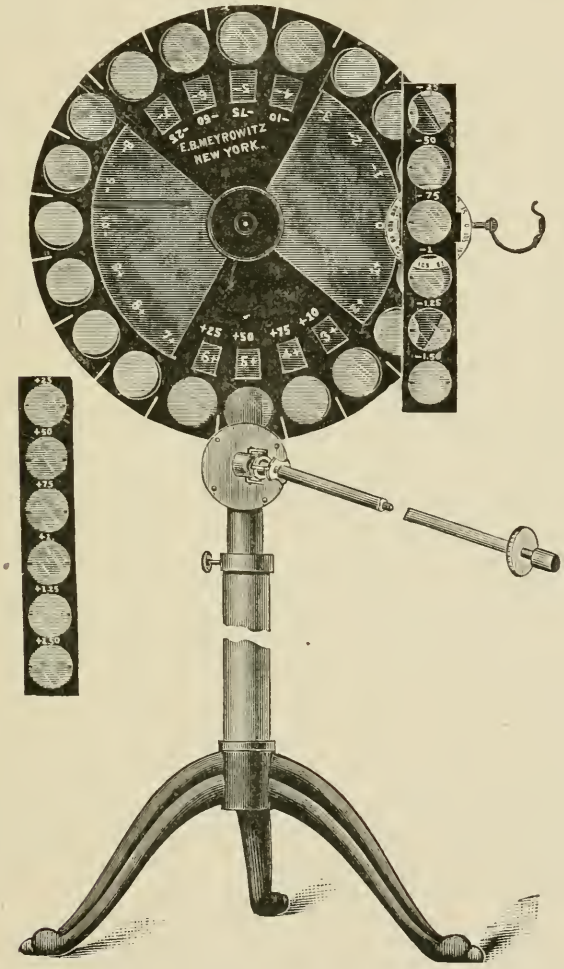
This instrument which I now present to the society is intended to be used in estimating errors of refraction by skiascopy.

It consists of two superimposed discs, one of which contains nine convex lenses ranging from +1 D. to +9 D., and ten concave lenses from —1 D. to —10 D.; the other disc contains .25, .50, 75, and 10. D., convex and concave.

By means of a gear movement operated by a tube and rod,

* A most interesting and instructive example of this group of cases is given by Dr. John T. Carpenter, Jr., of Philadelphia in the *Philadelphia Polyclinic* for the 5th of May, 1894, where he cites an instance in which he inadvertently too early ordered a minus correction in a case of plastic iritis at the time when the refractive apparatus was in a condition of functional myopia. Complaints of the patient as the plasticity of the ciliary muscle lessened and the lens regained its normal refractive curvatures, soon set matters aright by the substitution of a much weaker correction.

the latter working within the former, both discs can be revolved either independently or together, with one hand, thus enabling the examiner to rapidly bring the various lenses in front of the



eye-piece without changing his position during the examination. This is the special advantage of the instrument, and removes the great objection to skiascopy.

On the reverse side of the instrument is an arm carrying the eye-piece, which arm can be swung to either side of disc,

thus adapting eye-piece to right or left eye. The arm supports in front a graduated cell, in which a cylindrical lens can be placed at any desired axis, or a slide containing six cylindrical lenses of different foci, which are varied by raising or lowering the slide, while the desired axis is obtained by rotating the cell, and is indicated by a pointer on the scale.

In using the instrument in cases of astigmatism, first estimate the refraction of the two principal meridians, employing only the spherical lenses; then placing the cylinder thus indicated in the cell at the proper axis, repeat the test to insure accuracy. The advantage of using a slide with several cylinders is that the strength of same can be easily increased or diminished should the first estimate of the astigmatism be incorrect.

DISCUSSION.

DR. B. ALEXANDER RANDALL of Philadelphia. — I would like to say a word with regard to retinoscopy with the plane mirror, not from one meter, but from three or four. It is unquestionably better for many reasons. It is more delicate, and I can positively assert that for a large proportion of instances it can clearly show differences of 1/4 or even 1/10 diopter. In favorable cases I can easily distinguish between .65 and .75 D., can even discern that the anomaly lies between these two. It does seem to me that retinoscopy with a plane mirror, from three or four or even six meters, is a method which ought to have more trial than it has received. If the source of light is ample, and the plane mirror used has a sufficient sight-hole, it is perfectly possible to see the movements of the shadows at the longer distance so as to be cognizant of everything and to get the increased accuracy. It is a mistake to use this, which is a crucial test, when you want to do your coarse focussing; but for a fine focussing arrangement there is nothing approaching this method in satisfaction.

DR. HAY of Boston. — Is that practicable with a small pupil?

DR. RANDALL. — It is with a pupil of three millimeters.

DR. W. E. LAMBERT of New York. — I merely want to say a word in reply to Dr. Randall's remark. It is my custom to practice retinoscopy at three or four meters. I find, as Dr. Randall says, that you can get sufficient illumination with a plane mirror at that distance, and the estimate of error of refraction is more accurate than at the shorter range. It is a

mistake that the arm of the instrument which I have here exhibited was not made longer, and I intend to have it changed.

DR. SWAN M. BURNETT of Washington. — I don't know how long ago it is since I showed the first instrument of the kind described in this very room. It was not so complicated as this one, but I have used it with perfect satisfaction for six or seven years. I think that the complications connected with this one are rather against its success. If, as Dr. Randall says, for the more accurate results you must get off at a greater distance than one meter and have a number of glasses in front, I think the rod attachment no advantage.

I cannot fully agree with Dr. Randall as to what he calls retinoscopy, but which is not retinoscopy at all. The gentlemen present need not be alarmed. It is our usual fight over this proposition. Undoubtedly you can tell the difference in the reversal movement very well, even for a quarter diopter or less in many cases, but there are very many others in which that does not give you the correct refraction. I called the attention of the society three years ago to what I have called the internal shadow phenomena, in which the findings cannot be relied upon. The refractive media must be clear and uniform before you can get a movement that gives the exact refraction of the eye. To claim that you can get within $\frac{1}{4}$ or even $\frac{1}{2}$ diopter of the exact refraction is, I think, as much of a mistake as to say we can get the total of astigmatism with the ophthalmometer. We must not claim that for skiascopy any more than we claim it for the opthalmometer.

A CASE OF BINOCULAR COLOBOMA OF THE LENS WITH ACCOMMODATIVE POWER RETAINED.

BY C. F. CLARK, M.D.,

COLUMBUS, OHIO.

The fact that coloboma of the lens is a rare condition of which no satisfactory explanation has as yet been found renders it desirable that every case seen should be carefully studied and recorded.

Being an arrest of development at a relatively late period in the process of its embryonic growth, coloboma of the lens, while suggestive of, and often associated with, coloboma of the

iris and choroid, is evidently not due to the same cause,—imperfect closure of a fœtal cleft. In the absence of a sufficient number of accurately observed cases upon which to found a theory of its causation, our best working hypothesis is the ingenious one suggested by Heyl in his admirable monograph on the subject published in 1876.

According to his theory a defect in the inferior branches of the hyaloid artery which gives nutrition to the lens during the period in which the more peripheral fibers are developing would produce just such a defect as the one we are considering.

It is true that this does not tell us anything of the cause of the defect in the vascular supply, but from its situation we are justified in suspecting some connection between this deficiency and those causes which produce imperfect closure at a later period, resulting in the more common deformity,— coloboma of the iris and choroid.

The literature of coloboma of the lens is meagre; Heyl, Oliver, Knapp, Theobald, and Marple, in this country, have reported cases, and in the report for 1893 of the New York Eye and Ear Infirmary the last-named writer has given a list of the foreign observers who have contributed to the subject. He was able to find the reports of eighteen cases, thirteen of which have been published by foreign authors. Adding the cases published by Oliver and Theobald and the one which is the subject of this paper, we have twenty-one cases reported during the past sixty years. As Doctor Marple observes, however, many cases have no doubt been seen that have never been reported.

The reports to which I have had access were fairly complete in only twelve of these twenty-one cases and, while this is too small a number from which to draw conclusions, taken with the fragmentary records of the other nine cases, we are able to collect from them a few interesting facts concerning this curious deformity.

In fifteen cases of coloboma in which observation was made in reference to this point the right eye was affected in six, the left in two, and both in seven.

In twelve cases it was associated with myopia in nine, and with hypermetropia in three.

There was more or less cataract of the defective lens in six cases, while in eight cataract was not present. In seven cases it is not stated whether cataract existed or not.

That coloboma of the lens is not necessarily associated with coloboma of the iris and choroid may be seen from the following: coloboma of the iris was found with the same defect in the lens in nine out of twenty-one cases. It was absent in nine cases, while in three it is not mentioned. Coloboma of the choroid was found in eight cases, absent in nine, and not mentioned in three.

Coloboma of both iris and choroid existed in eight of the twenty-one cases.

Trembling iris was observed in six cases, and of these two had extopia lentis. In three cases it was distinctly stated that trembling of the iris did not exist, while in twelve the subject was not mentioned.

Of the twenty-one cases the defect was found in the inferior quadrant in fourteen, above in one, upward and outward in one, and in one instance downward and outward.

The form of the coloboma is mentioned in fifteen cases, and in all, with one exception, it is the chord of an arc; not always straight, but approaching a straight line. In the exceptional case it was a small notch.

We have record of astigmatism in three cases, of its absence in one, and in the remaining seventeen it is not mentioned.

This may be due to the fact that a number of them were described before Javal's ophthalmometer came into use.

With one exception the vision in all of these cases was defective, ranging from blindness or mere light perception, to 1/50 — 1/10 — 1/5, and in the case which I am about to describe 1/3 — 1/4. The exceptional case is that of which Bresgen gave a brief account in 1874. In this instance, in spite of a pronounced coloboma there was vision of 20/20 and a fair degree of accommodative power.

Among all of the cases enumerated above I find an account in the literature at my disposal (of only two instances) in which an attempt has been made to carefully study the effects of this lesion upon the refraction and accommodation of the eye involved.

This may in great measure be accounted for by the fact that lesions of transparency, coloboma of the iris and choroid, and other congenital defects, render the vision too imperfect in the majority of cases to allow of satisfactory investigation in this direction.

In the present case, however, while there is some amblyopia, we have vision sufficient to enable us to learn something, at least, of the effects produced when the lens is asymmetrical.

In Graefe's Archives, Vol. VIII, p. 229, 1862, Dr. Knapp stated "such eyes are apt to have astigmatism of a high degree, owing to the shape of the lens," but, in the case I am about to report, while astigmatism of the lens does exist, it will be seen that it is accommodative astigmatism.

In November, 1888, Edwin S., aged 10, was brought to my office from Marysville, Ohio, complaining of pain in the eyes, severe at times, and increasing on effort to read, photophobia and also a sense of what he described as "fluttering" in the eyes. There was no conjunctival injection or other evidence of inflammation, though he had the right eye tied up to exclude the light.

The above symptoms had been gradually increasing for about four years and, as his vision was very defective, he was referred to me by his physician, in the hope that he might be benefited by the adjustment of proper glasses. His vision was as follows:

R. E., counts fingers at 8′ — 6. sph. = 4/15—.

L. E., 4/40 — 2.5 sph. = 4/10.

R. E., reads Jaeger 2 at $\left\{ \begin{matrix} 75^{mm.} & 150^{mm.} \\ 3^{in.} & 6^{in.} \end{matrix} \right\}$ with — 6.^{s} = J. 2. @ $\left\{ \begin{matrix} 150^{mm.} & 225^{mm.} \\ 6^{in.} & 9^{in.} \end{matrix} \right\}$

L. E., reads Jaeger 2 at $\left\{ \begin{matrix} 75^{mm.} & 225^{mm.} \\ 3^{in.} & 9^{in.} \end{matrix} \right\}$ with — 2.5^{s} = J. 2 @ $\left\{ \begin{matrix} 150^{mm.} & 325^{mm.} \\ 6^{in.} & 13^{in.} \end{matrix} \right\}$

P — R = A

R. E., 13.D. — 6.D. = 7.D. = .50 normal A (14.D.), at ten years of age.

L. E., 13.D. — 2.5.D. = 10.5D. = .75 normal A (14.D.), at ten years of age.

These lenses were used with comfort both for distance and in reading.

The general appearance of the eyes was that usually presented by myopes, but on close inspection it was seen that every motion was accompanied by trembling of the irides, which were apparently normal, if we except a peculiar marking in very fine concentric and radiating lines, and the fact that they had, to a degree, the flat appearance characteristic of aphakia. There was a moderate degree of nystagmus at this time, which disappeared after several months under the use of lenses correcting his refractive error. On dilating the pupil a typical coloboma of the lower part of the lens was at once apparent in each eye.

The patient has been seen and subjected to repeated examinations during the last five and one-half years and, while there has been some increase in the myopia and a very slight diminution in the acuity of vision in both eyes, no material organic change has been observed and a description of his eyes as seen a few days ago is almost identical with that which I find in my note-books, entered on the occasion of his first visit in 1888,

With the exception of a few rather indefinite, wavy lines. apparently in the deeper tissues near the macula, and a slender bridge of opaque nerve fiber over one of the superior retinal vessels as it leaves the disc in the right eye, there was nothing abnormal in the appearance of the fundus nor anything to suggest coloboma of the iris or choroid.

The lenses presented the appearance of having had the lower portion cut off, the chord of an arc equal to one-fourth of the circumference forming the lower border. This line appeared straight when viewed by oblique illumination, but when seen with the ophthalmoscope it seemed slightly convex toward the center of the lens, and in each eye was inclined upward and to the left (of the observer) at an angle of about ten degrees.*

The lenses were transparent up to the borders, which were slightly rounded and presented the usual golden reflex, and the

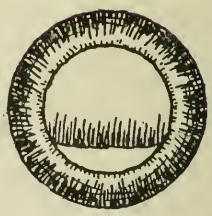
* There is a remarkable resemblance between this case and that described by Cissel in 1890. In both instances the lower border of the lens is inclined upward and to the left.

Oliver. 1887.

Clark. 1894

Cissel. 1890.

Dr. Schiss-Gemusius.
1871



Schiess.
1885.

suspensory ligaments, if present at this point, were so transparent as to be invisible.

Through the space between the edge of the lens and the border of the iris when the pupil was dilated with a mydriatic the red reflex of the fundus and the retinal vessels could be made out. It was observed that the trembling of the iris, while noticeable throughout its whole extent, was much more apparent in the inferior quadrant, over the coloboma of the lens.

The fluttering sensation in the eyes and pain extending to the back of the head induced by close application were relieved in great part by the use of atropia and, after I had succeeded in correcting, in a measure, the astigmatism as well as the myopia, he was fairly comfortable and able to successfully pursue his studies.

His refraction and accommodation were carefully and repeatedly tested a few weeks ago and the results obtained by the various methods employed were remarkably uniform with the exception of a slight but persistent discrepancy between the axis as determined by the ophthalmometer, and that resulting from the lens tests.

Javal's ophthalmometer yields the following:

R. E., axis 100°— 21. axis 10°— 22.25 = 1.25D.
L. E., axis 75°— 20. axis 165°— 22.75 = 2.75D.

While with the eyes under the influence of atropia he obtained the best vision with:

R. E., — 7. sph.⌒— 1.5 cyl. axis 180° = 4/18 —.
L. E., — 5. sph.⌒— 3. cyl. axis 180° = 4/18 — 1.

When the effect of the atropia had disappeared it was found that he could not accept the full correction of his astigmatism, but saw much better with the following:

R. E., — 8. sph.⌒— 1. cyl. axis 180° = 4/18 —.
L. E, — 5. sph.⌒— 1.5 cyl. axis 180° = 4/18 — 1.

This, as will be seen, is $\frac{2}{3}$ of the total corneal astigmatism in the right and $\frac{1}{2}$ in the left.

In accommodation he did best with the above spherical glasses reduced as follows:

R. E., —4.5 S.⌒—1. cyl. ax. 180° = J. 2 at $\left\{ \begin{matrix} 75^{mm}. & 250^{mm}. \\ 3^{in}. & 10^{in}. \end{matrix} \right\}$

L. E., —2.5 S.⌒—1.5 cyl. ax. 180° = J. 2 at $\left\{ \begin{matrix} 100^{mm}. & 250^{mm}. \\ 4^{in}. & 10^{in}. \end{matrix} \right\}$

P — R = A

R. E., 13.D.—7.D.=6.D.=.48 normal A (12.5), at 16 years of age.

L. E., 10.D.—5.D.=5.D.=.40 normal A (12.5), at 16 years of age.

He now wears with comfort glasses prescribed on the above formula, reduced slightly for the right eye.

The results obtained by lens tests, with complete mydriasis, therefore, confirm those obtained by the ophthalmometer, but when the accommodative power again reasserts itself we have a very interesting condition to observe. The astigmatism which, as we have seen, is corneal, is now partially neutralized by the lens, and it seems that the contraction of the ciliary muscle which should, in the normal eye, act equally on all meridians of the lens, by relaxing the fibers of the suspensory ligament in the present instance acts more upon the fibers which approximate the horizontal meridian than upon those in the vertical, which are rendered less efficient by the defect in the form of the lens.

If this theory of the case is correct, however, I am at a loss to explain the fact that under the varying phases of accommodation he accepts the same correction for his astigmatism as in distance vision, while, like many other myopes of high degree, he prefers a much weaker spherical glass in reading.*

A point of great interest in this case is the retention of so high a degree of accommodative power in a lens with so serious a defect of form.

* Is it possible that in the left eye, for example, the inequality of tension in the vertical and horizontal meridians of the suspensory ligament is represented by 3D.—1.5D.=1.5D. of astigmatism?

Cissel's case tends to disprove this, as he records no astigmatism.

And after the ciliary muscle has contracted sufficiently to relax the fibers in and near the horizontal meridian to such a degree as to equal the relaxation in the vertical meridian due to the coloboma, may not its continued relaxation produce an equal effect upon all the meridians?

If this is true in a case of coloboma of the lens, may it not also be true in other cases where defects exist in portions of the suspensory ligament or lens?

The trembling of the iris throughout its whole extent I am unable to explain, unless it be an evidence of relaxation of the suspensory ligament, and this seems inconsistent with his high degree of accommodative power.

The lens seems to be of normal thickness and the pupillary border of the iris appears to rest upon it, but as no accurate method was employed in measuring its thickness I am not prepared to speak positively on this point.

The pain and "fluttering" sensation which he experienced on attempting to read before his refraction was corrected, I am disposed to attribute to the partially successful efforts of a ciliary muscle struggling to accommodate a lens which is defective and not absolutely secure in its position.

DISCUSSION.

DR. ALBERT G. HEYL of Philadelphia, Pa.— I would like to refer to two points in connection with this subject. One is, that clinically we must distinguish between two varieties of congenital defects of the crystalline lens which probably belong to the same classification. In the one the lens is symmetrical in shape but small in size. That is not true coloboma of the lens as ordinarily described. The second variety is that in which there is a lack of symmetry in the lens as mentioned in Dr. Clark's case; this is coloboma lentis. The other point I desire to raise is with reference to the pathology. I would like to state Becker's view with reference to this matter, as his work on the pathology of the lens is not very accessible. He does not believe in the equatorial cells as described by von Becker (*Arch. f. Ophth*, Bd. IX.). He believes these cases of coloboma lentis are due to the imperfect development of the zonula, or possibly its absence at a given point. Thus it happens in the process of development that the lens is pulled out of shape. I think that is, perhaps, the latest view advanced in connection with the subject; it has certain difficulties connected with it which cannot now be discussed in detail.

DR. C. F. CLARK of Columbus, Ohio.— There are two cases recorded in which the suspensory ligament was detected. One was a case which occurred in Fuchs' clinic.

RUPTURE OF THE LYMPH SHEATH OF A RETINAL VEIN.

BY ALBERT G. HEYL, M.D.,

PHILADELPHIA, PA.

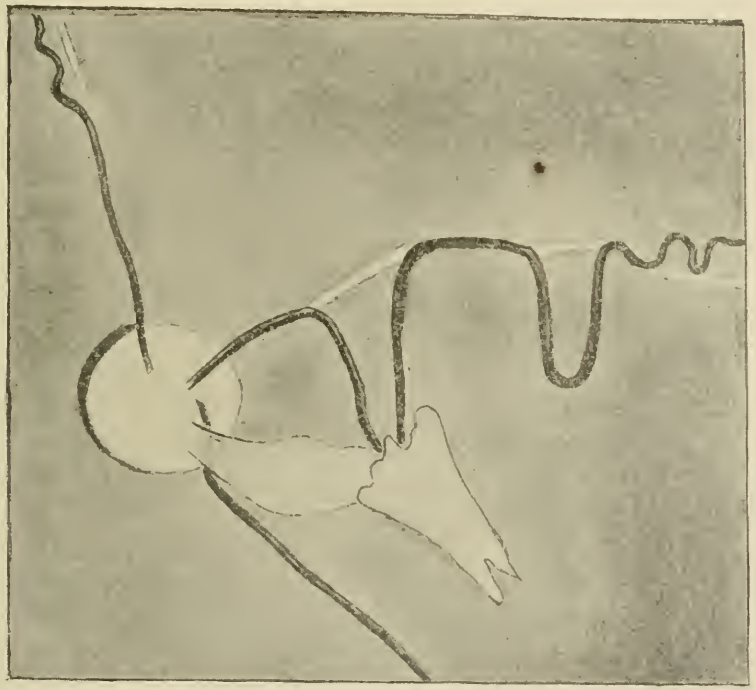
This paper relates to a case in which the lymph sheath of a retinal vein had spontaneously ruptured, allowing the vessel to project through the opening into the vitreous. The existence of *perivascular* lymph spaces in the retina was first demonstrated by * His (1865). Later, Schwalbe succeeded, by injecting underneath the pial sheath of the opticus, in filling these spaces about the retinal veins and capillaries. Although it does not seem to have been demonstrated by injection that the retinal arteries are likewise enclosed by lymph sheaths, yet it is highly probable that such is the case. (*a*) Because in the brain, arteries as well as veins and capillaries are surrounded by a lymph sheath. (*b*) If a retinal artery be observed, with the ophthalmoscope, at the point where it crosses an underlying vessel, a transparent edge to the red blood current of the vessel may be observed. Attention was first directed to this by E. Jaeger,† and was thought by him to be the peripheral portion of the blood stream. It may be, however, and probably is due to the lymph stream in the perivascular space.

The history of the case is as follows: The patient, Mrs. D., applied to me Sept. 26, '92, on account of defective sight. Two months previously, she was confined to her bed after the premature birth of a child. At this time, she noticed the dimness of sight. At the time of her first visit to me, the vision in each eye was 4/200. The media were clear, a few whitish retinal plaques were visible with here and there a retinal infaret. There was albumen in the urine. After continuing treatment for some time, the patient disappeared, but returned in the autumn of 1893 with the statement that on several occa-

* G. Schwalbe Lehre von Sinnen Organen, S. 122 (Hoffman's Anatomie, Bd. 2. abth. 3).

† Ergebnisse der Untersuch: mit Augenspiegel, S. 45–46.

sions the sight of the L. E. had become very much obscured, but had cleared up again. About two weeks before her visit, it had become obscured again and had so remained. The left fundus was found to be completely obscured by a gray opacity of some kind in the anterior part of the vitreous, slightly movable, while in the R. E. the condition represented in the drawing was observed.



In the foreground of the picture and below the disc, a whitish formation will be noticed. One extremity is merged into the optic disc, the other extended out into the vitreous; the refraction of this latter extremity, which was flat and almost perpendicular to the line of sight, was + 4.5 D.; the refraction of the optic disc was E. Therefore, we have here a vitreous opacity. It belongs to the connective tissue formation described by Wecker* as the *butterfly wing opacity*, there being

* Graefe and Saemisch augenheilkinde, Bd. IV, S. 688.

in some cases a resemblance to the unfolded wing of a butterfly, It will be further observed that the vein in the upper inner quadrant of the retina, a short distance from the disc, makes an abrupt turn and runs toward the vitreous opacity; it turns again just underneath this and descends to the retina, runs a short distance in the latter, then makes another loop as before. The refraction of the apex of the first loop was +4.5 D., of that of the second +3.5 D. The refraction of the disc and fundus being E., these vessel loops evidently projected into the vitreous. Lying in the retina and evidently in the original track of the vein, between the ascending and descending portion of the loops, were white elongated structures slightly larger in caliber than the vein. As soon as it was discovered that the vessel loops were projecting into the vitreous, the diagnosis was evident. The vessel had ruptured its lymph sheath and the remnant of the latter remained in the original track of the vessel. Beyond the second loop the vessel became tortuous again, but now apparently lay flat on the retina; below, however, was a whitish object in the retina, which no doubt represented another portion of ruptured lymph sheath. The vessel had escaped from it and lay curled on the retina. If the vein running in the upper outer quadrant be traced to the corner of the picture the same phenomenon will be seen.

Two remarks may be made in conclusion:

1. The immediate cause of the rupture of the lymph sheath was probably the pressure of the vein. It will be noticed that the vessel, where it had escaped from the sheath, is thrown into curves. It may well be that under a sudden access of *intravanous* tension the vessel within the sheath was thrown into curves, and thus the outer lymph sheath was torn. In this connection the effect of cardiac systole in inducing curves in arterial vessels may be studied.

It can hardly be that the sheath itself was in normal condition. Tortuous retinal vessels are too common, and lymph sheath rupture too infrequent to lead to any other conclusion than that the lymph sheath in this case had undergone some pathological change.

2. The co-existence of the butterfly-shaped connective

tissue opacity with the lymph sheath rupture could hardly have been a mere coincidence.

H. Pagenstecher* was, I believe, the first to point out that a growth of this kind had originated *not* from the stroma of the vitreous itself, but from lymph cells which had migrated into the vitreous from the blood vessels. An experiment of Schwalbe's† tends to corroborate this view. Schwalbe introduced portions of vitreous into a lymph sac in the back of a frog. In due time the piece of vitreous became infiltrated with the leucocytes, which had wandered into it from the lymph fluid in the sac. If it be true that leucocytes can develop into connective tissue, then we have a clear explanation of this opacity.

What seems to have taken place is this: *a*, rupture of the lymph sheath; *b*, a tear in the vitreous by the protruding vessel; *c*, the escape of leucocytes into the vitreous; *d*, the development of the leucocytes into connective tissue. Notice, also, that the vitreous growth reaches the papilla and seems connected with it. It was so in a case of this kind reported by G. Strawbridge.‡ Possibly the explanation of this is that the leucocytes on reaching the vitreous tend to escape from the eye by means of the lymph channels in the optic disc, and hence a train composed of innumerable leucocytes is formed, extending from the initial point of entrance into vitreous, to the optic disc.

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* Graefe and Saemisch augenheilkinde, Bd. IV, S. 675.

† Graefe and Saemisch augenheilkinde, Bd. I. S. 474.

‡ Report of American Ophthalmological Society, 1874, p. 304.

COLLOID DISEASE IN THE MACULAR REGION ANALOGOUS IN APPEARANCE TO THE SO-CALLED DRUSEN IN THE NERVE-HEAD.

BY G. E. DE SCHWEINITZ, M.D.,

PHILADELPHIA, PA.

Both from the clinical and the microscopical standpoint, the attention of the Society has been directed recently to the so-called drusen in the nerve-head. I desire to present the report of two cases exhibiting symmetrical macular lesions, in appearance not unlike these curious formations in the optic papilla.

CASE I. — Lizzie C., a trained nurse, aged thirty, presented herself for treatment on account of blepharitis, pain in the eyes, and frontal headache. Her father died of typhoid fever; her mother and one brother from causes unknown; one brother and one sister are living and well; her maternal grandfather and a maternal uncle and aunt died of phthisis. The patient, with the exception of atonic amenorrhœa, is in good health, and has not been ill since childhood, when she suffered from measles, scarlet fever, and diphtheria, all before the eighth year of her life.

The vision in each eye is 6/9, which, after the correction of a compound hypermetropic astigmatism,

O. D. + 2 D. ⌒ + .50c axis 15
O. S. + 2 D. ⌒ + .50c axis 165

rises to 6/6.

In each eye the disc is a vertical oval, somewhat hyperaemic, and its margins are slightly veiled with hazy retina. The macular regions present symmetrical lesions consisting of a collection of variously-shaped, chiefly roundish, yellowish and yellowish-white, slightly prominent bodies lying beneath the retinal vessels. They vary in size from quite minute ones to those equal to the width of one or one and one-half retinal veins. The bodies are so related one to the other that they are

closely in contact, somewhat piled up, giving the general impression of the mulberry-like appearance which has been attributed to the so-called colloid growths seen in the nerve-head. Each patch is a large oval three disc diameters in length and two in width.

The amplitude of accommodation, after correction of the refractive anomaly, is normal. There is an exophoria of four degrees. The visual field is normal and there is no scotoma. The appearances of the right eye are represented in the accompanying water-color; those of the left are practically the same.*

This patient was first seen more than four years ago, and has been examined on numerous occasions since that date, the last time only two weeks ago. There has never been the slightest change in the appearances of the spots, and never the least disturbance of central vision, which at the present time is 6/5.

Case II. — Louise N., a young unmarried woman, presented herself for treatment on account of persistent asthenopia and frontal and occipital headaches, which have been temporarily relieved by glasses. Her refractive error was first corrected six years ago, again two years ago, and lastly two months ago by myself. Father and mother are healthy, but the patient has never been very strong. When five years old she had measles severely and also chicken pox, but never scarlet fever. Seven years ago she was very ill with what was supposed to be acute anaemia. She improved under the influence of rest-cure and massage. At this time, however, it was discovered that the urine was loaded with albumin and contained numerous hyaline and granular tube-casts. These have persisted, although at the present time the quantity of albumin has greatly lessened and the general nutrition of the patient has much improved.

The vision in each eye is 6/9, which, after the correction of a compound hypermetropic astigmatism,

O. D. + .50s ⌒ + 50c axis V.
O. S. + .50s ⌒ + 62c axis V.

rises to 6/6.

* I have seen a third case, exactly like the ones I report, through the courtesy of Dr. John T. Carpenter, Jr. The water color of this case, by Miss Washington, has not been reproduced.

There is esophoria of six degrees. Abduction equals six degrees, adduction sixteen degrees.

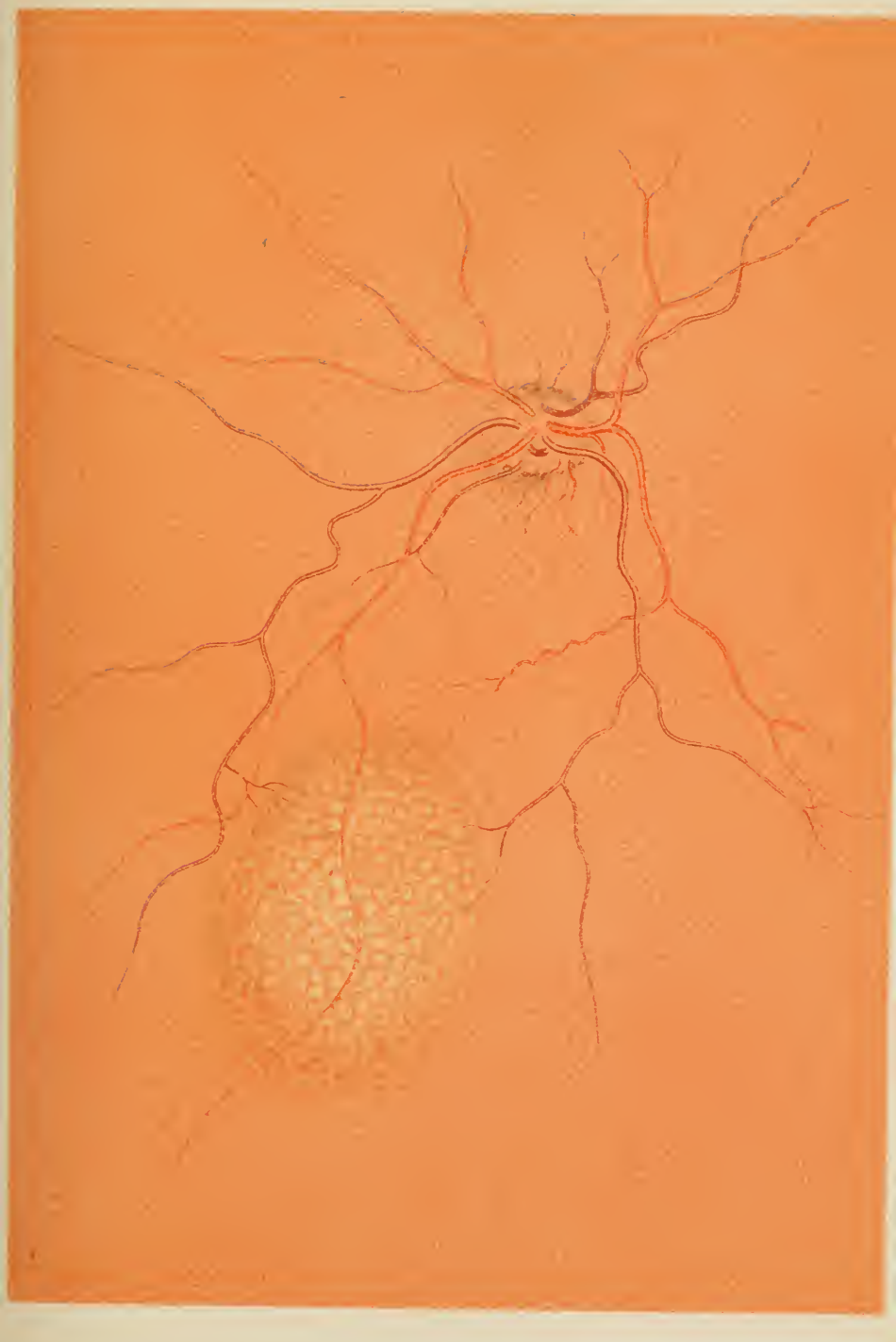
Each optical disc is a vertical oval, small, the edges mellow, the veins full and slightly tortuous. Each macular region is occupied by a large, oval, somewhat elevated patch composed of numerous roundish bodies, reddish-yellow and faintly translucent, joined together in such manner that they seem to lie not only side by side, but piled one above the other. These bodies lie beneath the retinal vessels. Here and there are a few flakes of pigment and some reddish spots. The accommodation is subnormal, even after the correction of the refractive error, the field of vision is unimpaired, there is no scotoma, and the pupillary reflexes are normal. The appearances are presented in the accompanying water-color by Miss Margaretta Washington.*

The illustrations, excellent in many respects, do not convey exactly the ophthalmoscopic picture of these cases, which cannot better be described than by comparing them to the appearances presented by the mulberry-like, hyaline or colloid outgrowths from the optic papilla. The bluish-gray color which is ascribed to the latter is not evident in these macular bodies, which somewhat resemble small masses of boiled sago or tapioca, with a faint reddish-yellow tint softened by the retinal covering. The verrucosities of the choroid described by De Wecker and Masselon† are represented occupying the fundus a short distance from the papilla and almost encircling it, but the macular region is uninvolved. Nettleship's‡ drawing of a case described as central guttate choroiditis, without defect of sight, which portrays "a number of small, perfectly circular, pale, greyish-yellow spots thickly congregated at the yellow-spot region, and more thinly scattered all around that part, reaching on the nasal side as far as the disc," somewhat resembles the illustrations which I present. The spots are, however, smaller, less bunched together, and not so prominent. It seems likely that these cases represent the ophthalmoscopic appearances of the so-called colloid degeneration of the vitreous mem-

* The patch of colloid change is misplaced; it should be more directly in the macular region.

† Ophthalmoscopie Clinique, 2d Edition, Figs. 79 and 80.

‡ *Trans. Ophth. Soc. U. K.*, Vol. IV, Plate II, Fig. 2.



brane of the choroid, which, as we know, consists of variously-shaped small projections from this structure. Colloid excrescences were first described as senile changes,* but they may occur in young subjects, as, for example, in the cases herewith presented, and are often unaccompanied by impairment of visual acuity. Dimmer† gives a good account of the pathological anatomy of these bodies and a résumé of the various theories which have been advanced to explain their origin, his own belief being that they may arise from cells, which become filled with a homogenous substance, gradually coalesce and form the colloid projections; in other words, the process is similar to simple colloid degeneration. Based upon microscopic studies,‡ I have expressed the opinion that colloid excrescenses of the lamina vitrea and drusen in the nerve-head are not analogous lesions, an opinion also held by a number of other observers.

A CASE OF ATROPHY OF THE OPTIC NERVE.

BY CHARLES W. KOLLOCK, M.D.,

CHARLESTON, S. C.

Six years ago this summer Miss L——, while riding a tricycle, fell off on her head, but apparently was not injured nor rendered unconscious. The next day her vision began to fail rapidly, but prior to this accident she had noticed that she did not see quite as well as formerly. She was at the time away from home, and a physician whom she consulted advised her to hasten home, as loss of vision was likely to follow. The prognosis was correct, for very soon she was almost entirely blind. She was for two or three years under the care of one or more physicians, but became gradually worse, and they gave up the

* An instructive chromo-lithograph representing senile degeneration of the macula, suggestive of this change, is given by Caspar (Monatsbl. f. prakt. Augenheilk., 1892, p. 284), who considers his case identical with the changes described by Nagel as "hyaline growths and crystalline deposits of lime on the inner surface of the choroid."

† *Arch. of Ophthalmology*, Vol. XIV, p. 65.

‡ *Trans. Amer. Ophth. Soc.*, 1892.

case as incurable. She was brought to me in August last, just five years after the fall which preceded the loss of vision.

Upon examination both pupils were found to be partially dilated and responded sluggishly to light. The right eye could only see light; the left had 4/cc vision, with fair color perception and a good field, considering the amount of vision. The ophthalmoscope showed gray atrophy of both optic nerves, the right whiter and cupped, and the vessels much contracted. The left disc was not so light in appearance and its vessels not as small, but there was some cupping. The ophthalmoscope also showed a myopia of 2 D., but no glass improved the vision. Tension was normal, and at no time had there been any pain. On account of the size of the vessels, the field of vision, and the good color perception, it seemed that some improvement might follow treatment, but my prognosis was, of course, unfavorable, as she had been in this condition for five years. Iodide of potassium was prescribed in ascending doses, beginning with ten grains three times a day. She came to me once a week, and after a time it was noted that the pupils were becoming smaller and reacted more quickly to light. Vision improved slowly, and in the course of two months she could see 15/cc. It then struck me that as some tendency to improvement existed, that regular exercise of the retina and nerve might be beneficial. Certainly it could do no harm. She was accordingly told to see everything that she could, to use her eye as much as possible every day upon surrounding objects. Before this she was listless and without hope; the advice gave her occupation, and she entered, heart and soul, into my plan, puzzled over objects, made them out, walked without assistance on the streets (she had been habitually led), read signs, etc. She began to write, and found after a little practice that she could write in parallel lines, and, though she could not read her writing — which was legible enough to others — she could see sufficiently to know when the ink ceased flowing from a fountain pen which she used. The iodide was gradually increased until she took over three hundred grains a day, and the vision became with — 2 D. 15/c. Strychnine was next tried in ascending doses, but without improvement. In fact, she seemed to thrive

better on the iodide. Before beginning treatment the hearing was very dull, and there were constant noises in both ears and flashes of light in the eyes. The hearing has not materially improved, but the noises and flashes of light have almost ceased. Some time before the accident she had trouble with both eye-teeth, which necessitated their being filled, and subsequently an abscess formed at the root of one, which left an enlargement. This entirely disappeared while she was taking the iodide. No history of syphilis could be obtained, though the patient has somewhat of a scrofulous appearance. The mother is in good health; the father, who was myopic, is dead. The patient continues to recognize objects better and better, and at times recognizes persons whom she does not expect to meet. She readily detects colors 1 cm. square at 15 inches.

I believe in this case that the improvement has been due not only to the large doses of iodide, but to the constant exercise of the retina. Constant use of the eye causes more blood to flow into it, and in atrophy there is a lack of blood. Why, therefore, should not exercise that improves paralyzed limbs not help to strengthen an atrophic optic nerve if some life is left? As to the cause of this atrophy there is doubt. The failure of vision before the accident may have been due to the myopia which she inherited from the father. This failure had not interfered with her duties as a school teacher. Glaucoma may be excluded by the conditions of the field, the color perceptions, lack of increased tension, and absence of pain. It is scarcely possible that there could have been a fracture at the base of the skull and through the orbit, for she was not rendered unconscious by the fall, nor did she suffer from pain. The improvement under the large doses of iodide would seem to indicate a specific cause. I do not expect much further improvement, but think that, considering her condition at the time treatment was begun, and the length of time (five years) that she had been in this condition, the result is, to say the least, gratifying.

THREE CASES OF SO-CALLED ECTROPION UVEAE.

BY DR. LUCIEN HOWE,

BUFFALO, N. Y.

In this short communication I desire

First. To place on record three cases of an affection of the eyes usually considered uncommon.

Second. To show that the confusion of nomenclature in regard to the growths under consideration is probably due to the fact that various forms of the same difficulty have been supposed to be different pathologically, and therefore given different names.

Third. I wish to call attention to the apparent relation existing between ectropion uveae and myopia.

To facilitate clearness of statement I will briefly recapitulate the three cases which have come under my observation, and then from a table of others which occur in the literature of the subject shall indicate the conclusions to be drawn from all together. These three cases are, very briefly, as follows:

CASE I. B. M., aged 44, applied at the Buffalo Eye and Ear Infirmary July 26, 1891, on account of a lachrymal fistula. Close examination showed that there existed also at the lower and outer edge of the pupil of the right eye a small projection about 1.5 millimeters in diameter. With the exception of a slight lachrymal conjunctivitis, the eye was otherwise in a normal condition with vision normal. Patient has been seen at intervals for about three years, and this peculiar condition of the edge of the iris frequently noticed. At one time it was at least two and one-half millimeters in diameter, but when last seen, May 23, 1894, it had become measurably smaller, about two millimeters in diameter.

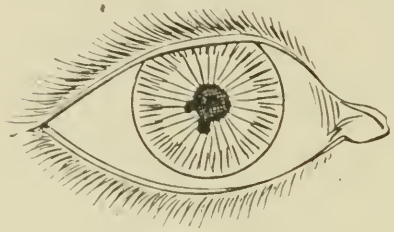
CASE II. Mr. R. C., 25 years old, consulted me September 15, 1882, on account of myopia and of a peculiar condition of each iris which he had noticed about five or six months before. This was a projection near the center of the upper portion

of the pupillary margin; it was about a millimeter and a half in length and extended into the anterior chamber about the same distance in each eye. The only other peculiarity was a slight degree of myopia, that in the right eye being corrected to $\frac{20}{20}$ with minus 1.25 dioptrie, left by minus 1.75 dioptrie.

The third case here reported was really the first one of the three that I saw, but it is given as the last for the reason that it is not only more marked than all the others, but presents the ectropion in a much greater degree. The outline of the case is as follows: Miss C. L., aged 24, the daughter of a physician in the town of North East, Pa., consulted me on the 9th of October, 1885. Since childhood she had noticed a certain amount of myopia, which had gradually increased, and for which a correspondingly strong glass had been used. For three or four months previous to her visit the vision had been more impaired than usual, and her father had noticed peculiar growths about the pupillary margin of the iris in each eye, which were gradually increasing, so as now almost to fill the pupillary space. A more exact examination of these showed, in the right eye, four small globular tumors projecting from the edge of the iris into the pupil. The largest one, almost directly below, was distinctly pedunculated, measuring four millimeters in diameter; the next in size was above and a little outward, measured three millimeters, and the two which were just between these — one on each side — measured two and one-half millimeters respectively.

As the pupil was naturally rather small, these were so crowded together as to leave no apparent opening there, but in the right eye minus fourteen dioptrie gave vision equal twenty-fortieths. In the left eye the appearance of the pupil was somewhat similar, there being three of these globular projections. The lower one measured about four millimeters in diameter, the second, above and outward, three millimeters, and the third, above and inward, also three millimeters. This pupil also appeared closed by the growths, but minus twelve dioptrie, gave vision for the left equal to twenty-thirtieths. These projections were so regular in form as to suggest a multiple cyst, but the color, the general appearance and the subsequent history was such as to eliminate that from the diagnosis.

While the case was under observation I had an opportunity of showing it to Dr. Carl Koller, to whom also the growth was then as new as to myself. The patient has been seen at intervals for about nine years, during which time the myopia in the right increased from fourteen to sixteen dioptrie, and in the left, from twelve to eighteen. It is interesting to note, however, that the growths became more and more pedunculated; one, at last, was so movable as to be almost floating, and finally all contracted more or less.



On the 23d of May, 1894, I had an opportunity of examining the patient, and found that, in the right eye, two of the four tumors had disappeared entirely. The one externally had been reduced to a mere point about half a millimeter in diameter, while the globular one below, hanging by a pedicle, measured two and one-half millimeters in diameter. In the other eye, the two smaller points had disappeared, and the one below measured only one and one-half millimeters in diameter.

The following table contains a list of articles on the subject and cases of a similar kind which could be found reported during the last sixteen years:

Observer.	Where Reported.	Age.	Congenital or not.	Form of growth.	Vision.
Graefe.	Arch. fur Ophthal. VII, 2. S. 35.	15	Yes.	Egg shaped.	Normal.
Colsman.	Klinische Monatsblätter, January, 1869.	Not given Adult.	Not stated.	Cabbage like.	Slight Myopia.
Holmes.	Chicago Med. Jour. 1873.	23	Yes.	Pear shaped.	Myopia.
Anke.	Centralblatt fur Augenheilkunde, page 311, 1885.	40	Not stated.	Globular excrescence.	Asthenopia and slight hypermetropia.
"	"	Not given	"	Slight projection.	Asthenopia.
"	"	"	"	3–4 excrescences Circa 3–4mm.	Ker. Inter.
E. Bock.	Klinische Monatsbl. fur Augenheilkunde, Vol. 26, page 163.	19		Round floating in anterior chamber.	Not tested.
Businelli.	Annales d'Oculistique, Vol. 60, page 168.	26		Round attached to iris.	" Vision feeble."
Wicherkiewicz.	Graefe's Archive, Vol. 37, page 204.	44	Not given.	Irregular 3 to 3–5mm.	—6, 5D. V.= 1–2.
S. Weinbaun.	id., Vol. 38, page 119.	26		Irregular.	V.=p. l.

Although the three cases which I here report, and those described by others differ somewhat, I am still inclined to the opinion that they are all forms of the same pathological condition. These can be divided into three groups.

First. Those in which the growths are congenital, usually very minute and continue about the same size through life. These are cases such as I have here reported, numbered one and two, and undoubtedly there are many other such, which escape observation. It is of these that Bock has said, "Such pigmentary excrescences in the pupillary edge of the iris have been quite often observed on eyes otherwise normal; nevertheless, they form but a relatively small part of the case records in large outdoor hospital services. The reason of this perhaps is, that these projections are perfectly black objects against a dark pupillary background, so that they can only be noticed when examined by oblique illumination."

In the second class of these cases, the projections at the margin of the iris either escape observation in infancy or youth, or rarely appear until middle life. These then increase in size, become more or less globular, attached to the iris by a pedicle, and then either absorb, as occurs in case number three, here reported, or else become loosened from the iris and float as foreign bodies in the anterior chamber. Such are the cases reported by Bock and others.

As long as these minute tumors are similar to those described in class one, or are in the early stage of those as described in class two, that is, while they are still mere projections at the edge of the iris, irregular in form, they have been called ectropion uveae, or later, in the pedunculated form they have been called, as does Colsman in the *Klinischeblatter* for 1869, papilloma iridis.

It is unfortunate that there exists any such confusion of terms in regard to what appeared to be successive stages of the same morbid process. It would tend to simplicity if all of these excrescences were classed under the name of papilloma iridis, at least until further pathological investigations show some reason to the contrary. If the term ectropion iridis is used at all, it should be restricted to these growths in the very early

stage, and the more indefinite "ectropion uveae" could then be discarded entirely.

Finally, I wish to call attention to the relation that exists between these cases and myopia. Not only was this present in the two I have called attention to, but it was also in a very noticeable degree in the cases reported by Bock and others. I have no reason to assign for this apparent relation, if indeed it is more than a coincidence, but possibly the distension of the choroid in the elongated eye may have something to do with the existence of the papilloma iridis, or so-called ectropion uveae.

NEURO-PARALYTIC KERATITIS OF BOTH EYES, LASTING OVER NINE YEARS.

By Dr. PETER A. CALLAN,

NEW YORK CITY.

Mrs. Chas. L., 47, English, weight 150 pounds, mother of four children. January, 1884, I was called in consultation by her family physician, Dr. A. C. Benedict of Yonkers, on account of a serious inflammation of the patient's left eye, which began shortly after giving birth to her last child. My first visit to her was three weeks after her confinement, when I found her very weak and complaining of her left eye, but was able to nurse the infant. Examination of the left eye showed an abscess of lower half of cornea, with the anterior chamber nearly half full of pus. Treated the case with atropine, hot water bathing, and performed a saemisch, with the result that she made a good, but slow recovery. Did not see the patient again for almost a year, when she presented herself at my office on account of impaired vision. The family history was rather negative; never very strong, had always fair health, however, and could only remember one severe attack of sickness, *viz.*, intermittent fever in 1874. Ten months after the trouble with the O. S. she noticed that the vision of the O. D. became somewhat impaired, and in less than six weeks the O. S. was

not so good as after recovering from the abscess. Patient was still nursing her baby, and showed the drain on her system by the marked pallor of her face and in her general physique. Both eyes were typical pictures of neuro-paralytic keratitis; the O. D. more pronounced than its fellow eye. The corneæ looked like wet mottled ground-glass, the epithelium rough, uneven, and wanting in spots, especially toward the centers; with almost total loss of sensitiveness. The conjunctiva of each eye showed much more sensation. The patient occasionally winked and the lachrymal glands secreted so that the anterior portion of the globe was kept moist. At no period of the nine years that the patient has been under my observation were the corneæ entirely divested of epithelium, not even the centers; neither was there any ocular irritation. The patient merely complained of poor vision. Always was subject to headaches, which became decidedly more severe about two years before the eye trouble. They affected the temporal and occipital regions on an average every third day, and she rarely escaped one at any time for three weeks. Complained frequently of irregular flushes of heat over face and head during past ten years, but at no time could I discover any changes as regard sensation, except in the case of the eyes. At the worst period the vision was reduced to 10/200, but has improved to 20/100 at present. In September, 1893, could read Sn. No. 4 at 7 in. with $-+16$. About the middle of October, five weeks after last visit, she presented herself again, having developed an abscess of the right cornea. The eyelids were œdematous, the ball considerably injected, with the cornea infiltrated from the center to the nasal side nearly 5 mm. in extent. There was a trace of hypoyon. My prognosis was grave, fearing that she might lose the eye, especially under the circumstances of the long-continued inflammation which both eyes had been subject to for so many years. Under the use of hot water bathing and the instillation of atropine with tonics internally, the eye promptly responded, and within two weeks was out of danger. The recovery from the abscess was apparently complete, leaving the portion of the cornea, which was not involved, clearer than it had been for years, but the site of the abscess was somewhat

opaque. This was the condition at the end of the first week of December. January 13, 1894, patient returned with fresh trouble with the O. D. Three days before she was awakened from a sound sleep by extreme pain in and about the O. D., which lasted four hours. I found the eye inflamed, with a small superficial ulcer of the cornea, occupying the median line and situated between the center and the temporal side. The ball painful to the touch in the upper ciliary region, with marked injection and a small amount of pus in anterior chamber. Lids swollen with some muco-purulent secretion adherent to the ciliæ. Put her on same treatment employed in combatting the abscess, and touched the ulcer and conjunctiva with a sol. 5 gr. nit. argt. January 21st the œdema of the lids had entirely disappeared. Eyeball was not painful to the touch, the ulcer was clean cut and sharply defined, the ball not injected, and the pus had disappeared from the anterior chamber. February 1st, eye free from all irritation, no secretion, ulcer healing. February 21st, ulcer healed. The left cornea is somewhat more mottled than the right, and with less lustre, but prior to the abscess of the right there was not much to choose between the two. If we except the two attacks of the right eye, the epithelium alone was affected, without the corneal tissue proper becoming involved, or any appearance of pus. The tension did not seem to be reduced, but this was difficult to determine, as both eyes were diseased.

April 30, 1894. The right eye presents a very good appearance if we except the opacities due to abscess and ulcer; the epithelial surface is unbroken and the reflex is normal, the erosions have all disappeared. It would seem as if the two inflammations, from which the eye suffered during the past seven months, aided, rather than otherwise, the recovery. The left eye presents still some central erosions of the cornea, but the sensitiveness of both eyes is not quite normal.

The unusual duration of this case afforded ample opportunity for testing various forms of medication, but none seemed to shorten the course of the disease. Eserine on the whole was not well borne, while atropine at no time developed the characteristic irritations which are so apt to follow its long con-

tinuance; the use of bandages, that is, one eye protected at a time, showed that the uncovered eye did quite as well as its fellow. Hot water bathing of the eyes proved of more service than anything else in the way of treatment; while to my mind the two severe inflammations of the right eye have been the means of removing the erosions and giving the cornea a lustre which it has not had in ten years.

The patient has been as faithful in treating her eyes as could be expected, considering the long period which the disease has lasted. There were periods when she gave them but scant attention, although she claims always to have carried out the treatment.

To my mind the case is one of trophic disturbance, local traumatism playing but an insignificant *rôle*. There was always some secretion of tears, and occasionally winking. The patient during the past ten years has been cachectic, with marked pallor of the face. In some respects myxoedema would suggest itself from the stolid mask-like expression, but there was no swelling of the features, simply a fullness. There was likewise wanting the mottling or bronzing of the face which we meet with in that disease.

CASE OF ENTROPION, PROBABLY CONGENITAL, COMPLICATED WITH EXTENSIVE ULCERATION OF BOTH CORNEÆ.

By J. A. LIPPINCOTT, M.D.,

PITTSBURG, PENN.

H. M. J., aged 6 weeks, was taken to my office April 19, 1894, by his parents, accompanied by Dr. J. C. Wilson, the family physician.

In both eyes there was a moderately abundant mucopurulent secretion. The upper lids were inverted, the lashes rubbing against the corneæ. The right cornea was slightly hazy, and the left showed an excavated ulcer about 3 mm. in

diameter, slightly to the outer side of the center. The parents were confident that the lid trouble dated back to the child's birth, but stated that the inflammatory symptoms were recent. Eversion of the upper lids was accomplished with considerable difficulty, and it was evident that the mal-position was due to malformation and not to spasm. An effort was made, by inserting the fingers under the upper lids and forcibly stretching them, to secure and maintain a normal position. A two per cent. solution of nitrate of silver was applied to the everted lids and neutralized with salt water. Directions were given to use bichloride solution 1-4000, also a weak solution of atropine sulphate, and ointment of the yellow oxide of mercury.

Four days later, April 23, 1894, as the corneal ulceration had progressed with great rapidity in both eyes, involving, in the left, an area about 7 millimeters in diameter, I made a canthotomy on each side, enlarging the palpebral fissure by the free use of the scissors, and stitched the mucous membrane to the skin in the usual manner. At the next visit, April 27th, the lids were normally placed, the discharge had lessened, but there was a large dense opacity of both corneæ.

Treatment continued.

May 3, 1894. Decided improvement in the appearance of the corneæ. Sutures removed.

May 21st. Discharge practically stopped. Corneæ almost clear, and position, appearance, and action of the lids all that could be desired.

A PORTABLE PERIMETER WITH ITS APOLOGY FOR EXISTENCE.

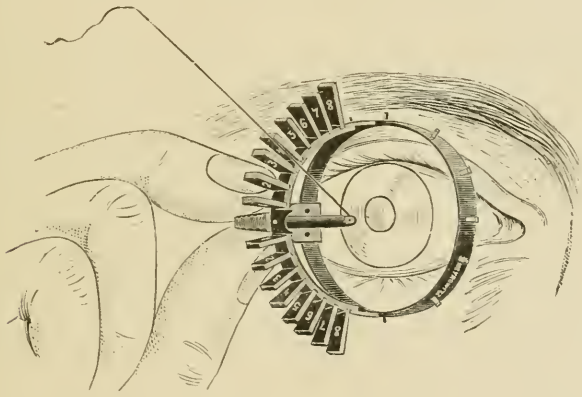
By F. M. WILSON, M.D.,

BRIDGEPORT, CONN.

This little instrument has two claims to existence, and only two: one that it is portable, which is evident, and the other that an accurate chart of the field of vision can be taken with it. Its principle is this: I have often been surprised how

near one can guess at a field of vision, *i. e.*, having had occasion to take a chart of a field of vision without instruments, and, soon after, having had opportunity to take an accurate chart of the same field with a perimeter, I have often been surprised that the errors of the guessed chart were not greater. If one uses a piece of string as a radius while guessing at a field, the line of the string helps in guessing angles. This perimeter is merely a small framework placed over the eyeball to register the position of the string.

It consists of a metal ring 25 mm. in diameter with brass pins projecting from it at intervals of thirty degrees. No fig-



ures are placed opposite these pins, for the reason that it is most convenient to change hands in using it, which would reverse the figures; but, as there are only two pins between perpendicular and horizontal in any case, there is no difficulty in identifying the meridian in which the string is swinging. At right angles to this ring is a half-ring, with projecting spokes at intervals of 10 degrees, to mark the position of this string on the meridian. Projecting toward the center of this half-ring is a post with an eyelet in its end, through which passes a piece of suture silk. These three parts, with an ivory handle, complete the instrument.

When in use, one eye of both patient and surgeon should be covered. The pupil of patient's eye the side of metal post of the instrument, and the pupil of the surgeon's eye should be in

line. The patient should be asked to open the eye widely just before the metal ring is brought in contact with the lids. Only enough pressure should be exerted to prevent winking. The end of metal post will be from 2–4 mm. from cornea.

In using most office perimeters, two registrations, opposite each other, are taken without moving the instrument. It is more convenient with this instrument to take one at a time, as it avoids crossing the arms.

It is more convenient, and sometimes necessary, on account of projecting brows, to have the patient's head tipped back a little. This, of course, increases the upper part of field. The length of the swinging radius can be varied with the length of the surgeon's arm.

Bits of paper can be threaded on to the silk and used as markers. I usually start with the half-ring perpendicular, and make a pencil mark above and below the eye in line with the brass pins. Then, as you rotate by bringing the successive pairs of pins in line with these marks, it is easy to determine the meridian in which the silk is swinging. If the silk is swung so as to be about 1 mm. from plane of half-ring, with a radius from 15–20 in., the marker will swing in the meridian corresponding to that of the brass pins.

DESCRIPTION OF AN ARTIFICIAL EYE INTENDED FOR THE STUDY OF OPHTHALMOSCOPY AND THE OBJECTIVE DETERMINATION OF AMETROPIA.

By CHARLES A. OLIVER, M.D.,

PHILADELPHIA, PENN.

As far as practicable, this model has been constructed in imitation of the human eye. As shown in the sketch, it is composed of two telescopic brass tubes of about four and a half centimeters in length, and two and a half centimeters in diameter, each. These are so made as to allow the smaller one

to slide into the other. At the far extremity of the anterior and larger tube, there is an adjustable cylinder-lens that can be made of any desired strength. This lens, which is one centimeter in diameter, is arranged in such a way that it can be rotated around a degree-index that is engraved upon the border of the circumference of the barrel. This index-register runs from zero to one hundred and eighty degrees. Just inside of the lens, in the tube, there is an accurately centred iris-diaphragm. This diaphragm, which is perforated, is connected to a graduated screw-head that is situated upon the outside of the barrel. The graduations upon the screw-head are gauged in such a manner that each index of movement represents an increase of one millimeter opening in the center of the diaphragm. More deeply situated in the tube there is a carefully-ground bi-convex lens of twenty diopters' strength. This lens represents the main focusing apparatus of the contrivance. Fastened to the anterior part of the underneath portion of the barrel, there is a sliding arrangement of heavy wire, which, with the small hook at the posterior part of the barrel, makes either a firm base upon which the contrivance can stand, or a means by which the apparatus may be suspended. The wire base is so gauged that when it extends to its greatest length out from the anterior face of the barrel, the distance measures about twelve millimeters.

The smaller tube has a double index running the greater part of its length upon its upper face. The indices starting from zero, run sequentially backwards to six along an "M" line, and forward to the same amount on an "H" line. To the back face of the tube, there is an arrangement by which an adjustable flat disc can be screwed into position. This disc contains a colored representation of the normal fundus-oculi engraved upon enameled paper.

This model, which has been made upon the principles involved in Queen's Student's Eye Demonstrator that was constructed upon suggestions made by Dr. William Thomson of this city, embraces more of the salient features of the human eye in the least possible compass, than any other form of similar contrivance.

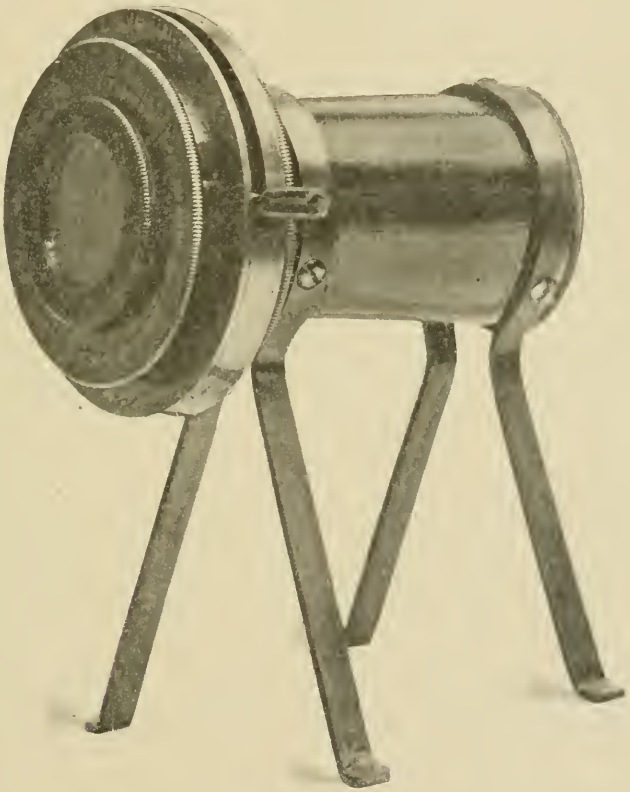
Starting with a focal distance of five centimeters, which is

marked upon the smaller tube as zero, emmetropia is reached. By gradually withdrawing the smaller tube, the exact equivalents of axial myopia are obtained; these being registered by the numbers upon the linear index that is engraved upon the tube. By slowly pushing the smaller tube into the larger one from the point of registry of emmetropia, increasing amounts of axial hypermetropia are gotten. If it be desired to study astigmatism, the cap containing the cylindrical lens can be adjusted to the face of the large tube, and any axis of least and greatest astigmatism of the strength of lens employed in the cap* can be easily obtained by revolving the cap around the graduated circle upon the circumference of the larger tube. To this astigmatism, supposing that it be studied while the fundus level is placed at the emmetropia mark, any degree of ametropia up to the full extent of the instrument-registration can be added; remembering that in the minus series, or those designative of near-sightedness, the strength of the cylinder-lens used must be subtracted from the amount of the degree of myopia that is registered.† Should desire be had to study the relative elevation and depression of localized areas in the background of the eye, as, for example, suppositional swelling of the optic nerve disc, as in reality is found in papillitis, or supposed cupping of the optic-nerve head, as is so often seen in glaucoma,—the observer's gaze can be limited to the varying appearances of the optic disc itself when the tubes are approximated to one another, and when they are separated to different degrees. Here, the amount of correction that is necessary with the ophthalmoscope to produce proper definition of the optic disc, or, in fact, any other part of the organ that can be so studied, while the smaller tube is slid backwards and forwards in the larger one, can be employed to designate the degree of change of antero-posterior position of the area under consideration from its supposed normal plane. In this study, it should always be remembered that when the tubes are approximated, the relative position of the disc, as compared with that where it is intended for emmetropia,

* In the ordinary model made for the writer, a convex cylinder of one diopter's strength has been used.

† Of course it must be understood that upon account of slight separation of the two lenses in the tube, there must be a variation from the exact equivalent expressed in the readings.

is equivalent to the projection of an object forward into the chambers of the eye, as in intra-ocular swellings. Further, it must be understood that when it becomes necessary to separate the tubes, the abnormal position is equivalent to the recession of the object in view, as, for instance, in pathological cuppings of the optic nerve-head.



In the ordinary model, the appearance of the supposed normal eye-ground is given. If desired, this picture can be used as the basis upon which any one, if an artist, can sketch and paint any variety of pathological change that may be wished. The student is thus enabled at a moment's notice to have a proper ophthalmoscopic representation under almost the same conditions as when they are studied in the living subject. The plan, therefore, if carefully tried, will give far better ideas of

the true nature of the ophthalmoscopic appearances of intra-ocular change than any other form of graphic reproduction. In reality, the technique becomes almost the same as when it is done with the patient, and the findings are rendered quite similar to those which have been sought to study. To offer additional difficulties in the work, and thus give much greater ability in after work, especially among old subjects, the pupillary opening can be diminished to extremely small areas, and the studies repeated under these circumstances.

Besides giving practice in the frequently repeated technique that is necessary to obtain any degree of expertness in the handling of the ophthalmoscope for the production of proper and adequate results in both of these plans, there remains a third and most important method of precision which can be practised with this little model of an eye. This, which is the ordinary fundus-reflex test, can be employed by either having the artificial eye placed upon some object that will bring it upon a level with the supposed eye of a patient, or suspended from some point so as to bring it to a convenient height for observation.

Practically, in all of these procedures, the method is the same as should be pursued were the artificial eye a living organ.

Mr. Edward B. Fox, of the firm of Queen & Co. of this city, has kindly undertaken the manufacture of the contrivance, and is now able to furnish any number of them at extremely low prices.

The instrument as here represented, will be modified, by having the iris diaphragm made smaller and the legs shortened.

CONCERNING MONOCULAR DIPLOPIA, WITH CASES.

BY G. E. DE SCHWEINITZ, M.D.,

PHILADELPHIA, PENN.

The following cases of monocular diplopia present certain features of interest to which I desire to call attention:

CASE I. S. W. S., male, aged 46, a wholesale liquor dealer, and resident of Philadelphia, was riding in an omnibus in May, 1889, when the vehicle was struck by a fast freight train. The coach contained twelve persons, two of whom were killed, one died three days later, and all of the others were injured. This patient was picked up unconscious, bleeding freely from a large scalp wound, and carried to a neighboring general hospital. The unconsciousness persisted for three days, and was followed by a condition of bewildered and confused intellection. This gave place to intense headache, general soreness of the trunk and limbs, and a sense of pressure in the head. Ever since the accident he has suffered from pain in the head, which is usually referred to a point beneath a scar on the forehead; he is easily perplexed, becomes puzzled when he attempts to work, can no longer keep his books, and frequently mistakes figures.

Examination, made Feb. 8, 1893, by Dr. F. X. Dercum, revealed the following points: There is a large scar, somewhat pigmented and irregular in outline, over the left frontal region, running obliquely, which appears to be attached to the subjacent structures. This scar is painful, and the skull in the immediate neighborhood is unusually sensitive to percussion. There are also a number of cicatrices about the face and chin. The muscles of the back are sensitive to pressure in the lumbar region on both sides. There is a painful spot on the left arm over the musculo-spiral nerve. The knee-jerks are + on each side; there is no ankle clonus. The dynamometer registers with the right hand 76; with the left hand 30. There is well-marked vertigo, although the patient has never fallen. He has tinnitus,

is "nervous," can bear no excitement, sleeps badly, and suffers from frequent micturition. After sitting still for a short time, his feet and hands become livid, cold, and moist. There is pronounced siderodromophobia. The rest of the functions of the body appear to be practically normal.

The eyes were examined on a number of occasions, with the following result: Vision and accommodation, with suitable correction, practically normal in each eye; pupillary reactions normal; fundus oculi negative, or, at least, no more haze in the retina than is commonly present in slightly ametropic eyes, the optic discs having a good color and the retinal circulation exhibiting no abnormality. There is slight insufficiency (two degrees) of the external recti muscles, but no paretic condition is demonstrable, and the excursion of the eyeballs is good in all directions, and the field of fixation normal. The fields of vision are not far from natural in extent; the red and blue lines run rather close together, but otherwise there is no change in the relation of the colors one to another.

The interesting symptom is the presence of diplopia, which is monocular, the double images being present when both eyes are open, or when either eye is excluded from the visual act. The true image is always vertical and the false image in front of it and inclined toward the left. The diplopia is present only for certain objects, for example, a point of light. If the patient is seated before a candle flame, and a red glass placed before the right eye, the left eye being excluded from vision, the diplopia appears, the real flame being behind the other. If the red glass is now changed to the left eye, and the right eye excluded from vision, diplopia again appears.

If both eyes are open, the red glass being before the left eye, three images appear, the real image being in the center and the false images on each side, the one on the left or on the same side as the red light being sharply marked, and the other one dim. The positions and relative distinctness of the two lights can be reversed by reversing the red glass. With a six-degree prism, base down, before the right eye, a red glass being before the left eye, there is vertical diplopia, the upper images being composed of the double candle flames in the position

which they assume when looked at with the right eye alone. The lower image is a single flame, red-colored. If now the right eye is excluded from vision, the upper image which belongs to it, namely, the double-candle flame, disappears, and the red flame, or that seen with the left eye, becomes doubled, the images assuming the same position as described when the left eye was tested alone.

At subsequent examinations, when the images were doubled by means of a vertical prism, and a red glass placed before the right eye and a blue glass before the left, there was, according to his description, a doubling of the appearances seen with each eye, or, in other words, four images, the upper ones being red and the lower ones blue. By changing the prism to the left eye, the red and the blue images were made to exchange places.

The patient brought suit against the railroad company, and was awarded large damages for his injuries. These examinations were made before the award of the damages by myself, by my assistant, and I think by Dr. H. C. Wood, although I am not quite sure that he accurately determined the character of the diplopia. Dr. Harlan also examined him, but considered the evidence of diplopia insufficient. The patient has been examined on several occasions since the award, the last time only a few weeks ago, and exactly the same state of affairs was apparently present.

The following testimony was given in regard to the ocular symptoms of this case: The eyes are practically normal in all respects, with the exception of monocular diplopia, which the plaintiff alleges is present when he looks with either eye, or with both eyes, at a point of light. This character of diplopia may be explained by one of several conditions: (1) By anomalies of refraction, particularly astigmatism; (2) by opacities in the cornea or lens; (3) by irregular cramp of the ciliary muscle; (4) by hysteria or allied functional nervous disturbance, for example, neurasthenia and cerebrasthenia; (5) by organic disease of the brain or its membranes; and (6) by simulation, the symptom being an invention of the patient for the purpose of magnifying the result of his injuries.

It was further testified (assuming the plaintiff was not a

malingerer) as the first three explanations, viz., astigmatism, opacities in the media and ciliary cramp, could be excluded, that the condition must have been due either to functional nervous disturbance, for example, hysteria or traumatic neurasthenia, or to organic brain disease. In either event, it was caused by the injury.

Inasmuch as the patient presented some signs of pachymeningitis, as well as the undoubted general symptoms of traumatic neurasthenia, and as there was no possible question in regard to the severity of his injuries, the scars of which were only too manifest, it seemed fair to assume that he had not invented this somewhat unusual symptom. Moreover, he was examined by several independent observers, and his answers were substantially consistent in so far as the existence of double vision was concerned, although it will be noted that his descriptions of the positions of the images, under the varying tests, did not always come in reconciliation with his claim of diplopia with each eye. Thus, with both eyes open, three, not four, images were described, and when a vertical prism was interposed, four, not six, images were seen.

Once more assuming that the patient was not a malingerer, the interesting question to decide in this case is whether the monocular diplopia was due to organic brain trouble or to that ill-defined condition which we describe under the name hysteria and the result of an auto-suggestion.

In many respects the case is similar to several others that have been recorded, notably one by Dr. J. H. Thompson,* which, after excluding other factors, he ascribed to hysteria. It will be remembered that there have been several cases of uniocular diplopia reported, associated with autopsy, and that Marcus Gunn and James Anderson,† after reporting a case of nerve disease with ocular symptoms, including alleged monocular diplopia, and referring to other cases of this disorder which have been published in the Transactions of the Ophthalmological Society of the United Kingdom, namely, those by Mr. Adams, Dr. Ord, and Dr. Abercrombie, exclude the case of Mr. Adams,

* Transactions of the Ophthalmological Section of the American Medical Association, Washington, 1891, p. 217.

† Transactions of the Ophthalmological Society of the United Kingdom, Vol. IV, p. 292.

which they believe to be spurious, and describe especially Dr. Ord's second case and Dr. Abercrombie's, in both of which there was an autopsy. Three points are emphasized, namely, that in their own cases, and in those of Dr. Ord and Dr. Abercrombie, there was also present abducens paralysis; that the uniocular diplopia disappeared in two of the cases with the disappearance of the abducens paralysis, suggesting that both phenomena might be due to a common central cause; and, finally, they point out the presence of coarse cerebral disease in two of the cases where there had been a post-mortem examination. We know that in three autopsies the chief lesion was found in the right cerebral hemisphere, involving its posterior part, and that one of them was situated in the cerebellum.

Duret and Dujardin* have described monocular diplopia in a case of injury to the skull without ocular lesions, and suggest disturbance in the left visual center as the explanation of the phenomenon. Tilley,† who has recorded some very interesting examples of this condition and refers to those in literature, accepts Fontan's explanation that impressions received by each eye are transmitted respectively to the right and left hemispheres, and that in normal conditions these impressions are fused by communicating nerve fibres. When these communicating nerve fibres, however, are disturbed, double monocular vision occurs.

An interesting case of monocular diplopia described by Bonveret and Chapoto‡ had incomplete left hemiplegia involving slightly the lower limb and arm. There was slight ptosis of the right upper eyelid, on the left side paralysis of the sixth and third nerves, and on the left side also diplopia, which did not exist to the right side. There was beginning optic neuritis in both eyes. At the autopsy, amongst other lesions, tuberculous tumors of the peduncles were discovered, and the authors believed that the diplopia was of nuclear origin due to these tumors. It will be noted that here, again, there was sixth nerve involvement.

* Jour. des Science med. de Lille, 1892, No. 2.

† Transactions of the Ophthalmological Section of the American Medical Association, Detroit, 1892, p. 277.

‡ Revue de med., 1892, XII, p. 28.

Other cases might be cited to show the lesions which have been found in cases of uniocular diplopia and the explanations which have been given.

The present instance affords no evidence which with certainty establishes the cause of the condition; in fact, the possibility of simulation could not be perfectly excluded, although the evidence is in favor of ascribing it to the results of a traumatic hysteria.

The second case of monocular diplopia to which I would refer occurred in the wards of the Philadelphia Hospital, and has been chiefly under the care of Dr. James Hendrie Lloyd, to whom I am indebted for permission to use it. The patient was a woman, aged 44, with a tuberculous family history; her habits were bad; she was accustomed to drink to excess, and four years ago had a fit in the street, and two years after a similar one, for which no definite cause was found. At the present time the gait is spastic, the toes scarcely lifted from the floor, and she is unable to walk without the help of a cane. There is resistance to flexion at the knees, but no interference with voluntary flexion or extension, but these are followed by clonus of the leg; the knee-jerk is much exaggerated and the plantar reflexes are active. There is diminished tactile sensibility over the trunk and lower extremities, and also on the right side of the face and arms. There is no analgesia and no thermo-anæsthesia.

Her eyes have been examined on a number of occasions by myself, recently only a few weeks ago. The light reflexes of both pupils are normal. The vision is very imperfect, amounting to about one-twentieth of normal, or even less.

In the right eye the disc is a vertical oval, pale, the arteries about normal in size, a small patch of lymph lies on the anterior capsule of the lens, and there is a history of former iritis. There is a hypermetropic astigmatism of 2D., and in the macula a few small yellowish spots resembling colloid change.

In the left eye the disc is a vertical oval, of atrophic pallor, with marked diminution in the size of the retinal arteries, and the macula is occupied by a large patch of atrophic choroiditis. Both visual fields are contracted to a considerable extent and

there is partial reversal of the red and blue lines. The patient alleges monocular diplopia, which, when I examined her, was noticed with the left eye particularly, the images being superimposed, very much in the same position as they would have been had paralysis of the superior rectus existed. At the present time the patient still claims this double vision at times; at other times, however, asserts that the images no longer exist.

Clinically, this is a case of spastic paraplegia of probable organic origin, associated with marked hysterical stigmata, especially in the form of islands of anæsthesia, and hence the diplopia may be attributed to the latter condition. It is very intereresting to observe, however, that the two important factors in the eye itself which may be responsible for this condition, namely, astigmatism and opacities in the transparent media, are present.

DISLOCATION OF BOTH CRYSTALLINE LENSES.

BY C. F. CLARK, M.D.,

COLUMBUS, OHIO.

The following is a case of congenital enlargement of the corneæ without the usual corresponding change in the sclerotic, in which the lenses, dislocated into the vitreous, have fallen forward into the anterior chamber at frequent intervals during a period of five years.

I report it here, not as a clinical curiosity, but because its course during these five years has been instructive and throws some light upon the prognosis in such cases.

On February 14, 1889, Nellie S., aged 5, was brought to me from a neighboring town by her physician, Dr. Pritchard.

The family history was negative. For some three or four weeks her eyes had seemed to be a source of discomfort and she had shown a constant tendency to rub them.

Five days before coming, her father noticed a "grayish" mass which he described as like a "drop of fat," lying in the lower part of the anterior chamber of the right eye.

On coming to the city in the train she vomited without apparent cause, unless it be the motion of the train, and on bringing her in for examination, the "drop of fat" had disappeared. There was slight corneal dullness due evidently to some form of irritation.

On inspection the first impression was that I was dealing with a case of ordinary buphthalmus.

The corneæ were greatly enlarged, the irides and the whole of the anterior chambers, while symmetrical in form, seemed to belong to eyes at least one and one-half times the size proper to the adult. The palpebral fissures were not correspondingly large, and it was soon discovered that we had to deal with a case in which a cornea 16 mm. in diameter was grafted upon a sclerotic of about the size usually found in a child of five years.

The effect upon the expression, while differing from that of buphthalmos, was peculiar and quite startling.

The ciliary region was free from injection and there was none of the sclerectasia so often found in enlarged eyes, but there was a uniform bluish shade of the sclera which suggested that condition.

While the aqueous chambers were large and deep they seemed symmetrical and I could see no evidence of the thinning and stretching which we so often see in cases of that class.

The irides were steel-gray, somewhat faded toward the periphery, and while they trembled with every motion of the eyes, the pupils were normal in size and responded actively to light.

The aqueous and vitreous were clear and the fundus seemed normal, but presented the appearance usual in aphakial eyes. The child was quite healthy and in other respects apparently normal, but, owing to extreme restlessness, it was difficult to obtain a satisfactory view of all parts of the fundus. She had not learned the alphabet, but could count fingers at six to seven feet, seeming to do better with a strong convex glass.

Homatropine was instilled, and upon re-examining her the right lens was found lying in the lower portion of the anterior chamber.

It was transparent, but not so large as is usually found in a

child of five years, and appeared very small by contrast with the large cornea.

On placing the patient in the supine position the lens quickly slipped back into the vitreous chamber, and it was found that it could be brought out at will by leaning the head well forward. Though the discs seemed normal and no evidence of glaucoma was apparent, an unfavorable prognosis was given, but it was decided to defer operative interference until her case could be observed for a short time.

Convex lenses, of first four, and later eight dioptries were prescribed and a weak solution of eserine was given to contract the pupils and prevent the lenses from coming forward, as that produced some irritation, and the eyes seemed to do well while the lenses were in the vitreous chamber.

Under this treatment the patient became comfortable, the eyes clear, and the lenses came forward less frequently, though it became necessary to use a drop of gr. ii — f. oz. i solution of eserine twice daily to prevent it for some weeks until the little girl learned how to replace them herself.

She would go into some dark place and throw her face upward, and if not successful, would lie down on her back until the lens slipped through the pupil.

The parents were naturally averse to an operation of so serious a nature as the extraction of a dislocated lens so long as the child was doing well, and when, after several months had elapsed, I found the eyes continuing quiet and free from all evidence of deterioration, I advised that she be kept under close observation and brought to me from time to time that I might act promptly in the event of glaucomatous symptoms appearing.

Instead of deterioration, I found on the occasions when she was brought to me for examination, a marked improvement both in the child and her eyes. On June 8, 1891, two years and four months after her first visit, I find notes in my case-book to the following effect:

The eyes have been comfortable and free from inflammation. She now goes to school, and, being a naturally bright child, makes fair progress in her studies with charts and slate.

The nystagmus (which, though never excessive, had at first

seriously interfered with her examination,) has now almost entirely ceased.

The lenses come out sometimes as often as two or three times a day, but she restores them at once without difficulty, making no complaint when they are in the anterior chambers, further than that she sees a shadow before her eyes.

All portions of the fundus that could be seen were normal. In the right eye a good view of the disc was obtained, and it was normal. Restlessness prevented a thorough inspection of the left.

Vision. R. E. + 6. sph. = 4/36.
L. E. + 6. " = 4/36.

A curious feature of her case at this time was a persistent tendency to invert every book or picture presented to her when carefully inspecting it. This, her mother states, has been the case for a long time.

Eight months later, and three years after her first visit, she again returned with a similar report, but marked improvement in vision. She was now able to read in the first reader.

Vision. R. E. + 8. sph. = 4/24.
L. E. + 6. " = 4/26.

The right eye with + 14. sph. D. read J. 2 at 5″ — 6″ and a part of J. 1.

By oblique illumination the lens was seen lying in the lower portion of the vitreous chamber, and the ophthalmoscope revealed an apparently normal fundus in each eye.

At this point I find the following remark in my case-book: "Had I operated successfully I would probably have attributed the present marked improvement to the result of the operation."

For two years and two months, notwithstanding my urgent advice that her eyes be kept under close observation, I saw nothing of my interesting case.

In spite of my explanations the parents seemed not to appreciate the gravity of the situation, and on April 18, 1894, sent her to me with the statement that the vision of the left eye had been steadily failing for some six or eight months, and to my chagrin I discovered that, without pain or apparent discomfort,

an insiduous glaucomatous process was doing at last what I had feared at first.

Vision. R. E. Counts fingers at 3′ — 4′ with + 6. sph. = 4/60.
L. E. " " " 3′ unimproved.

R. E. with + 14 sph. reads J. 4. at 7″ with difficulty.

Javal's ophthalmometer reveals:

R. E. 2.5 D. axis 105°.

L. E. 1. D. " 90°.

But adding this to the spherical correction makes no improvement in the vision.

The discs were pale, with marked glaucomatous cupping, and the tension was, in the right eye: + 1., and in the left eye: + 2.

For four years, while these lenses lay in the vitreous, presumably pressing upon the ciliary bodies, the eyes continued to do well, and for more than half that time certainly improved.

Is it possible that the same process which originally caused the enlargement of the cornea and weakened the suspensory ligament of the lens may be acting as an important element in inducing glaucoma at this time, and does clinical experience justify us in stating positively that the removal of this lens would have prevented the present unfortunate result?

I am of the opinion that in an early operation lies our only safety in all cases of dislocation of the lens into the vitreous, and while I blame the parents for not obeying the instructions I gave them, for not yielding to my first impulse to remove from these eyes, when the opportunity was afforded me, this source of irritation so sure in the end to work mischief, I also blame myself.

One significant feature of this case, possibly bearing on the relation of the lens when *in situ* to glaucoma, but certainly not in keeping with the classical theory of that disease, is the fact that the periphery of the iris was not pressed forward into the filtration angle, and that, with pronounced cupping of the discs and tension from + 1. to + 2., the pupils responded actively to light stimulus.

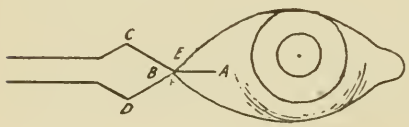
A MODIFICATION OF THE OPERATION FOR CANTHOPLASTY.

BY C. F. CLARK, M.D.,

COLUMBUS, OHIO.

There are many cases of entropion and blepharophimosis which, owing to neglect, have become so desperate as to defy every effort made to restore the lids to their proper position, and, in my own experience at least, there has occasionally been a case in which the usual operation for canthoplasty has proven a dismal failure.

Thorough division of the palpebral ligaments and careful approximation and suturing of the conjunctiva to the skin is at



times rewarded only by a degree of cicatricial contraction which seems to render the patient's condition worse than before the operation.

A case of entropion of high degree, with narrowing of the palpebral fissure following many years of neglect of trachoma, reported to me some months ago at St. Francis Hospital. She had been operated upon for entropion some ten years before in Canada, but had had little treatment since that time.

The left eye was extremely defective, owing to pannus, while the right was practically useless, having only light perception. She was subjected to the usual treatment for trachoma, and, after a few weeks, I operated upon the upper and lower lids of one eye, doing an entropion operation and a canthoplasty at the same time. This was followed in a short time by a similar operation upon the other eye.

I was rewarded by great improvement of vision in the left and permanent restoration of the ciliary margins to a position

no longer menacing the corneæ in both eyes, with the exception of a portion of the upper lid of the right.

Here the lashes again turned in, and after a few weeks it became apparent that, in spite of the fact that no granulation tissue had appeared, the cicatricial contraction at the outer canthus was sufficient to render her condition at this point as bad as before.

While the conjunctiva was possibly sufficiently lax to have allowed me to repeat the usual operation, it occurred to me that much more would be gained for the patient if instead of sacrificing a part of the already scant inter-palpebral membrane, I could add to it. I therefore undertook to transplant a spear-head shaped flap of integument from the temple to fill the gap created by division at the external canthus.

The inter-tarsal ligament and the tarsal ligaments were divided, as was also the conjunctiva from the external canthus inward for a distance of about six to eight millimeters.

From the outer extremity of this incision, that is, from the junction of conjunctiva with skin at the external canthus, two incisions six to seven mm. long were made in the skin at an angle of about eighty degrees with one another. At their outer extremities they were turned at an angle and continued in curved lines for about twelve mm. to complete the figure of a spear-head, the shaft of which consisted of a strip of skin about three mm. wide. (See Figure.)

After carefully dissecting up this thin spear-head shaped flap, it was found to be an easy matter to slide it forward and attach its apex (B) to the inner extremity of the conjunctival incision (A) and its angles (C and D) to the extremities of the palpebral margins (E and F).

Two additional sutures at the points occupied by the angles (C and D), uniting these points to the narrow portion of the flap at the neck of the spear-head, gave security against retraction by contraction of the flap in its long axis.

After doing, in addition to the above, an entropion operation on the upper lid, I applied an antiseptic dressing, which was renewed after two or three days.

The wound healed without accident, and, instead of a trifling

advantage such as so frequently follows the usual operation when the conjunctiva begins to shrink as it assumes the character of skin, I was gratified, after many weeks, to find the result excellent. The eye gradually cleared, and vision was soon sufficient to allow the patient to go about the ward by the aid of this eye alone.

An advantage of this operation that is well worth considering is the absence of the unsightly break in the continuity of the palpebral edges so often seen where sufficient effect has been obtained by the old method.

In reviewing to some extent the literature of the subject, I had the usual fate of would-be devisers of new operations and found that others had attempted to obtain relief for blepharophimosis in a manner very similar to that which I have described. There were, however, some essential differences.

The operation which most nearly resembled the one suggested was one devised by Kuhnt. He brought the flap from the upper lid and avoided the necessity of suturing to the membrane by inserting its point beneath the conjunctiva.

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*Dr. P. N. K. Schwenk,	827 North 7th Street,	Philadelphia, Pa.
Dr. W. W. Seeley,	S. E. cor. 4th St. & B'dway,	Cincinnati, Ohio.
Dr. Henry L. Shaw,	431 Boylston Street,	Boston, Mass.
Dr. J. A. Spalding,	627 Congress Street,	Portland, Me.
Dr. Francis P. Sprague,	229 Commonwealth Ave.,	Boston, Mass.
Dr. Myles Standish,	200 Dartmouth Street,	Boston, Mass.
Dr. George T. Stevens,	33 West 33d Street,	New York, N. Y.
Dr. Samuel B. St. John,	26 Pratt Street,	Hartford, Conn.
Dr. Geo. Strawbridge,	1500 Walnut Street,	Philadelphia, Pa.
Dr. T. Y. Sutphen,	999 Broad Street,	Newark, N. J.
Dr. J. Oscroft Tansley,	28 West 43d Street,	New York, N. Y.
Dr. Lewis H. Taylor,	41 South Franklin Street,	Wilkes Barre, Pa.
Dr. Samuel Theobald,	304 West Monument St.,	Baltimore, Md.
Dr. Ch. Hermon Thomas,	1807 Chestnut Street,	Philadelphia, Pa.
Dr. William Thomson,	1426 Walnut Street,	Philadelphia, Pa.
Dr. John Van Duyn,	111 South Salina Street,	Syracuse, N. Y.
Dr. J. J. B. Vermyne,	2 Orchard Street,	New Bedford, Mass.
Dr. O. F. Wadsworth,	526 Beacon Street,	Boston, Mass.
Dr. Leroy P. Walker,	25 East 24th Street,	New York, N. Y.
Dr. James Wallace,	121 North 16th Street,	Philadelphia, Pa.
Dr. David Webster,	327 Madison Avenue,	New York, N. Y.
Dr. J. E. Weeks,	154 Madison Avenue,	New York, N. Y.
Dr J. A. White,	200 E. Franklin Street,	Richmond, Va.
*Dr. W. H. Wilder,	103 State Street,	Chicago, Ill.
Dr. Chas. H. Williams,	15 Arlington Street,	Boston, Mass.
Dr. Wm. H. Wilmer,	1330 N. York Ave., N. W.,	Washington, D. C.
Dr. F. M. Wilson,	317 State Street,	Bridgeport, Conn.
Dr. J. P. Worrell,	20 South Seventh Street,	Terre Haute, Ind.
Total, ...		134.

HONORARY MEMBER

Dr. C. Schweigger, ...	Berlin, Prussia.
Whole Number, ...	135.

MINUTES OF THE PROCEEDINGS.

THIRTY-FIRST ANNUAL MEETING.

PEQUOT HOUSE,
NEW LONDON, July 17, 1895.

The Thirty-first Annual Meeting of the Society was called to order by the President, Dr. G. C. HARLAN, at 10.15 A. M. The President announced the following committees:

Committee on Bulletin — Drs. S. D. RISLEY and L. HOWE.

Committee on Membership — Drs. JOHN GREEN, C. S. BULL, ARTHUR MATHEWSON, SAMUEL THEOBALD, and W. H. CARMALT.

Auditing Committee — Dr. H. G. MILLER.

After a short executive session the Committee on Bulletin reported, and the following papers were read:

1. "The Final Results in the Operative Treatment of Convergent Squint," by Dr. C. S. Bull. Discussed by Drs. Theobald, Lippincott, Bull, Carmalt, and Norris.

Drs. H. W. Ring and Alling of New Haven; Adams of Newburgh and Peck of Norwich were invited to seats as guests of the Society.

2. "Amblyopia ex Anopsia," Dr. W. B. Johnson. Discussed by Drs. H. D. Noyes, Mittendorf, Theobald, Howe, Wadsworth, Risley, and Johnson.

3. "Recurrent Oculo-motor Palsy," by Dr. G. E. de Schweinitz.

4. "Oyster-Shucker's Keratitis," by Dr. R. L. Randolph. Discussed by Drs. Theobald, H. D. Noyes, Dennett, Carmalt, and Miller.

5. "Note on the Variations in the Power and in the Astigmatism of thin Spherical, Toric, and Cylindrical Lenses, in principal cases of Oblique Centrical Refraction," by Dr. Jno. Green. Discussed by Drs. H. D. Noyes, Mittendorf, Dennett, Williams, Wadsworth, and Green.

6. "Four thousand cases of Ocular Headache, and the different states of Refraction connected therewith," by Dr W. F. Mittendorf. Discussed by Dr. H. D. Noyes, Mittendorf, Sutphen, Buller, Capron, and Theobald.

7. "A Novel Way of Wearing an Artificial Eye," by Dr. S. Theobald.

Adjourned to 2.30 P. M.

Afternoon session called to order at 2.30.

Reading of papers resumed.

8. "The Terminal Loops of the Rods and Cones of the Human Retina with illustrative photo-micrographs," by Dr. W. F. Norris. Discussed by Drs. Weeks, Norris, and Wadsworth.

9. "Spontaneous Rupture of the Choroid," by Dr. A. G. Heyl.

10. "Albuminoid Deposit in Retina and Optic Nerve," by Dr. A. G. Heyl.

11. "A Trifle in Reading-Glasses," by Dr. W. S. Dennett.

12. "The specific effect of Strychnia upon the Internal Recti muscles," by Dr. H. S. Oppenheimer. Discussed by Drs. Risley, Howe, Harrower, and Oppenheimer.

13. "Small Cavernous Angioma of the Conjunctiva," by Dr. J. A. Lippincott.

14. "A case of early diagnosis of Choroidal Sarcoma," by Dr. F. Buller. Discussed by Drs. H. D. Noyes, Norris, Reeve, Wadsworth, Fryer, Randolph, Green, St. John, Lippincott, Cheatham, Bull, and Buller.

15. "Adenoma of Meibomian Gland," by Dr. O. F. Wadsworth.

16. "Traumatic Enophthalmos (with case)," by Dr. G. E. de Schweinitz.

17. "Ivory Exostosis of Frontal Sinus," by Dr. R. A. Reeve.

18. "Eye-symptoms in four cases of Myxoedema," by Dr. P. A. Callan. Discussed by Dr. Wadsworth.

19. "Clinical and Microscopical report of two cases of Tumor of the Iris," by Dr. H. F. Hansell.

20. "Trauma of Orbit with Exophthalmos, recovery without operation," by Dr. B. E. Fryer.

21. "Discission of Capsule after Cataract Extraction," by Dr. J. E. Weeks.

22. "A third Table of 10,000 Cataract Extractions," by Dr. F. M. Wilson.

These two papers discussed by Drs. Cheatham, H. D. Noyes, Risley, Fryer, Williams, and Weeks.

23. "Note on experimental Salicylic Acid Amblyopia," by Dr. G. E. de Schweinitz.

24. "Salicylate of Soda in Glaucoma," by Dr. T. Y. Sutphen. Discussed by Drs. Mittendorf and Risley.

25. "Sudden loss of sight in one eye following enucleation of the other for Absolute Glaucoma," by Dr. J. A. Lippincott.

26. "A case of Recurrent Hemorrhage in the Vitreous in a youth, ending in recovery," by Dr. C. J. Kipp.

Adjourned to meet in executive session at 8 P. M.

Society met at executive session at 8 P. M.

Amendments to the Constitution and By-Laws proposed at the morning session were adopted. Treasurer's report received, and ordered on file upon report of auditing committee that the vouchers showed it to be correct.

Voted, That assessment of $5.00 be laid for the ensuing year.

The following gentlemen were proposed by the Committee on Membership, and were all elected: Dr. E. E. JACK of Boston; Dr. H W. RING of New Haven; Dr. A. A. HUBBELL of Buffalo; Dr. WM. E. COWEN of New York; Dr. J. B. GIBSON of Colorado Springs; Dr. W. H. WILDER of Chicago; Dr. H. R. PRICE of Brooklyn; Dr. P. N. K. SCHWENK of Philadelphia; Dr. R. J. PHILLIPS of Philadelphia; Dr. G. M. GOULD of Philadelphia; Dr. WM. D. HALL of Boston.

The death of H. W. Williams of Boston was announced, and on motion of Dr. Green it was voted that the President be instructed to select a member to prepare a memorial for publication, and that a portrait be printed with the memorial in our TRANSACTIONS. (The President subsequently selected Dr. Jno. Green as the memorialist.) After brief remarks, eulogistic of Dr. Williams, the executive session adjourned.

July 18th. Society called to order at 10 A. M. Reading of papers resumed.

27. "Two cases of Congenital Entropion of both upper Lids with deficiency of Tarsal Cartilages," by Dr. G. C. Harlan. Discussed by Drs. de Schweinitz and Lippincott.

28. "A Case of Congenital Ptosis and Operation," by Dr. J. O. Tansley. Discussed by Drs. H. D. Noyes, St. John, Howe, Harlan, Theobald, Johnson, Reeve, and Wadsworth.

29. "Demonstration of Sections of Eyes of Rodents," by Dr. L. Howe. Discussed by Drs. Green, Risley, Dennett, and Williams.

30. "Seven cases of removal of pieces of metal from Vitreous by Electro-magnet," by Dr. E. E. Holt.

31. "Vaso-motor Ataxia simulating Graves' Disease," by Dr. S. D. Risley. Discussed by Dr. de Schweinitz.

32. "An Act for the Prevention of Blindness in New Jersey," by Dr. W. B. Johnson. Discussed by Drs. Howe, Green, St. John, and H. D. Noyes.

33. "A Modified Photometer," by Dr. C. H. Williams. Discussed by Drs. Dennett, Green, Williams, and Wadsworth.

34. "An Interesting Case of Iritis," by Dr. J. O. Tansley.

35. "Two cases of Cataract Operation in High Myopia with Hemorrhage," by Dr. H. D. Noyes.

36, "Severe Keratitis produced by the Forceps during instrumental Delivery," by Dr. H. D. Noyes.

37. "Report on Worsteds for Holmgren's Test," by Dr. B. J. Jeffries.

Adjourned.

S. B. ST. JOHN, *Secretary.*

Members present at the thirty-first annual meeting :

Dr. Wm. F. Aiken,
Dr. William T. Bacon,
Dr. Charles S. Bull,
Dr. F. Buller,
Dr. Peter A. Callan,
Dr. F. P. Capron,
Dr. W. H. Carmalt,
Dr. Wm. Cheatham,
Dr. David Coggin,
Dr. C. M. Culver,
Dr. W. S. Dennett,
Dr. Edw. Friedenberg,
Dr. H. Friedenwald,
Dr. B. E. Fryer,
Dr. John Green,
Dr. H. F. Hansell,
Dr. George C. Harlan,
Dr. David Harrower,
Dr. Albert G. Heyl,
Dr. E. E. Holt,
Dr. Lucien Howe,
Dr. D. W. Hunter,
Dr. W. B. Johnson,
Dr. Charles J. Kipp,
Dr. Richmond Lennox,
Dr. J. A. Lippincott,
Dr. Arthur Mathewson,
Dr. H. G. Miller,
Dr. W. F. Mittendorf,
Dr. William O. Moore,
Dr. William F. Norris,
Dr. Henry D. Noyes,
Dr. J. F. Noyes,
Dr. H. S. Oppenheimer,
Dr. J. S. Prout,
Dr. R. L. Randolph,
Dr. R. A. Reeve,
Dr. Frank W. Ring,
Dr. Samuel D. Risley,
Dr. G. E. de Schweinitz.
Dr. Myles Standish,
Dr. Samuel B. St. John,
Dr. T. Y. Sutphen,
Dr. J. Oscroft Tansley,
Dr. Samuel Theobald,
Dr. William Thomson,
Dr. J. J. B. Vermyne,
Dr. O. F. Wadsworth,
Dr. J. E. Weeks,
Dr. Charles H. Williams,
Dr. F. M. Wilson.

PRELIMINARY REPORT ON SIX HUNDRED AND TWELVE CASES OF CONVERGENT SQUINT, WITH THE FINAL RESULTS OF OPERATION.

BY CHARLES STEDMAN BULL, M.D.,

OF NEW YORK.

Carefully tabulated statistical reports of the results of operations, undertaken for the cure or improvement of convergent squint, have formed but little part of the ophthalmic literature of the last fifty years; and this fact has produced in the minds of the profession at large, and especially in the minds of some ophthalmologists, the feeling that the operation of tenotomy for the cure of squint is of doubtful value in many cases. The absence of useful, working statistics on this point has no doubt been largely due to the fact that it is extremely difficult to follow out these cases for a sufficiently long time after the operation, because the patients are so easily lost sight of, especially if they be hospital cases, and if the first operation has proved only partially successful.

The feeling that operative procedures for the cure of squint are of doubtful value in many cases arises largely from the discrepancy in our ideas as to what constitutes a "cure" of convergent squint. If by "cure" is meant merely the removal of all visible disfigurement, with apparent restoration of parallel axes of the eyes, then the results of operation should be deemed very satisfactory. But if something more is meant, and we understand by the word "cure," not only the apparent restoration of parallel axes, but the improvement of vision in the squinting eye, the establishment of binocular vision, and the ability of the patient to use the eyes for all purposes, except close work, without correcting glasses, then our ideas of the value of tenotomy must be materially modified.

So wide is the difference of opinion among ophthalmologists as to the existing conditions in squint, the value of operative interference, and the nature of the operation which is to be

done, that the writer has long held the view that the whole subject of strabismus is the least understood by modern ophthalmologists in the whole domain of ophthalmic science. We need but to glance over our text-books and the contents of our journals to be readily convinced of the truth of this statement. Leaving entirely out of consideration the different views that are held as to the nature and causation of squint, there are many of our colleagues who question the wisdom of operating in early childhood, while others hold that in many instances no operation is necessary.

It is not the intention of the writer of this paper to enter into a discussion of the general subject of squint. The paper is intended to be merely a preliminary report on the effects of operative interference upon the condition of abnormal convergence of one or both eyes, including such other statistical details as may be necessary for a proper appreciation of the results obtained.

The entire number of 612 cases occurred in the private and hospital practice of the writer, and all the cases were carefully followed up and watched for a length of time varying from six months to ten years. All examinations of the refractive and muscular conditions of these cases, all the various operations, and all subsequent observations, were made by the writer himself. A much larger number of cases have been examined and operated than the six hundred and twelve here considered, but they could not be followed with any accuracy for a longer period than a few weeks, and hence they have formed no part in these statistics. Whatever conclusions may be drawn from these statistics must, therefore, be based solely on the six hundred and twelve cases here tabulated.

No case under six (6) years of age has been included, owing to the difficulty of testing the refraction and of obtaining anything like an accurate idea as to the existing acuity of vision in very young patients.

In all cases of equal or approximately equal refraction, full correction by glasses was ordered immediately after the operation, and these glasses the patients were directed to wear constantly for a varying length of time. The faithfulness with which these directions were carried out varied with the fre-

quency with which the patients were subsequently seen, and the length of time they were under observation. When the refraction differed markedly in the two eyes, full correction for the non-squinting and partial correction for the squinting eye was ordered, and in some instances the strength of the latter glass was increased as time elapsed.

The cases were about equally divided between the sexes, there being 304 males and 308 females.

The refraction was, in the great majority of instances, hypermetropic, these statistics agreeing on this point with all previous statistics hitherto published. The refractive condition of the 612 cases was as follows:

Simple hypermetropia, 521 cases.
Simple hypermetropic astigmatism, 24 cases.
Compound hypermetropic astigmatism, 34 cases.
Simple myopia, 13 cases.
Simple myopic astigmatism, 3 cases.
Compound myopic astigmatism, 2 cases.
Emmetropia, 15 cases.

There were 57 cases of anisometropia and 2 cases of antimetropia.

The 15 cases of emmetropia were so regarded because, while under the influence of atropine, the vision for 20 feet was made perceptibly worse by a glass of +D 0.50, whether spherical or cylindrical.

A study of the tables showing the degree of refraction in each case gives some interesting data.

The 579 cases of hypermetropic refraction were divided as follows:

Under D 1, in one or both eyes, 27 cases.
Between D 1 and D 2, in one or both eyes, 205 cases.
" D 2 and D 3, " " 147 "
" D 3 and D 4, " " 95 "
" D 4 and D 5, " " 76 "
" D 5 and D 6, " " 51 "
" D 6 and D 7, " " 20 "
" D 7 and D 8, " " 5 "
" D 9 and D 10, " " 1 case.

Over D 10, in one or both eyes, 2 cases.

The cases of myopic refraction varied between D 0.50 and D 9.

Amblyopia, or defective visual acuity, was a very marked feature in the squinting eye, as might have been expected; but a study of the tables shows also a more or less decided subnormal acuity of vision in the fellow eye. The tables also show a by no means inconsiderable number of cases in which there was no loss of visual acuity in either eye.

There was defective vision in the squinting eye in 236 cases, or about 37 per cent.

There was defective vision in both eyes in 291 cases, or about 48 per cent.

There was no amblyopia in either eye in 85 cases, or about 15 per cent.

The tests for vision were made first without the use of atropia, and subsequently the accommodation was paralyzed and the tests repeated in all cases, except where the age of the patient rendered it unnecessary.

The operative procedures employed in the treatment of these cases consisted of simple tenotomy of one internal rectus; tenotomy of the internal rectus of each eye at different periods; simultaneous tenotomy of both internal recti; tenotomy of the internal rectus of one eye and advancement of the external rectus of the same eye; tenotomy of the internal recti of both eyes and advancement of the external rectus of the squinting eye; and simultaneous tenotomy of the internal recti of both eyes, followed at a varying length of time by a second tenotomy of the internal rectus of the squinting eye.

Simple tenotomy of the right internal rectus was done in 72 cases.

Simple tenotomy of the left internal rectus was done in 92 cases.

Tenotomy of both internal recti at different periods was done in 186 cases.

Simultaneous tenotomy of the internal rectus of both eyes was done in 20 cases.

Tenotomy of the right internal rectus and advancement of the right external rectus was done in 91 cases.

Tenotomy of the left internal rectus and advancement of the left external rectus was done in 131 cases.

Tenotomy of both internal recti and advancement of the external rectus of the squinting eye was done in 14 cases.

Simultaneous tenotomy of the internal rectus of both eyes, and subsequent tenotomy of the internal rectus of the squinting eye, was done in 6 cases.

The results of the various operations upon the degree of squint was as follows:

Simple tenotomy of the internal rectus of one eye was done in 164 cases. The final result was:

Convergence in 102 cases, or about 62 per cent.

Parallelism in 55 cases, or about $33\frac{1}{3}$ per cent.

Divergence in 7 cases, or about 4 per cent.

In all cases of resulting convergence, the degree was much less than before the operation. No second operation in any one of these 102 cases was permitted.

Tenotomy of the internal rectus of both eyes at different periods was done in 186 cases. The final result was:

Convergence in 144 cases, or about 78 per cent.

Parallelism in 33 cases, or about 17 per cent.

Divergence in 9 cases, or about 5 per cent.

Simultaneous tenotomy of the internal rectus of both eyes was done in 20 cases. The final result was:

Convergence in 13 cases, or about 66 per cent.

Parallelism in 1 case, or about 5 per cent.

Divergence in 6 cases, or about 30 per cent.

Tenotomy of the internal rectus and advancement of the external rectus of the squinting eye was done in 222 cases. The final result was:

Convergence in 38 cases, or about 16 per cent.

Parallelism in 178 cases, or about 80 per cent.

Divergence in 6 cases, or about 2 4-5 per cent.

Tenotomy of the internal rectus of both eyes and advance-

ment of the external rectus of the squinting eye was done in 14 cases. The final result was:

Convergence in 3 cases, or about 21 per cent.
Parallelism in 9 cases, or about 60 per cent.
Divergence in 2 cases, or about 14 2-7 per cent.

Tenotomy of the internal recti of both eyes and subsequent tenotomy again of the internal rectus of the squinting eye was done in 6 cases. The final result was:

Convergence in 3 cases, or 50 per cent.
Parallelism in 1 case, or about $16\frac{2}{3}$ per cent.
Divergence in 2 cases, or about $33\frac{1}{3}$ per cent.

The general percentage of final results was as follows:
Whole number of cases operated, 612.
Resulting, *convergence* in 307 cases, or about 50 per cent.
" *parallelism* in 277 cases, or about 45 per cent.
" *divergence* in 32 cases, or about 5 per cent.

In all cases in which convergence was the final result, the degree of convergence was decidedly less than that of the original defect.

A few words, now, in regard to the question of the supposed improvement in vision of the squinting eye.

There was an improvement in the visual acuity of the squinting eye alone, after the operation, in 7 cases.

There was an improvement in the vision of the fellow eye alone in 65 cases

There was an improvement in the vision of both eyes in 14 cases.

A somewhat careful study of these cases has led me to the conclusion that the instances of improvement in the visual acuity were undoubted, but that while occurring *after the operation*, they could not be considered as *due to the operation*, but rather to the stimulating, beneficial effect induced by wearing the full correction of the refractive error.

Complications. A number of the cases were complicated by other lesions, the existence of which may have had some influ-

ence upon the final result after operation. There were 30 cases in which there was more or less marked loss of power in the external rectus. In six (6) of these cases the paresis of the muscle was due to diphtheria, and in four (4) cases to falls upon the head. There were nine (9) cases of more or less marked blepharitis or blepharo-adenitis, all of which recovered after the operation and fitting with correcting glasses. There were two (2) cases of strabismus sursum vergens associated with the convergent squint, and in both the upward deviation disappeared after the operation.

There were eighteen (18) cases of corneal opacity more or less distinctly marked.

In seven (7) cases the appearance of the squint had been immediately preceded by measles, and in two (2) cases by scarlatina.

General chorea existed in two (2) of the cases, and rotary nystagmus in seven (7) cases.

In eight (8) cases the squint had followed an attack of epileptiform convulsions, and in three (3) cases it occurred during an attack of pertussis.

The convergence was complicated in two (2) cases by congenital ptosis, in one case by facial paralysis, and in two (2) cases by encanthis.

In two (2) of the myopic cases detachment of the retina occurred after the operation.

In four (4) cases there was no fixation with the squinting eye, either before or after the operation.

A cursory review of the final results of the operation on the degree of the squint would lead the surgeon to believe that the greatest effect is to be expected from tenotomy of the internal rectus and advancement of the external rectus of the squinting eye, and that the method of operating by simultaneous tenotomy of the internal recti of both eyes is the least valuable.

A more careful study of each case, however, has led the writer to the formulation of the following conclusions, which may be modified by lapse of time and a larger experience.

1st. If the squint is in one eye and of the alternating

variety, there is usually very little amblyopia in either eye, and but little difference in the refractive error in the two eyes. In the majority of these cases free tenotomy of the internal rectus of the eye which usually squints, with immediate full correction of the refractive error, will give as a final result either apparent parallelism or such a slight degree of convergence as is not noticeable under the glasses.

2d. If the squint is always in the same eye, there is almost always a decided amblyopia in the squinting eye, and usually a decided difference in the refraction of the two eyes. In these cases, if there be no loss of power in the external rectus, the best results are gained by tenotomy of the internal rectus and advancement of the external rectus of the squinting eye, and subsequent full correction by glasses.

3d. If there be marked amblyopia in the squinting eye and some loss of power in the external rectus of the same eye, the best operation will be found to be tenotomy of the internal rectus and advancement of the external rectus of the squinting eye, and at a varying period later tenotomy of the internal rectus of the other eye. Simultaneous tenotomy of the internal rectus of both eyes and advancement of the external rectus of the squinting eye, is not a desirable operation in these cases, as it too often leads to permanent divergence.

4th. If, however, the squinting eye is markedly amblyopic and the external rectus of this eye is entirely paralyzed, the best results are gained by a simultaneous tenotomy of the internal rectus of both eyes and advancement of the external rectus of the squinting eye.

5th. In the emmetropic cases, fifteen in number, the best results were gained by tenotomy of the internal rectus of the squinting eye, followed at a varying period by tenotomy of the internal rectus of the other eye. The reason for this is not as yet apparent.

6th. There will always be a number of cases, by no means inconsiderable, in which it will be impossible to decide in advance what method of operating will be likely to give the best results, and in which what we do will be more or less a matter of guess-work.

7th. Any complication which interferes with the visual acuity of a squinting eye, such as corneal maculæ, striæ in the lens, or extensive choroidal atrophy, must be regarded as pointing to the necessity of more extensive operative interference than simple tenotomy, even when no great refractive difference exists between the eyes, and when no paresis of the external rectus is present.

In studying closely the statistics of a considerable number of cases of convergent squint, one of the lessons taught is, that though defective vision is probably one of the causes of permanent squint, yet the results of the operation are satisfactory in a very large number of cases. Another fact that becomes evident is, that in a by no means inconsiderable number of cases a tenotomy on the squinting eye is useless, and we are forced to do a tenotomy on the other eye.

Schweigger seems to be correct in saying that in the majority of cases periodic squint is cured by a simple tenotomy, and that an imperfect result can be supplemented by tenotomy on the other eye.

The absence of fixation in the squinting eye in some cases of marked amblyopia renders it doubtful whether a satisfactory final result can be gained by any operation. Not a few cases may be found in the tables appended to this paper in which only slight improvement was gained, even by tenotomy of both internal recti and advancement of the external rectus of the squinting eye.

It should not be forgotten that a primary good result very often retrogrades, and surgeons do not sufficiently consider that the strength of the antagonistic muscle exerts a powerful influence on the ultimate result of the operation. Apparent loss of power in the external rectus does not always mean actual loss of power, and *Schweigger* has some reason for recommending gymnastic exercise of the muscles by alternately turning the eyes to the right and left as a useful preliminary to the operation for squint. It is a mistake to suppose that advancement of a muscle immediately brings about a permanent position of this eye, for, as in simple tenotomy, the immediate result never

remains permanent, but usually diminishes somewhat, though it may increase.

DISCUSSION.

DR. SAMUEL THEOBALD of Baltimore. — Did you mean literally the full correction attained under the Mydriatic? Have you found it possible to get the patients to wear the full correction? My experience has been that where there is marked ametropia, if full correction is given the retinal image is apt to be so blurred and indistinct that it is a difficult matter to induce patients to wear the glasses.

DR. J. A. LIPPINCOTT of Pittsburg. — I would ask whether in these cases of simultaneous operation upon the internal and external recti muscles any great amount of deformity resulted? I mean a diminished mobility of the eye inward or bulging of the eye forward.

DR. C. S. BULL. — I have never noticed the bulging in any case, but have seen the diminished mobility, which improves in time.

DR. W. H. CARMALT of New Haven. — It is permissible, I think, in connection with this exhaustive paper of Dr. Bull's on the results of cutting operations in strabismus, to refer to two cases of convergent strabismus cured without a cutting operation, by muscle stretching with full correction of refractive errors. They were both of recent origin, in young adults. In one case there was anisometropia (compound myopic astigmatism of different degrees), in the other antimetropia (R. E., compound myopic astigmatism; L. E., hypermetropic). In the former case the myopia was of quite recent date; in the latter the myopia had existed for fifteen years, but the strabismus, as stated, was of quite recent development, a few weeks, but it was very noticeable.

In both cases temporary diplopia could be called up under full correction of each eye, with V = 1 in all, though entirely absent before, but it would soon disappear, and my efforts were directed to inducing the patients to fuse the images.

Before treatment was instituted the images could not be fused by any effort of the patient, and the diplopia would disappear by reason of the greater excursion of the strabismic eye. The first attempts at stretching the muscle brought about either an appreciable approximation or the ability to fuse temporarily the images, and which, by continuing the treatment, improved to the completion of the cure. Besides the actual manipulation of the muscle, which was repeated every two or three days, the patients were instructed to practice calling up the diplopia, and

then to fuse the images. This was not possible, at first, under ordinary conditions of vision, but in the evening, after dark, it could be done by having nothing but a single small light to look at.

A few trials of this kind were sufficient to teach them to call up the diplopia at other times, and, from that time, the improvement was rapid, for, with the establishment of the diplopia, the desire to fuse the images became greater and the habit became established.

DR. W. F. NORRIS of Philadelphia. — How is this stretching done?

DR. CARMALT. — By simply catching the internal rectus muscle at its insertion together with the conjunctiva in forceps and drawing it forward, or, perhaps better expressed, rotating the eye outwards on its vertical axis. The glasses for full correction of either hypermetropia or myopia were worn constantly; the difference in size of the images did not bother them. They spoke of it at first, but it soon disappeared.

DR. C. S. BULL of New York. — As to Dr. Theobald's point on full correction of the refraction. He questions whether it is possible for the patients to wear such lenses from the beginning. It is true that you will have difficulty at first with complaints on the part of the patients. Tell them they must wear the glasses and the troublesome symptoms will soon disappear. I have rarely found a case in which the full correction could not be worn, by a little judicious management on the part of the physician.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
1. M.	16	H. 1/24	R.=10/200 L.=20/30+	Tenotomy of right int. " left int., 2 wks. interval.	3 years.	R. 20/200 L. 20/20	Slight divergence	Correcting glasses worn constantly.
2. M.	23	H. 1/30	R. 20/30+ L. 5/100	Tenotomy of left int. " right int., 2 wks. " left int., 1 mo.	1 year.	R.=20/20 L.=10/100	conv. 5°	Correcting glasses worn constantly.
3. F.	21	H. 1/20	O. U. 20/40	Simultaneous tenotomy of both int. Advancement of left int. 1 mo. later.	14 mos.	O. U. 20/40+	conv. 5°	Correcting glasses worn constantly.
4. F.	6½	H. 1/40	O. U. 20/20−	Tenotomy of left int.	4 years.	O. U. 20/20	parallelism	Correcting glasses worn 18 mos.
5. M.	32	H. 1/36	R. E. 20/20 L. E. 20/200	Tenotomy of left int. " right int., 3 wks. later.	6 mos.	R. 20/20 L. 20/50+	conv. 5°	Correcting glasses worn constantly.
6. F.	21	H. 1/16 Ash. 1/36	O. U. 20/50	Tenotomy of right int. " left int., 2 wks. later.	1 year.	O. U. 20/30	parallelism	Correcting glasses worn constantly.
7. M.	20	H. 1/36 Ash. 1/36	R. E. 20/200 L. E. 20/20	Tenotomy of right int. and advancement of left int.	1 year.	R. E. 20/200 L. E. 20/20	parallelism	Correcting glasses worn constantly.
8. M.	11	H. 1/30	R. E. 20/20 L. E. 12/200	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20 L. E. 20/200	divergence 3° R. E.	Correcting glasses worn constantly.
9. F.	6	H. 1/24	R. E. 20/100 L. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	6 years.	R. E. 20/100 L. E. 20/30+	conv. 5°	Correcting glasses worn constantly.
10. M.	11	H. 1/30	R. E. 20/30 − 1 L. E. 20/50 −	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20 L. E. 20/40−	conv. 5°	Correcting glasses worn constantly.
11. F.	14	H.+1/10 Aphakia R. E. 5/200 L. E. 4/200		Tenotomy of left int. " right int., 2 wks. later.	3 years.	R. E. 20/70 { +1/10 L. E. 20/200 {	parallelism	Corneal maculæ; congenital cataract; seven needlings done on two eyes within 14 mos.
12. M.	36	H. 1/40 Ash. 1/40	R. E. 20/20 L. E. 20/200	Tenotomy of left int.	2 years.	R. E. 20/20 L. E. 20/40−	conv. 5°	Blow on head 11 years ago and since then Squint in L. E.; full correction by glasses.
13. F.	62	H. 1/20	R. E. 20/50 L. E. 5/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/50+ L. E. 10/200	conv. 5°	Granular lids and pannus.

14. M.	12	H. 1/30 Ash. 1/40	R. E. 20/30 L. E. 20/40+	Tenotomy of left int. " right int., 2 wks. later, " left int., 3 wks. later.	4 years.	R. E. 20/20– L. E. 20/20–	parallelism	Constant correction.
15. F.	11	H. 1/36	R. E. 20/20 L. E. 20/50–	Tenotomy of left int. " right int., 2 wks. later.	6 years.	R. E. 20/20 L. E. 20/50–	parallelism	Constant correction.
16. F.	17	H. 1/12	B. E. 20/100	Tenotomy of right int.	1 year.	B. E. 20/100	divergence 5°	Corneal maculæ; suppuration of wound; divergence and opacity of cornea.
17. M.	24	E.	R. E. 3/100 L. E. 20/30+	Tenotomy of right int., and advancement right ext.	10 years.	R. E. 3/100 L. E. 20/20	parallelism	Severe injury of right side of face and skull.
18. M.	22	M. 1/30	R. E. 5/100 L. E. 20/30	Tenotomy of right int. " left int.	1 year.	R. E. 5/100 L. E. 20/30	conv. 5°	Concave glasses worn constantly; no loss of power in ext. rect.
19. F.	9	H. 1/24	R. E. 20/30+ L. E. 20/100+	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20+ L. E. 20/70+	conv. 5°	Marginal blepharitis.
20. F.	14	H. 1/40	R. E. 20/100 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later. " right int., 1 mo. later.	2 years.	R. E. 20/100 L. E. 20/20	divergence 5°	
21. M.	8	H. 1/36	R. E. 20/30– L. E. 20/200	Tenotomy of left int. " right int., 2 wks. later.	4 years.	R. E. 20/20 L. E. 20/200	conv. 5°	Correcting glasses constantly.
22. M.	14	H. 1/30	R. E. 20/200 L. E. 20/30+	Tenotomy of right int. " left int. 1 mo. later.	1 year.	Same	conv. 5°	Correcting glasses constant.
23. F.	14	H. 1/40	R. E. 20/30 L. E. 20/30	Tenotomy of right int. " left int. 3 wks. later.	2 years.	B. E. 20/20	parallelism	Correcting glasses constant.
24. F.	21	H. 1/36 Ash. 1/72	R. E. 20/20 L. E. 20/20–	Tenotomy of right int.	2 years.	R. E. 20/30+ L. E. 20/20	parallelism	Correcting glasses constant.
25. F.	6	H. 1/16	R. E. 20/20 L. E. 20/100	Tenotomy of left int. " right int.. 1 week later.	1 year.	R. E. 20/20 L. E. 20/70	conv. 5°	Externus normal; complete correction.
26. M.	27	H. 1/16 Ash. 1/30	R. E. 5/200 L. E. 20/20	Tenotomy of right int., and reef in right ext.	1 year.	R. E. 5/200 L. E. 20/20	parallelism	Some loss of power in right, ext.; complete correction.
27. F.	10½	H. 1/20	R. E. 20/30+ L. E. 20/70–	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20 L. E. 20/50–	conv. 5°	Rachitic disease of cervical vertebræ; complete correction.
28. F.	7	H. 1/16	R. E. 20/200 L. E. 20/20–	Tenotomy of right int. " left int., 1 mo. later.	4 years.	R. E. 20/200 L. E. 20/20	parallelism	Complete correction.
29. M.	8	H. 1/36	R. E. 20/20 L. E. 20/30–	Tenotomy of left int. " right int., 3 wks. later.	4 years.	R. E. 20/20 L. E. 20/30–	parallelism	Complete correction.
30. F.	7	H. 1/16 Ash. 1/40	R. E. 20/200 L. E. 5/200	Tenotomy of left int. " right int., 2 wks. later. Advancement of left ext.	6 years.	R. E. 20/200 L. E. 5/200	parallelism	Rotary nystagmus; complete correction.
31. F.	17	H. 1/24	R. E. 20/50 L. E. 20/70–	1. Tenotomy of left int. 2. " right int., 2 wks. later. 3. " left int., 1 mo. later.	1 year.	R. E. 20/50 L. E. 20/70–	conv. 5°	Full correction; externi normal.
32. F.	17	H. 1/18	R. E. 20/20 L. E. 20/20	Tenotomy of left int. " right int., 3 wks. later.	1½ years.	R. E. 20/20 L. E. 20/20	conv. 10°	Externus normal; full correction.
33. F.	8	H. 1/36	R. E. 20/40 L. E. 20/20	Tenotomy of right int. " left int., 1 year later.	4 years.	R. E. 20/40 L. E. 20/20	conv. 3°	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
34. F.	30	H. 1 30	R. E. 20/40— L. E. movements of hand	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/30— L. E. movements	parallelism	Full correction.
35. M.	7	E.	R. E. 20/30— L. E. 20/30—	Tenotomy of both int., simultaneously. 1 mo. later tenotomy left int., and reef in ext.	5 years.	R. E. 20/20 L. E. 20/20	conv. 3°	No glasses.
36. M.	9½	H. 1 30	R. E. 20/20 L. E. 20/40+	Tenotomy of left int. " right int., 3 wks. later.	8 years.	R. E. 20/20 L. E. 20/40	conv. 3°	Came during teething. Full correction.
37. F.	7	H. 1/30	R. E. 20/30 L. E. 20/70	Tenotomy of left int.	2 years.	R. E. 20/30 L. E. 20/50	divergence 3°	Following measles. Full correction.
38. F.	8	H. 1/20 and 1/7	R. E. 20/30— L. E. 20/200+	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/20 L. E. 20/100 +	conv. 3	Full correction of R. E.; partial of L. E.
39. F.	16	H. 1/8 and 1/24	R. E. 20/200 L. E. 20/50+	Simultaneous tenotomy of both int. One mo. later tenotomy right int., and advancement of right ext.	2 years.	R. E. 20/200 L. E. 20/50+	parallelism	Full correction, 1. 16 and 1/24.
40. F.	7	H. 1/36	R. E. 20/20— L. E. 20/20	Tenotomy of right int. 1 mo. later tenotomy of left int.	1 year.	R. E. 20/20— L. E. 20/20	conv. 5°	Full correction.
41. M.	8	H. 1/24	R. E. 20/20 L. E. 20/40	Tenotomy of right int. " left int., 1 mo. later.	4 years.	R. E. 20/20 L. E. 20/40	conv. 5	Followed pertussis. Full correction.
42. M.	7	H. 1/16	R. E. 20/30 L. E. 20/30	Tenotomy of left int.	4 years.	R. E. 20/20 L. E. 20/30	conv. 3°	Full correction; came on after diphtheria; no paralysis.
43. M.	9	H. 1/36	R. E. 20/20 L. E. 20/40	Tenotomy of left int. " right int., 1 mo. later.	1 year.	R. E. 20/20 L. E. 20/30	parallelism	Full correction.
44. M.	6	H. 1/20	R. E. 20/200 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	2 years.	R. E. 20/200 L. E. 20/20	conv. 5°	Full correction.
45. M.	41	H. 1/10	R. E. 3/100 L. E. 20/70 +	Tenotomy of right int., and advancement of right ext.	4 years.	R. E. 3/100 L. E. 20/30—	parallelism	Cataract B. E. Subsequently cataract removed from left eye, giving V.=20/30—with+1/4½.
46. M.	7	H. 1/30	R. E. 20/20 L. E. 20/200	Tenotomy of left int. " right int., 1 mo. later.	2 years.	R. E. 20/20 L. E. 20/200	conv. 5°	Complete correction.
47. M.	16	H. 1/6	R. E. 20/70+ L. E. 20/30+	Tenotomy of right int. " left int., 3 wks. later.	16 mos.	R. E. 20/20+ L. E. 20/30+	divergence 5°	Complete correction.
48. F.	35	H. 1/36	R. E. 20/30+ L. E. 8/100	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/30+ L. E. 8/100	conv. 5°	Complete correction.
49. F.	6	H. 1, 12	R. E. 20/200 L. E. 20/30	Tenotomy of right int. " left int., 1 mo. later.	18 mos.	R. E. 20/200 L. E. 20/20	conv. 5°	Following attack of fever with delirium and convulsions; complete correction.

50. F.	10	H. 1/24	R. E. 20/30 L. E. 20/30	Tenotomy of left int. " right int., 1 mo. later.	1 year.	R. E. 20/30+ L. E. 20/30+	divergence 3°	Complete correction.
51. F.	6	H. 1/20	R. E. 20/20 L. E. 20/70	Tenotomy of left int. " right int., 3 mos. later.	2 years.	R. E. 20/20 L. E. 20/70	conv. 5°	Complete correction.
52. F.	7	H. 1/40	R. E. 20/100 L. E. 20/20	Tenotomy of right int. " left int., 3 mos. later.	4 years.	R. E. 20/100 L. E. 20/20	conv. 5°	Complete correction.
53. M.	12	H. 1/24	R. E. 20/40 L. E. 20/200	Tenotomy of left int. " right int., 1 wk. later.	1 year.	R. E. 20/30+ L. E. 20/200	conv. 5°	Complete correction.
54. M.	16	H. 1/13	R. E. 20/70+ L. E. 20/70+	Tenotomy of left int. " right int., 1 mo. later.	1 year.	R. E. 20/70+ L. E. 20/70+	conv. 5°	Complete correction.
55. F.	8	H. 1/30	R. E. 20/20 L. E. 10/200	Tenotomy of left int. " right int., 1 wk. later.	18 mos.	R. E. 20/20 L. E. 10/200	parallelism	Complete correction.
56. M.	7	H. 1/16	R. E. 20/20 L. E. 20/100	Tenotomy of left int. " right int., 1 mo. later.	1 year.	R. E. 20/20 L. E. 20/100	conv. 5°	Following convulsions; complete correction.
57. F.	7	H. 1/40	R. E. 20/200 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	1 year.	R. E. 20/200 L. E. 20/20	conv. 3°	Complete correction.
58. F.	7	H. 1/40	R. E. 20/20 L. E. 20/20—	Tenotomy both int. simultaneously. Tenotomy left int. 3 years later.	4 years.	R. E. 20/20 L. E. 20/20	divergence 3°	Complete correction.
59. F.	14	H. 1/40	R. E. 10/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	5 years.	R. E. 10/200 L. E. 20/20	parallelism	Central leucoma adherens; complete correction.
60. M.	6	H. 1/24	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/20 L. E. 10/200	parallelism	No fixation in L. E.
61. F.	7	E.	R. E. 20/20 L. E. 20/20—	Tenotomy of left int.	4 years.	R. E. 20/20 L. E. 20/20	parallelism	Hemichorea, left side.
62. M.	6½	H. 1/12	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 20/200 L. E. 20/20	divergence 3°	No fixation with R. E.; extensive atrophy, region of macula.
63. F.	20	H. 1/10	R. E. 20/70 L. E. 3/100	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/40 L. E. 3/100	parallelism	Paresis ext. rectus.
64. F.	45	H. 1/20	R. E. 20/70 L. E. 20/50+	Tenotomy of right int.	1 year.	R. E. 20/70 L. E. 20/40	parallelism	Complete correction; convulsions in infancy.
65. F.	13	H. 1/20	R. E. 20/100 L. E. 20/70	Tenotomy of right int. " left int., 3 wks. later.	13 mos.	R. E. 20/100 L. E. 20/50	conv. 5°	Complete correction.
66. M.	6½	H. 1/30	R. E. 20/40 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	3 years.	R. E. 20/40 L. E. 20/20	conv. 5°	Complete correction.
67. M.	34	H. 1/24	R. E. 20/20 L. E. 20/20—	Tenotomy of left int.	14 mos.	R. E. 20/20 L. E. 20/20	parallelism	Complete correction.
68. F.	25	H. 1/20	R. E. 20/100 L. E. 20/200	Tenotomy of left int.	1 year.	R. E. 20/40 L. E. 20/70	parallelism	Granular lids; slight pannus; treated for 6 mos.
69. F.	6	H. 1/16	R. E. 20/20 L. E. 5/200	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/20 L. E. 5/200	conv. 5°	Complete correction.
70. F.	25	H. 1/12	R. E. 20/40 L. E. light	Extraction linear of cataract with iridectomy; 3 mos. later tenotomy of left int.	2 years. 3 years.	R. E. 20/30 L. E. 20/100 with 1/3½	conv. 3°	Congenital cataract; linear extr. iridectomy.
71. F.	12	H. 1/24	R. E. 20/20— L. E. 20/20—	Tenotomy of right int.	1 year.	R. E. 20/20 L. E. 20/20—	parallelism	Full correction.
72. M.	10	H. 1/30	R. E. 20/20 L. E. 20/20	Tenotomy of left int. " right int., 4 wks. later.		R. E. 20/20 L. E. 20/20—	conv. 5°	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
73. M.	13	H. 1/24	R. E. 20/40— L. E. 20/40—	Tenotomy of left int.	2 years.	R. E. 20/30+ L. E. 20/40—	conv. 3°	Full correction.
74. M.	9	H. 1/10	R. E. 20/30— L. E. 20/50—	Tenotomy of left int. " right int., 4 wks. later.	1 year.	R. E. 20/20 L. E. 20/50	conv. 3°	Full correction.
75. F.	8	H. 1/30	R. E. 20/200 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	2 years.	R. E. 20/200 L. E. 20/20	conv. 5°	Full correction.
76. M.	17	H. 1/18	R. E. 20/70 L. E. 20/70—	Tenotomy of left int. " right int., 2 wks. later.	1 year.	R. E. 20/40 + L. E. 20/40	conv. 3°	Full correction.
77. F.	6	H. 1/20	R. E. 20/20 L. E. 20/100	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20 L. E. 20/100	conv. 5°	Full correction.
78. F.	6	H. 1/30	R. E. 20/20 L. E. 20/40	Tenotomy of left int. " right int., 4 wks. later.	1 year.	R. E. 20/20 L. E. 20/40	conv. 3°	Full correction.
79. F.	30	H. 1/40	R. E. 20/20— L. E. light	Linear extraction upwards with iridectomy; 3 mos. later tenotomy of left int.	18 mos.	R. E. 20/20 L. E. 20/200	conv. 3°	Congenital cataract; triangular pupil, apex downward.
80. F.	9	H. 1/20	R. E. 10/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	3 years.	R. E. 10/200 L. E. 20/20	parallelism	Full correction; very weak externus.
81. F.	9	H. 1/12	R. E. 20/30— L. E. 20/70 +	Tenotomy of left int. " right int., 3 wks. later.	4 years.	R. E. 20/20— L. E. 20/50	parallelism	Full correction.
82. F.	7	H. 1/30	R. E. 20/20 L. E. 20/20—	Tenotomy of left int.	2 years.	R. E. 20/20 L. E. 20/20	parallelism	Full correction.
83. F.	6	H. 1/24	R. E. 20/30— L. E. 20/30—	Tenotomy of right int.	3 years.	R. E. 20/30— L. E. 20/20	conv. 3°	Full correction.
84. F.	8	H. 1/10	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/20 L. E. 10/200	conv. 3°	Full correction.
85. F.	9	H. 1/12	R. E. 20/20 L. E. 20/200	Tenotomy of left int., " right int., 3 wks. later.	1 year.	R. E. 20/20 L. E. 20/200	conv. 3°	Full correction.
86. M.	23	H. 1/10	R. E. 5/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 5/200 L. E. 20/30—	parallelism	Full correction.
87. M.	24	H. 1/30	R. E. 20/20 L. E. 20/40—	Tenotomy of left int.	14 mos.	R. E. 20/20 L. E. 20/40—	conv. 3°	Full correction.
88. F.	6	H. 1/12	R. E. 20/ 10— L. E. 20/70—	Tenotomy of left int. " right int.	2 years.	R. E. 20/30+ L. E. 20/70	conv. 5°	Full correction.
89. F.	14	H. 1/40	R. E. 20/20 L. E. 20/20—	Tenotomy of left int.	1 year.	R. E. 20/20 L. E. 20/20—	parallelism	Full correction.
90. F.	7	H. 1/16	R. E. 20/20 L. E. 20/50	Tenotomy of left int.	2 years.	R. E. 20/20 L. E. 20/50	conv. 5°	Full correction.
91. M.	11	H. 1/20	R. E. 20/20 L. E. 20/40—	Tenotomy of left int.	6 years.	R. E. 20/20 L. E. 20/30—	conv. 3°	Full correction.

92. F.	9	H. 1/30	R. E. 20/70 L. E. 20/30—	Tenotomy of right int. " left int., 3 wks. later.	6 years.	R. E. 20/70 L. E. 20/30—	conv. 5°	Full correction.
93. F.	13	H. 1/20	R. E. 20/50 L. E. 20/50	Tenotomy of right int. " left int., 2 wks. later.	2 years.	R. E. 20/50 L. E. 20/20—	conv. 1°	Full correction.
94. F.	42	H. 1/24	R. E. 20/200 L. E. 20/50—	Tenotomy of right int., and advancement of right ext.	18 mos.	R. E. 20/200 L. E. 20/40+	parallelism	Full correction.
95. F.	6	H. 1/24	R. E. 20/40 L. E. 20/40	Tenotomy of right int.	7 years.	R. E. 20/30+ L. E. 20/20	parallelism	Squint intermittent; full correction.
96. F.	10	H. 1/16	R. E. 20/20 L. E. 20/40—	Tenotomy of left int.	2 years.	R. E. 20/20 L. E. 20/40+	parallelism	Full correction.
97. F.	6	H. 1/20	R. E. 20/200 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	2 years.	R. E. 20/200 L. E. 20/20	conv. 5°	Following measles; full correction.
98. F.	13	H. 1/12	R. E. 20/20 L. E. 20/20	Tenotomy of left int.	1 year.	B. E. 20/20	div. 3°	Full correction.
99. M.	6	H. 1/20	R. E. 20/20 L. E. 10/200	Tenotomy of left int. " right int., 3 wks. later.	3 years.	R. E. 20/30+ L. E. 10/200	conv. 3°	Full correction.
100. M.	34	H. 1/16	R. E. 20/20— L. E. 2/200	Tenotomy of left int., and advancement of left ext.	14 mos.	R. E. 20/20 L. E. 2/200	parallelism	Full correction.
101. M.	8	H. 1/10	R. E. 20/40— L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	3 years.	R. E. 20/40— L. E. 20/20—	conv. 5°	Full correction.
102. F.	7	H. 1/20	R. E. 20/20 L. E. 20/200	Tenotomy of left int.	2 years.	same	conv. 5°	Alternating.
103. F.	12	H. 1/10	R. E 20/20 L. E. 20/200	Tenotomy of left int. " right int., 2 wks. later.	1 year.	R. E. 20/20 L. E. 20/200	conv. 5°	Full correction.
104. F.	14	M. 1/18	R. E. 2/50 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	R. E. leucoma adherens; L. E. macula corneæ; squint in L. E.
105. F.	14	H. 1/30	R. E. 20/30+ L. E. 15/200	Tenotomy of left int., and advancement of left ext.	10 years.	R. E. 20/20 L. E. 15/200	parallelism	Full correction.
106. M.	8	H. 1/20	R. E. 10/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	R. E.	parallelism	Full correction.
107. M.	13	H. 1/72	R. E. 20/100 L. E. 20/200	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	conv. 5°	Nystagmus; full correction.
108. M.	6	H. 1/12	R. E. 20/100 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
109. M.	10	H. 1/24	R. E. 20/50 L. E. 20/30+	Tenotomy of right int. " left int., 2 wks. later.	1 year.	R. E. 20/50 L. E. 20/20	conv. 3°	Full correction.
110. M.	18	H. 1/40	R. E. 20/20— L. E. 20/100	Tenotomy of left int. " right int., 3 wks. later.	2 years.	R. E. 20/20 L. E. 20/100	conv. 3°	Full correction.
111. F.	14	H. 1/30		Tenotomy of left int. " right int., 2 wks. later.	3 years.	R. E. 20/30+ L. E. 20/50	conv. 5°	Full correction.
112. F.	14	H. 1/20	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	3 years.	R. E. 20/200 L. E. 20/20	parallelism	Full correction.
113. F.	15	H. 1/10	R. E. 20/20— L. E. 20/100	Tenotomy of left int. " right int., 3 wks. later.	4 years.	R. E. 20/20— L. E. 20/100	conv. 5°	Full correction.
114. F.	6	H. 1/72	R. E. 20/20 L. E. 20/20	Tenotomy of left int.	3 years.	same	parallelism	Full correction.
115. F.	12	H. 1/30	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
116. F.	10	H. 1/48	R. E. 20/20 L. E. 20/20	Tenotomy of right int.	3 years.	same	conv. 3°	Alternating; full correction.
117. M.	14	H. 1/24	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Complete correction.
118. M.	7	H. 1/72	R. E. 10/200 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/70 L. E. 20/200	parallelism	R. E. keratitis; L. E. macula corneæ.
119. M.	6	H. 1/24	R. E. 20/20 L. E. 20/70	Tenotomy of left int. " right int., 2 wks. later.	3 years.	R. E. 20/20 L. E. 20/70	divergence 3°	Full correction.
120. F.	9	H. 1/30	R. E. 20/200 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 5°	Squint followed a fall on her head. Chr. gran. conj.
121. F.	15	H. 1/72	R. E. 20/20 L. E. 20/30	Tenotomy of right int.	4 years.	R. E. 20/20 L. E. 20/30	parallelism	
122. M.	15	H. 1/7	R. E. 20/70+ L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	Gave full correction for each eye (+ 1/10 and + 1/7).
123. M.	6	H. 1/20	R. E. 20/50— L. E. 20/50—	Tenotomy of right int. " left int. 3 wks. later.	2½ years.	same	conv. 3°	Full correction.
124. M.	11	H. 1/20	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right int.	1 year.	same	parallelism	Full correction.
125. M.	6	H. 1/16	R. E. 20/30 L. E. 20/20	Simultaneous tenotomy of R. E.; internal recti.	2 years.	same	conv. 5°	Full correction.
126. F.	9	H. 1/40	R. E. 20/20 L. E. 20/40	Tenotomy of left int.	5 years.	R. E. 20/20 L. E. 20/40+	parallelism	Full correction.
127. M.	8	H. 1/30	R. E. 20/40 L. E. 20/50—	Tenotomy of left int., and advancement of left ext.	4 years.	R. E. 20/20 L. E 20/30	parallelism	Loss of power of ext. rect. Full correction.
128. F.	8	H. 1/24	R. E. 20/30 L. E. 20/30+	Tenotomy of left int.	6 years.	R. E. 20/20 L. E. 20/20—	parallelism	Full correction.
129. F.	5	H. 1/20	R. E. 20/20 L. E. 20/30+	Tenotomy of right int.	5 years.	R. E. 20/20 L. E. 20/30	conv. 3°	Full correction.
130. F.	6	H. 1/36	R. E. 20/20 L. E. 20/200	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/20 L. E. 20/200	conv. 5°	Full correction.
131. F.	17	H. 1/30	R. E. 20/30— L. E. 20/50	Tenotomy of left int. " right int., 3 wks. later.	18 mos.	same	conv. 3°	Full correction.
132. M.	6	H. 1/36	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	4 years.	R. E. 20/200 L. E. 20/20	parallelism	Paresis right ext. Full correction.
133. M.	6	H. 1/30	R. E. 20/40+ L. E. 20/20	Tenotomy of right int.	4 years.	R. E. 20/40+ L. E. 20/20	conv. 5°	Followed measles and pertussis. Full correction.
134. M.	21	H. 1/10	R. E. 20/30 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Loss of power in ext. rect. Full correction.
135. M.	9	H. 1/20	R. E. 20/20 L. E. 20/30—	Tenotomy of left int.	1½ years.	same	conv. 5°	Full correction, but not worn.

136. M.	10	H. 1/16	R. E. 20/30— L. E. 20/200	Tenotomy of left int., and advancement of left ext.	6 years.	R. E. 20/20 L. E. 20/200	parallelism	Full correction.
137. M.	22	H. 1/8	R. E. 4/200 L. E. 20/30—	Tenotomy of right int., and advancement of right ext	2 years.	R. E. 4/200 L. E 20/20—	parallelism	Loss of power in ext. rect. Partial correction.
138. F.	22	H. 1/10	R. E. fingers L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Loss of power in ext. rect. Full correction.
139. M.	15	H. 1/7	B. E. fingers 10 ft.	Simultaneous tenotomy of both int.	3 years.	B. E. 20/70	parallelism slight div.	Full correction.
140. M.	8	H. 1/20	R. E. 20/100 L. E. 20/70	Tenotomy of right int. " left int., 2 wks later.	4 years.	same	conv. 5°	Loss of power in ext.rect.; full correction; corneal maculæ.
141. F.	6	H. 1/12	R. E. 20/40 L. E. 20/40	Tenotomy of left int. " right int., 2 wks. later.	3 years.	B. E. 20/40+	conv. 3°	Full correction.
142. F.	14	H. 1/24	R. E. 2/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	Full correction.
143. M.	11	H. 1/48	R. E. 20/20— L. E. 20/20—	Tenotomy of right int. " left int., 2 wks. later.	18 mos.	same	conv. 5°	Alternating. Full correction.
144. F.	7	H. 1/40	R. E. 20/20 L. E. 20/40+	Tenotomy of left int.	2½ years.	same	conv. 3°	Full correction.
145. M.	15	H. 1/36	B. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	4 years.	B. E. 20/30+	conv. 5°	Full correction.
146. F.	8	H. 1/9	R. E. 20/40 L. E. fingers	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/20— L. E. fingers	parallelism	Full correction.
147. F.	30	H. 1/30	R. E. 20/30+ L. E. 8/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
148. F.	60	E.	B. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/30+ L. E. 20/200	parallelism	Cataract B.E.; ext. simp. B.E. with 3 ms. intv.; sub. tenotomy.
149. F.	9	H. 1/9	R. E. 20/30+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Following measles two years ago. Full correction.
150. F.	14	H. 1/40	R. E. 20/20 L. E. 20/100	Tenotomy of left int. " right int., 3 wks. later.	3 years.	R. E. 20/20 L. E. 20/100	conv. 5°	Full correction.
151. F.	7	H. 1/20	R. E. 20/40 L. E. 20/70	Tenotomy of left int. " right int., 3 wks. later	2 years.	R. E. 20/20 L. E. 20/70+	conv. 1°	Full correction.
152. M.	7	H. 1/16	R. E. 20/200 L. E 20/20	Tenotomy of right int., and advancement of right ext.	3 years.	R. E. 20/200 L. E. 20/20	parallelism	Full correction.
153. M.	9	H. 1/18	R. E. 20/20 L. E. 1/200	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/20 L. E. 1/200	parallelism	Full correction.
154. M.	9	H. 1/16	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	2 years.	R. E. 20/20 L. E. 20/20	conv. 3°	Full correction.
155. M.	20	H. 1/18	R. E. 20/30+ L. E. 20/30+	Tenotomy of left int.	1 year.	same	conv. 3°	Full correction.
156. M.	13	H. 1/4 H. 1/7	R. E. 20/40+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction of weaker eye (+1/7).
157. F.	13	H. 1/10	R. E. 20/200 L. E. 20/30	Tenotomy of right int. " left int., 3 wks. later.	2 years.	same	conv. 5°	Full correction.
158. M.	8	H. 1/40	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Paresis of ext. rect. Full correction.
159. F.	14	H. 1/30	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	2 years.	same	conv. 5°	Full correction. Phlyct. keratitis R. E.

OPH.—3

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
160. M.	12	H. 1/24	R. E. 20/20 L. E. 20/30+	Tenotomy of left int.	1 year.	same	conv. 5°	Partial ptosis.
161. M.	20	M. 1/26	R. E. 0 L. E. 20/40	Tenotomy of right int.	2 years.	same	diverg. 5°	Cataract R. E.; complete ext. good result; tenotomy 3 m. later.
162. F.	6	H. 1/20	R. E. 10/200 L. E. 20/20	Tenotomy of right int., and advancement right ext.	2 years.	same	parallelism	Full correction.
163. F.	8	H. D. 1	R. E. 20/30+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
164. M.	6	H. D. 4	R. E. 4/200 L. E. 20/100	Tenotomy of right int., and advancement of right ext.	2 years.	R. E. 4/200 L. E. 20/50+	parallelism	Full correction.
165. F.	12	H. D. 2	R. E. 20/20 L. E. 20/50	Tenotomy of left int.	1 year.	same	conv. 5°	
166. F.	13	H. D. 3	R. E. 20/20— L. E. 10/200	Tenotomy of left int.	1 year.	same	conv. 5°	Leucoma adhaerens L. E.
167. M.	14	H. D. 1.50	R. E. 20/40— L. E. 20/30—	Tenotomy of right int. " left int., 3 wks. later.	2 years.	same	diverg. 5°	Full correction.
168. F.	8	M. D. 1	B. E. 20/20—	Tenotomy of left int.	1 year.	same	parallelism	M. uncorrected.
169. F.	18	R.+D. 1.50 L.+D. 3.50	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction B. E.
170. M.	11	H. D. 3	R. E. fingers L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
171. F.	11	H. D. 1	R. E. 20/200 L. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	Right congenital facial paralysis; squint on same side.
172. M.	14	H. D. 2.50	R. E. 20/50 L. E. 20/20	Tenotomy of right int.	3 years.	same	parallelism	Full correction.
173. F.	12	H. D. 2	R. E. 20/20 L. E. 20/30	Tenotomy of left int.	2 years.	same	conv. 3°	Full correction.
174. M.	46	H. D. 1.50	R. E. 20/100 L. E. 2/200	Tenotomy of left int., and advancement of left ext. Excision of pterygium.	1 year.	same	parallelism	Trauma ant. syn., and coloboma iridis; aphakia in L. E.; T +1; conv. squint R. E.; nasal pterygium.
175. F.	15	H. D. 1	R. E. 20/50 L. E. 20/50	Tenotomy of left int. " right int., 2 wks. later.	2 years.	R. E. 20/30— L. E. 20/50	conv. 5°	Corneal macula B. E.; full correction.
176. M.	9	H. D. 2.50 H. D. 4	R. E. 20/20— L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction B. E.
177. M.	14	H. D. 3	R. E. 20/20 L. E. 10/200	Tenotomy of left int.	2 years.	same	conv. 5°	Full correction.
178. M.	25	H. D. 2	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.

179. F.	23	H. D. 1.50	R. E. 20/20 L. E. fingers	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
180. M.	15	H. D. 2.25	R. E. 20/20 L. E. 20/20—	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
181. F.	7	H. D. 4	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
182. M.	11	H. D. 2.50	R. E. 20/40 L. E. 20/200	Tenotomy of right int.	1 year.	same	parallelism	Full correction.
183. M.	20	H. D. 1.25 H. D. 3.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction B. E.
184. M.	12	H. D. 3.50	R. E. 20/40 L. E. 20/50	Tenotomy of left int. " right int., 3 wks. later.	2 years.	R. E. 20/30+ L. E. 20/50	conv. 5°	Full correction.
185. M.	7	H. D. 4	R. E. 20/70 L. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	3 years.	same	conv. 5°	Full correction.
186. M.	6	H. D. 3	R. E. 20/20— L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
187. F.	12½	H. D. 1	B. E. 20/20	Tenotomy of right int.	2 years.	same	parallelism	Full correction.
188. M.	14	H. D. 1.50	B. E. 20/20—	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
189. F.	9	H. D. 2	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Paresis of ext. rect. from diphtheria two mos. ago.
190. M.	16	H. D. 1	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	Full correction.
191. M	15	M. D. 1.50 M. D. 1.50	R. E. 20/30 L. E. 20/50—	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
192. M.	14	H. D. 4	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	4 years.	R. E. 20/70 L. E. 20/20	conv. 5°	Full correction.
193. M.	21	H. D. 6	R. E. 20/50 L. E. 20/50	Tenotomy of left int. " right int., 2 wks. later. " left int., 3 wks. later.	3 years.	same	conv. 1°	Full correction.
194. F.	13	H. D. 3.50	R. E. 20/70 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/30 L. E. 20/100	parallelism	Full correction.
196. F.	9	M. D. 1 H. D. 10	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Half correction of L. E.
197. M.	19	H. D. 2	R. E. 20/200 L. E. 20/30+	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
198. M.	12	H. D. 1.75 H. D. 3.50	R. E. 20/20 L. E. 20/70	Simultaneous tenotomy both interni.	2 years.	same	conv. 5°	Full correction.
199. M.	14	H. D. 4	R. E. 20/20— L. E. 20/30—	Tenotomy of left int.	1 year.	same	conv. 5°	Full correction.
200. M.	15	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	Full correction.
201. F.	33	H. D. 2.50	R. E. 20/30 L. E. 20/40	Tenotomy of left int. " right int., 3 wks. later.	2 years.	R. E. 20/20 L. E. 20/40+	parallelism	Full correction.
202. M.	10	H. D. 2	R. E. 20/20— L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
203. F.	11	H. D. 4	R. E. 20/40+ L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/20— L. E. 10/200	parallelism	Full correction.
204. F.	15	H. D. 1.50	R. E. 20/200 L. E. 2 /20	Tenotomy of right int. " left int., 2 wks. later.	4 years.	R. E. 20/200 L. E. 2 /20	conv. 5°	Following measles; full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Visior	Result as to Squint.	Remarks.
205. M.	51	H. D. 2	R. E. 20/30 L. E. 5/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
206. M.	9	H. D. 3	R. E. 20/100 L. E. 20/20	Tenotomy of right int. " left int., 4 wks. later.	2 years.	same	conv. 5°	Full correction.
207. F.	23	H. D. 2.75	R. E. 20/100 L. E. 20/50	Tenotomy of right int., and advancement of right ext.	18 mos.	same	diverg. 3°	Rotary nystagmus and conv. squint for one year; full correction.
208. F.	13	H. D. 1	R. E. 20/20 L. E. 20/30	Tenotomy of left int. " right int., 3 wks. later.	3 years.	same	conv. 3°	Full correction.
209. M.	6	H. D. 2	R. E. 20/100 L. E. 20/70+	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Full correction.
210. F.	18	H. D. 2	R. E. 20/200 L. E. 20/30+	Tenotomy of right int., and advancement of right ext.	6 years.	R. E. 20/200 L. E. 20/20	parallelism	Full correction.
211. M.	9	H. D. 2	R. E. 20/50 L. E. 20/50	Simultaneous tenotomy both interni.	2 years.	R. E. 20/30 L. E. 20/30—	conv. 5°	Marked convergence B. E.
212. M.	12	H. D. 3	B. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	3 years.	B. E. 20/30+	conv. 3°	Intermittent; full correction.
213. F.	55	H. D. 4.50	R. E. 20/70 L. E. 20/70	Tenotomy of right int., and advancement of right ext.	1 year.	O. U. 20/50	parallelism	Full correction.
214. M.	7	H. D. 3	B. E. 20/30	Tenotomy of left int. " right int., 3 wks. later.	18 mos.	same	conv. 3°	Full correction.
215. F.	10	H. D. 2	B. E. 20/20	Tenotomy of right int.	1 year.	B. E. 20/20	conv. 5°	R. E. full correction.
216. F.	14½	H. D. 3	R. E. 20/20 L. E. 20/70	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/20 L. E. 20/70	parallelism	Macula cornea L. E. Full correction.
217. M.	23	H. D. 2	B. E. 20/20—	Tenotomy of left int.	1 year.	B. E. 20/20	conv. 3°	L. E. full correction.
218. M.	7	H. D. 3	B. E. 20/40	Tenotomy of left int. " right int., 3 wks. later.	2 years.	R. E. 20/30— L. E. 20/40	conv. 5°	L. E. full correction.
219. F.	23	H. D. 1.50	R. E. 20/30 L. E. 20/50	Tenotomy of left int.	1 year.	R. E. 20/20 L. E. 20/50	parallelism	L. E. full correction.
220. M.	22	H. D. 3	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
221. M.	45	E.	B. E. 20/20	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Paresis left ext.
222. M.	8	H. D. 1	R. E. 20/200 L. E. 20/30—	Tenotomy of right int. " left int., 3 wks. later.	18 mos.	R. E. 20/40 L. E. 20/20	conv. 3°	Full correction.
223. M.	43	E.	R. E. 10/200 L. E. 20/70	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	conv. 5°	Choroidal atrophy opacities in vitreous in R. E. Iritis. in L. E.
224. M	20	H. D. 2	R. E. 20/200 L. E. 20/30	Simultaneous tenotomy of both interni.	1 year.	same	divergence 3°	Squint R. E. for 10 years.

225. M.		Ash.	R. E. 20/70 L. E. 20/30	Tenotomy of right int. " left int., 4 wks. later.	2 years.	R. E. 20/70 L. E. 20/20	conv. 5°	Full correction.
226. F.	15	H. D. 1	B. E. 20/50+	Tenotomy of left int.	3 years.	same	conv. 5°	Full correction.
227. M.	14	H. D. 2	B. E. 20/20	Simultaneous tenotomy both interni.	2 years.	B. E. 20/20	divergence 3°	Both eyes squint.
228. M.	60	H. D. 1	R. E. 20/70 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Paresis of left ext. Neuroretinitis.
229. F.	13	H. D. 1.75	R. E. 20/20 L. E. 20/50	Tenotomy of left int. " right int., 3 wks. later	4 years.	R. E. 20/20 L. E. 20/50	conv. 5°	Correction 2 years later.
230. M.	6	H. D. 5	R. E. 20/100 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
231. F.	7	H. D. 1.75	R. E. 20/30 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
232. M.	14	H. D. 1	B. E. 20/20	Tenotomy of right int.	3 years.	B. E. 20/20	conv. 5°	Full correction.
233. M.	15	Ash.	R. E. 20/30 L. E. 20/30—	Tenotomy of left int.	1 year.	R. E. 20/30+ L. E. 20/30—	conv. 5°	Full correction.
234. M.	13	H. D. 3	R. E. 20/50+ L. E. 20/70	Tenotomy of left int.	2 years.	same	conv. 3°	Rotary Nystagmus. Full correction.
235. M.	21	H. D. 5	B. E. 20/40+	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
236. F.	12	H. D. 3.50	B. E. 20/40—	Tenotomy of left int.	3 years.	same	slight conv.	Squints inwards and upwards L. E. Full correction.
237. M.	14	H. D. 5	R. E. 20/40 L. E. 20/70	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
238. F.	17	H. D. 1	R. E. 20/20 L. E. 20/50	Tenotomy of left int.	3 years.	same	conv. 3°	Conv. squint and ptosis L. E. from birth.
239. M.	12	H. D. 1.50	B. E. 20/20	Tenotomy of left int.	1 year.	B. E. 20/20	parallelism	Full correction.
240. F.	12	Asm.	R. E. 20/200 L. E. 20/50–	Tenotomy of right int., and advancement of right ext.	2 years.	R. E. 20/200 L. E. 20/30+	parallelism	Scarlatina one week after birth. R. E. post syn. and caps. cat. L. E. myopic.
241. M.	6	H. D. 2	B. E. 20/30	Tenotomy of right int.	3 years.	B. E. 20/30+	conv. 3°	Full correction.
242. M.	7	H. D. 4	R. E. 20/50 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
243. F.	15	H. D. 4	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/30+ L. E. 20/200	parallelism	Full correction.
244. F.	11	Ash.	B. E. 20/30—	Tenotomy of right int.	1 year.	R. E. 20/30— L. E. 20/20	parallelism	Marginal bleph. Full correction.
245. F.	11	H. D. 6	R. E. 20/30 L. E. 20/70	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	parallelism	Full correction.
246. M.	16	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	Full correction.
247. M.	8	H. D. 1.50	R. E. 20/30+ L. E. 20/70	Tenotomy of left int. " right int., 2 wks. later.	1 year.	R. E. 20/20 L. E. 20/70	conv. 3°	Full correction.
248. M.	15	H. D. 1	B. E. 20/20	Tenotomy of right int.	2 years.	same	parallelism	Full correction.
249. M.	10	H. D. 1.25	R. E. 20/30+ L. E. 20/50	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	parallelism	Full correction.
250. F.	11	H. D. 4	B. E. 20/50	Tenotomy of right int. " left int., 2 wks. later.	2 years.	R. E. 20/50 L. E. 20/30	conv. 5°	Full correction.
251. F.	12	H. D. 2.25	R. E 20/30 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/20 L. E. 20/200	parallelism	R. E. macula cornea. L. E. squint.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
252. M.	14	H. D. 4	R. E. 20/50 L. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
253. F.	12	H. D. 6	R. E. 20/40 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 3°	Convulsion 8 months ago followed by squint.
254. F.	7	H. D. 3	B. E. 20/100	Tenotomy both int., and advancement right ext.	1 year.	same	parallelism	B. E. full correction.
255. F.	14	H. D. 2	R. E. 20/70 L. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 5°	R. E. full correction.
256. F.	8	Ash.	R. E. 20/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	2 years.	R. E. 20/200 L. E. 20/30	parallelism	R. E. full correction.
257. F.	11	H. D. 5	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
258. M.	8	H. D. 4.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	L. E. full correction.
259. M.	9	H. D. 2.50 H. D. 1.75	R. E. 20/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 20/200 L. E. 20/30+	parallelism	R. E. full correction.
260. M.	17	H. D. 4.50	R. E. 20/70 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	R. E. full correction.
261 M.	13	Ash.	R. E. 20/30 L. E. 20/40	Tenotomy of left int.	1 year.	R. E. 20/20 L. E. 20/20	parallelism	L. E. full correction.
262. F.	13	Ash.	B. E. 20/40	Tenotomy of left int.	1 year.	R. E. 20/20 L. E. 20/40	parallelism	L. E. full correction.
263. M.	9	H. D. 5.50	B. E. 20/50+	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Paresis left ext. Full correction.
264. F.	26	Em.	R. E. fingers L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Paresis right ext. in infancy.
265. M.	14	Em.	R. E. 20/70 L. E. 20/20	Tenotomy of right int.	3 years.	same	conv. 3°	R. E.
266. M.	11	H. D. 4	B. E. 20/100 20/30+ with └D4	Tenotomy of right int.	5 years.	same	parallelism	Full correction.
267. M.	10	H. D. 3	B. E. 20/200	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Full correction.
268. F.	17	H. D. 4.50 D. 1.25	R. E. 20/200 L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
269. F.	14	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	R. E. full correction.
270. F.	11	H. D. 6	R. E. 20/100 L. E. 20/30	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	R. E. full correction.
271. M.	21	H. D. 1	R. E. 20/30 L. E. 20/70—	Tenotomy of left int.	1 year.	same	conv. 5°	L. E. full correction.

272. M.	9	H. D. 5.50	R. E. 20/200 L. E. 20/30	Tenotomy of right int., and advancement right ext.	4 years.	same	parallelism	R. E. full correction.
273. M.	11	H. D. 3	R. E. 5/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	R. E. full correction.
274. M	7	H. D. 1.75 D. 3.50	R. E. 10/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	4 years.	same	parallelism	R. E. full correction.
275. M.	13	Ash.	B. E. 20/50 +	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
276. F.	23	Ash.	B. E. 18/100	Simultaneous tenotomy of both interni.	6 years.	R. E. 20/50 L. E. 20/50 +	divergence 5°	Full correction, squints in B. E.
277. F.	12	Ash.	R. E. 20/30 – L. E. 20/50 –	Tenotomy of left int	2 years.	same	conv. 3°	Convulsions 1 year ago, followed by squint, full correction.
278. M.	19	H. D. 3	R. E. 20/20 L. E. 2/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
279. F.	23	Ash.	R. E. 20/30 L. E. 20/200	Tenotomy of both int. " left int., and advancement of left ext. 1 mo. later.	1 year.	same	conv. 5°	Following perforating ulcer of cornea in childhood. Full correction.
280. F.	21	H. D. 1.25	B. E. 20/20 –	Tenotomy of right int.	1 year.	same	parallelism	Full correction.
281. M.	16	M.	B. E. 20/200 with –1/32= 20/50 +	Tenotomy of left int.	2 years.	same	divergence 3°	Full correction.
282. F.	19	H. D. 5	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/40 + L. E. 20/200	parallelism	Full correction.
283. F.	24	Ash.	R. E. 20/40 – L. E. 20/20	Tenotomy of right int.	2½ years.	same	conv. 3°	Constitutional syphilis.
284. F.	7	H. D. 4	R. E. 20/30 L. E. 20/40	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	B. E. full correction.
285. M.	14	H. D 2.50	B. E. 20/20	Tenotomy of left int.	1½ years.	same	conv. 5°	L. E. full correction.
286. M.	18	Ash.	R. E. 20/100 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/50 L. E. 20/200	parallelism	L. E full correction.
287. M.	28	H. D. 4	B. E. 20/200	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
288. F.	16	H. D. 1	R. E. 20/20 L. E. fingers	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	L. E. full correction.
289. M.	10	H. D. 2.50	R. E. 20/30 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	4 years.	R. E. 20/20 L. E. 20/100	conv. 3°	L. E. full correction.
290. M.	14	M. D. 1.50	R. E. 20/40 L. E. 20/20	Tenotomy of right int.	3 years.	same	divergence 3°	R. E. full correction.
291. F.	11	Ash.	B. E. 20/50 +	Tenotomy of right int.	2 years.	B. E. 20/30	parallelism	Marginal blepharitis. Full correction
292. M.	16	E.	B. E. 20/20	Tenotomy of left int.	1½ years.	same	parallelism	
293. M.	8	M. D. 0.50 H. D. 0.50	R. E. 20/30 L. E. 20/70	Tenotomy of left int.	4 years.	R. E. 20/20 L. E. 20/70	conv. 5°	Full correction.
294. F.	10	H. D. 1.75	R. E. 20/20 L. E. 20/40	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	parallelism	Full correction.
295. M.	15	H. D. 6	B. E. 20/200	Tenotomy of right int., and advancement of right ext.	6 years.	same	parallelism	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
296. F.	11	H. D. 4.50	B. E. 20/50	Tenotomy of left int. " right int., 3 wks. later.	3 years.	B. E. 20/40+	conv. 3°	Full correction.
297. F.	12	H. D. 2.25	R. E. 20/30 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
298. M.	14	H. D. 4 H. D. 2.50	R. E. 20/50 L. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
299. F.	12	Co. ash.	R. E. 20/50 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	18 mos.	R. E. 20/30 L. E. 10/200	parallelism	Convulsions at 8 mos. of age, followed by squint. Full cor.
300. F.	7	Co. ash.	B. E. 20/100	Tenotomy of both int., simultaneously.	5 years.	same	conv. 5°	Full correction.
301. F.	14	Ash.	R. E. 20/70 L. E. 20/30	Tenotomy of right int. " left int., 3 wks. later	2 years.	R. E. 20/70+ L. E. 20/30+	conv. 3°	Full correction.
302. F.	8	H. D. 3.50	R. E. 20/200 L. E. 20/40	Tenotomy of right int. and advancement of right ext.	4 years.	same	parallelism	Full correction.
303. F.	21	H. D. 5	B. E. 20/20	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
304. M.	8	H. D. 4.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
305. F.	9	H. D. 2.50 D. 1.75	R. E. 20/200 L. E. 20/40	Tenotomy of right int.	2 years.	R. E. 20/200 L. E. 20/20–	conv. 5°	Full correction.
306. F.	17	H. D. 4.50	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	conv. 5°	Full correction.
307. F.	11	H. D. 1	R. E. 20/20 L. E. 20/30+	Tenotomy of left int.	5 years.	same	parallelism	L. E. marg. bleph.
308. F.	11	H. D. 6	R. E. 20/30 L. E. 20/70	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	conv. 5°	Full correction.
309. M.	16	E.	R. E. 20/15 L. E. 20/20	Tenotomy of left int.	18 mos.	same	parallelism	
310. M.	8	M. D. 0.10	R. E. 20/20 L. E. 20/30	Tenotomy of left int.	4 years.	same	parallelism	Full correction.
311. F.	10	H. D. 1.25	R. E. 20/40 L. E. 20/50	Tenotomy of left int. " right int., 2 wks. later.	1 year.	R. E. 20/20— L. E. 20/50	conv. 5°	Full correction.
312. M.	15	H. D. 7	B. E. 20/200	Tenotomy of right int., and advancement of right ext., tenotomy of left int.	2 years.	same	parallelism	Full correction.
313. F.	11	H. D. 5	B. E. 20/50	Tenotomy of right int. " left int., simultaneously.	1 year.	same	divergence 5°	Full correction.
314. F.	12	H. D. 2.25	R. E. 20/30 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	R. E. 20/20 L. E. 20/200	parallelism	Full correction.

315. M.	14	H. D. 4 D. 2.50	R. E. 20/50 L. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 3°	Full correction.
316. F.	12	H. D. 5 D. 3	R. E. 10/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Squint after convulsions at 8 mos. of age; full correction.
317. F.	7	Co. ash.	B. E. 20/100	Tenotomy of both int., and advancement of left ext.	3 years.	R. E. 20/50 L. E. 20/100	parallelism	Extreme conv. L. E. No power in left ext. Full correction.
318. F.	14	Ash.	R. E. 20/70 L. E. 20/30	Tenotomy of right int.	1 year.	same	conv. 5°	Full correction.
319. F.	11	H. D. 5	B. E. 20/20 –	Tenotomy of right int.	2 years.	same	slight conv.	Full correction.
320. M.	8	H. D. 4.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	18 mos.	same	parallelism	Full correction.
321. F.	9	H. D. 2.75 D. 1.75	R. E. 20/200 L. E. 20/40	Tenotomy of right int.	1 year.	R. E. 20/200 L. E. 20/20—	conv. 5°	Full correction.
322. F.	17	H. D. 4.50	R. E. 20/70 L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	1 year.	same	divergence 3°	Full correction.
323. M.	15	H. D. 1.50	B. E. 20/30+	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
324. M.	13	H. D. 2	R. E. 20/20 L. E. 20/30–	Tenotomy of left int.	2 years.	same	slight conv.	Full correction.
325. F.	13	H. D. 1.50	B. E. 20/40 –	Tenotomy of left int. " right int., 3 wks. later.	1 year.	R. E. 20/30 L. E. 20/40–	slight conv.	L. E. full correction.
326. M.	9	H. D. 5.50	R. E. 20/30 L. E. 20/50	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
327. F.	26	Ash.	R. E. fingers L. E. 20/40	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Full correction.
328.* M.	14	H. D. 3	R. E. 20/200 L. E. 20/20 –	Tenotomy of right int., and advancement of right ext.	4 years.	same	parallelism	R. E. full correction.
329. M.	11	H. D. 4.50	B. E. 20/100	Tenotomy of right int.	5 years.	R. E. 20/100 L. E. 20/30+	parallelism	Full correction.
330. M.	10	M. D. 3	R. E. 10/200 L. E. 20/200	Tenotomy of right int., and atropine for 2 mos.	2 years.	R. E. 10/200 L. E. 20/70	conv. 3°	
331. F.	17	H. D. 4.50 H. D. 1.50	R. E. 20/200 L. E. 20/50	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 20/200 L. E. 20/30–	parallelism	Full correction.
334. F.	14	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	R. E. full correction.
335. F.	11	H. D. 6	R. E. 20/100 L. E. 20/30	Tenotomy of right int., and advancement of right ext.	18 mos.	same	parallelism	Full correction.
338. M.	21	H. D. 0.50	R. E. 20/30+ L. E. 20/70 –	Tenotomy of left int. " right int., 2 wks. later.	1 year.	R. E. 20/20 L. E. 20/70—	conv. 3°	Full correction.
339. M.	9	H. D. 5.50	R. E. 20/200 L. E. 20/30 –	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
340. M.	7	H. D. 1.75 D. 3.50	R. E. 20/40+ L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/20— L. E. 10/200	conv. 3°	Full correction.
341. M.	13	H. D. 6	B. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	L. E. full correction.
342. F.	23	H. D. 4	R. E. 20/200 L. E. 20/200	Simultaneous tenotomy of both interni.	6 years.	R. E. 20/40+ L. E. 20/100	divergence 5°	Full correction.
343. M.	14	H. D. 4	B. E. 20/100	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 5°	R. E. full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
344. F.	12	H. D. 1.75	B. E 20/30+	Tenotomy of left internus.	2 years.	same	conv. 3°	Convulsions at the age of 2 years. Full correction.
345. F.	23	H. D. 2.50	R. E. 20/30– L. E. 2/200	Tenotomy of both interni. One month later advancement of left ext. and tenotomy of left int.	3 years.	same	parallelism	Leucoma adherens and squint L. E.
346. F.	21	H. D. 2.75	R. E. 20/20 L. E. 20/30	Tenotomy of left int. " right int., 4 mos. later.	1 year.	same	parallelism	Full correction.
347. M.	16	M. D. 1.50	R. E. 20/50 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2½ years.	R. E. 20/20— L. E. 20/200	parallelism	Paresis of L. ext.
348. F.	19	H. D. 5.50	R. E. 20/40 L. E. 10/200	Simultaneous tenotomy both interni.	2 years.	same	conv. 5°	Macula corneæ. Full correction.
349. M.	6	H. D. 2	R. E. 20/40 L. E. 20/30+	Tenotomy of right int. " left int., 3 wks. later.	4 years.	same	conv. 3°	Full correction.
350. F.	7	H. D. 1	B. E. 20/20—	Tenotomy of left int.	2 years.	same	slight conv.	L. E. full correction.
351 M.	14	H. D. 3.50	R. E. 20/40 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	L. E. full correction.
352. F.	18	Ash.	R. E. 20/40 L. E. 3/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 3°	Full correction.
353. F.	20	H. D. 1	R. E. 20/50 L. E. 20/30+	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 3°	Full correction.
354. M.	28	H. D. 1.50	R. E. 10/200 L. E. 20/200	Tenotomy both int., and advancement right ext.	1 year.	same	parallelism	Full correction.
355. F.	16	H. D. 1	R. E. 20/20 L. E. 3/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 3°	Full correction.
356. M.	10	H. D. 1.50 D. 2.50	R. E. 20/30 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	4 years.	same	parallelism	Full correction.
357. M.	9	H. D. 3	B. E. 20/70	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	conv. 10°	R. E. full correction.
358. M.	14	H. D. 3.50	R. E. 20/50 + L. E. 4/200	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/40+ L. E. 4/200	conv. 5°	R. E. full correction.
359. M.	27	H. D. 1	R. E. 20/30 L. E. 20/20	Tenotomy of right int.	1 year.	same	parallelism	Full correction.
360. F.	11	H. D. 4	R. E. 20/100 L. E. 20/30+	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
361. F.	23	Ash. Co.	R. E. 20/20 L. E. 20/40	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	conv. 3°	Full correction.
362. F.	10	H. D. 1.25 D. 3	R. E. 20/20 L. E. 20/30—	Tenotomy of left int. " right int., 3 wks. later.	3 years.	same	conv. 3°	Full correction.

363. M.	8	H. D. 1.25 D. 2.75	R. E. 20/20 L. E. 20/40	Tenotomy of left int.	1 year.	same	conv. 5°	Full correction.
364. M.	7	H. D. 0.75	R. E. 20/20 L. E. 20/30	Tenotomy of left int.	3 years.	same	parallelism	Full correction.
365. M.	10	H. D. 5.50 D. 3.50	R. E. 20/50+ L. E. 20/200	Tenotomy of right int.	2 years.	same	conv. 5°	Full correction.
366. F.	14	H. D. 2	R. E. 20/20 L. E. 20/50	Tenotomy of left int.	1 year.	same	conv. 3°	Full correction.
367. M.	11	H. D. 1.50	R. E. 20/20 L. E. 20/30	Tenotomy of left int.	2 years.	same	very slight conv. without his glasses	Full correction.
368. M.	8	H. D. 1	B. E. 20/20	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
369. F.	13	H. D. 5.50	R. E. 20/100 L. E. 4/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 3°	L. E. full correction.
370. F.	15	H. D. 3 D. 3.50	R. E. 20/30 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	L. E. full correction.
371. M.	14	H. D. 1.50	B. E. 20/20—	Tenotomy of right int. " left int., 1 mo. later.	2 years.	same	parallelism	R. E. full correction.
372. F.	14	H. D. 2	R. E. 20/70 L. E. 20/20—	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	conv. 5°	R. E. full correction.
373. M.	24	H. D. 10 H. D. 6	R. E. 20/20 L. E. 1/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 3°	Full correction.
374. M.	39	H. D. 1.50	R. E. 20/30+ L. E. 1/200	Tenotomy of left int., and advancement of left ext. Tenotomy of right int. 3 wks. later.	1 year.	same	parallelism	Full correction.
375. M.	42	H. D. 1	R. E. 20/20 L. E. 3/200	Tenotomy of left int., and advancement of left ext.	6 mos.	same	conv. 5°	Full correction.
376. F.	13	H. D. 4.50 D. 5	R. E. 20/70 L. E. 4/200	Tenotomy of left int., and advancement of left ext. Tenotomy of right int.	4 years.	R. E. 20/40+ L. E. 4/200	parallelism	Full correction.
377. F.	6	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	Full correction.
378. F.	9	H. D. 3	R. E. 20/40 L. E. 20/50	Tenotomy of left int. " right int., 3 wks. later.	4 years.	R. E. 20/30 L. E. 20/50	conv. 3°	Full correction.
379. F.	15	Em.	R. E. 20/20 L. E. 20/50	Tenotomy of left int. " right int., 4 mos. later.	18 mos.	same	parallelism	
380. M.	22	Ash.	R. E. 20/20 L. E. 20/30—	Tenotomy of left int.	1 year.	same	conv. 5°	Full correction.
381. F.	12	H. D. 5	R. E. 20/70 L. E. 20/40	Tenotomy both int. simultaneously.	2 years.	same	conv. 5°	Full correction.
382. M.	6	M. D. 1.50	B. E. 20/70	Tenotomy of right int.	5 years.	B. E. 20/30	slight conv.	Full correction.
383. M.	42	Ash.	R. E. 20/70 L. E. 20/30+	Tenotomy of right int. " left int., 3 wks. later.	8 mos.	same	conv. 3°	Full correction.
384. F.	27	Ash.	R. E. 20/20 L. E. 20/30	Tenotomy of left int.	18 mos.	same	parallelism	Full correction.
385. M.	14	H. D. 1.50	B. E. 20/30	Tenotomy of right int.	2 years.	same	slight conv.	Full correction.
386. F.	9	H. D. 3	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	5 years.	R. E. 20/30 L. E. 20/200	parallelism	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
387. F.	17	H. D. 5.50	R. E. 20/30 L. E. 4/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 5°	Full correction.
388. F.	14	H. D. 1.50 D. 3	R. E. 20/30 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 5°	Full correction.
389. F.	6	H. D. 1.50	R. E. 20/70 L. E. 20/50+	Tenotomy of right int. " left int., 3 wks. later.	5 years.	same	slight conv.	Full correction.
390. F.	14	H. D. 0.50	B. E. 20/20	Tenotomy of right int.	2 years.	same	slight conv.	Full correction.
391. M.	15	H. D. 1.25	B. E. 20/20–	Tenotomy of left int.	1 year.	same	slight conv.	Full correction.
392. M.	11	H. D. 3	R. E. 20/100 L. E. 20/30–	Tenotomy of right int. " left int., 2 wks. later.	18 mos.	same	conv. 5°	Full correction.
393. M.	9	H. D. 1	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	Full correction.
394. F.	16	H. D. 3.50	B. E. 20/50–	Tenotomy of left int. " right int., 2 wks. later.	2 years.	B. E. 20/30	diverg. 3°	Encanthis. Full correction.
395. M.	15	H. D. 2	R. E. 10/200 L. E. 20/30–	Tenotomy of right int., and advancement of right ext.	20 mos.	same	parallelism	No fixation with R. E. Paresis of right ext.
396. F.	15	H. D. 0.75	B. E. 20/20	Tenotomy of right int.	3 years.	same	conv. 3°	Full correction.
397. F.	6	H. D. 1.50	R. E. 20/30 L. E. 20/20	Tenotomy of right int. " right int., 2 yrs. later.	4 years.	same	parallelism	Full correction.
398. M.	13	Ash.	R. E. 20/20 L. E. 20/30–	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
399. M.	9	Co. Ash.	B. E. 20/50	Tenotomy of right int.	1 year.	B. E. 20/30–	parallelism	Full correction.
400. M	14	H. D. 3	R. E. 20/30 L. E. 20/50–	Tenotomy of left int. " right int., 3 wks. later.	2 years.	same	conv. 5°	Full correction.
401. F.	8	H. D. 4.50	R. E. 20/30 L. E. fingers	Simultaneous tenotomy both interni.	3 years.	same	conv. 5°	Weak ext.
402. M.	14	H. D. 4	R. E. 20/200 L. E. 20/30–	Tenotomy of right int., and advancement of right ext.	2½ years.	same	parallelism	Full correction.
403. F.	12	H. D. 2.50	R. E. 20/40 L. E. 20/40+	Tenotomy right int. at age of 5 " left int. later.	3½ years.	same	conv. 3°	Weak ext.
404. F.	15	H. D. 4.50	R. E. 20/70 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 5°	Full correction.
405. F.	22	H. D. 4.50	R. E. 20/50 L. E. 20/20	Tenotomy of right int. " left int., 6 wks. later.	3 years.	same	conv. 5°	Full correction.
406. M.	14	H. D. 4	R. E. 20/70 L. E. 20/20	Tenotomy right int. " left int., 2 wks. later.	18 mos.	same	conv. 5°	Full correction.
407. F.	14	H. D. 1.50	B. E. 20/20–	Tenotomy of left int.	2 years.	same	conv. 5°	Full correction.
408. M.	14	H. D. 3	R. E. 20/50 L. E. 20/20–	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	conv. 3°	Full correction.
409. F.	12	H. D. 7	R. E. 20/200 L. E. 15/200	Tenotomy of left int., and advancement of left ext.	2½ years.	same	parallelism	Full correction.

410. M.	10	H. D. 6.50	B. E. 20/100	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	conv. 5°	Full correction.
411. M.	13	H. D. 1	B. E. 20/20	Tenotomy of right int.	2 years.	same	very slight conv.	R. E. full correction.
412. M.	8	H. D. 2	R. E. 20/100 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Came on after a fall. Paresis right ext. Full correction.
413. F.	13	H. D. 2.50	R. E. 20/20 L. E. 20/40—	Tenotomy of left int. " right int., 2 wks. later	1 year.	same	parallelism	Full correction.
414. F.	13	H. D. 2	B. E. 20/40+	Tenotomy of left int. " right int., 3 wks. later.	1 year.	same	slight conv.	Full correction.
415. F.	19	H. D. 5	R. E. 20/200 L. E. 20/30	Tenotomy of both int.	1 year.	R. E. 20/70 L. E. 20/30	conv. 3°	Weak externi.
416. M.	12	H. D. 1.75 D. 3	R. E. 20/40 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/30 L. E. 20/100	parallelism	Full correction.
417. M.	23	Co. Ash.	R. E. 20/50 L. E. 20/40	Tenotomy of right int.	2 years.	same	conv. 5°	Full correction.
418. F.	12	Co. Ash.	R. E. 20/20 L. E. 20/50	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
419. M.	14	H. D. 4	R. E. 20/30— L. E. 20/50—	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
420. M.	26	H. D. 3	R. E. 20/200 L. E. 20/100	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Corneal maculae. Full c r-rection.
421. M.	12	H. D. 2	R. E. 20/50— L. E. 20/40	Tenotomy of right int.	3 years.	same	parallelism	Full correction.
422. M.	21	H. D. 2.50	R. E. 20/20 L. E. 20/200	Tenotomy of both int. " left int. 1 mo. later.	1 year.	same	parallelism	Full correction.
423. F.	47	H. D. 3	B. E. 20/40	Tenotomy of right int. " left int. 1 mo. later.	1 year.	same	conv. 5°	Full correction.
424. F.	17	H. D. 4	R. E. 20/30— L. E. 10/200	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
425. F.	8	H. D. 4.50	R. E. 20/50 L. E. 20/200	Tenotomy of left int.	1 year.	R. E. 20/30 L. E. 20/200	conv. 5°	Full correction.
426. F.	25	H. D. 4.50	R. E. 20/30— L. E. 20/70	Tenotomy of left int.	1 year.	same	parallelism	Full correction.
427. M.	7	H. D. 1.50	R. E. 20/20 L. E. 20/40	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	conv. 3°	Full correction.
428. F.	10	Ash. Co.	R. E. 20/70 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1½ years.	R. E. 20/40+ L. E. 20/200	parallelism	Full correction.
429. F.	14	H. D. 1.50	B. E. 20/30	Tenotomy of right int. " left int., 3 wks. later.	2 years.	same	conv. 3°	Full correction.
430. F.	18	H. D. 1	R. E. 20/50 L. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	Full correction.
431. M.	10	H. D. 4	B. E. 20/50	Tenotomy of both int. simultaneously.	3 years.	same	divergence 3°	Full correction.
432. M.	14	Em.	B. E. 20/20	Tenotomy of left int.	18 mos.	same	slight conv.	L. E. following a fall on back of head.
433. M.	52	H. D. 9	R. E. 10/200 L. E. 3/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
434. F.	7	H. D. 1.50	R. E. 20/30— L. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 3°	L. E. marg. bleph. and chalazion.
435. F.	6	H. D. 2	B. E. 20/30—	Tenotomy of both int.	3 years.	same	conv. 10°	Marked conv. B. E. Full correction.
436. F.	15	Co. Ash.	R. E. 20/50 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
437. M.	13	H. D. 3	R. E. 20/20— L. E. 20/40—	Tenotomy of left int.	2 years.	same	conv. 3°	L. E. full correction.
438. F.	13	H. D. 2.75	R. E. 20/20 L. E. 20/30+	Tenotomy of left int.	2 years.	same	very slight conv.	Diphtheria, weak ext. Full correction.
439. M.	8	H. D. 1.50	R. E. 20/30 L. E. 20/40	Tenotomy of left int. " right int., 1 mo. later.	1 year.	same	conv. 3°	Full correction.
440. F.	7	H. D. 1.25	B. E. 20/20—	Tenotomy of right int.	3 years.	same	slight conv.	R. E. full correction.
441. F.	17	H. D. 4.50	R. E. 20/40+ L. E. fingers	Tenotomy of both int., and advancement of left ext.	1 year.	same	diverg. 3°	Full correction.
442. M.	13	Co. Ash.	R. E. 20/50— L. E. 20/30	Tenotomy of right int.	2 years.	same	conv. 3°	Full correction.
443. F.	15	H. D. 1.50 D. 1	R. E. 20/30 L. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
444. F.	12	H. D. 5	R. E. 20/30 L. E. 20/70	Tenotomy of left int. " right int., 2 wks. later.	5 years.	same	conv. 5°	Convergens and sursum vergens. Full correction.
445. F.	13	H. D. 2	B. E. 20/20—	Tenotomy of right int. " left int., 3 mos. later.	1 year.	same	parallelism	R. E. measles and croup. Full correction.
446. F.	7	H. D. 3.50	R. E. 20/50 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
447. M.	15	H. D. 1.50	B. E. 20/20—	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
448. M.	13	H. D. 4	R. E. 20/70 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	L. E. full correction.
449. F.	10	H. D. 3	R. E. 20/20 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	4 years.	same	parallelism	Full correction.
450. M.	19	H. D. 3	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
451. M.	8	Ash.	R. E. 20/50 L. E. 20/40	Tenotomy of right int. " left int., 2 wks. later.	2 years.	R. E. 20/40+ L. E. 20/30+	slight conv.	R. E. full correction.
452. M.	12	Co. Ash.	R. E. 20/40— L. E. 10/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	L. E. full correction.
453. F.	12	H. D. 2.50	R. E. 20/70— L. E. 20/20—	Tenotomy of right int. " left int., 3 wks. later.	2 years.	same	conv. 3°	R. E. full correction.

454. M.	14	Asm. D. 1.50	R. E. 20/70 L. E. 20/50	Tenotomy of right int. " left int., 2 wks. later.	1 year.	R. E. 20/50 L. E. 20/40—	parallelism	R. E. full correction.
455. M	10	H. D. 4	R. E. 10/200 L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	R. E. full correction.
456. M.	12	H. D. 1.50	R. E. 20/20—	Tenotomy of left int.	1 year.	same	conv. 3°	L. E. full correction.
457. F.	15	H. D. 2.50	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 3 wks. later.	1 year.	same	parallelism	R. E. full correction.
458. F.	15	H. D. 1	B. E. 20/20	Tenotomy of right int.	2 years.	same	slight conv.	R. E. full correction.
459. M.	13	H. D. 5	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	18 mos.	R. E. 20/30 L. E. 20/200	parallelism	L. E. full correction.
460. M.	21	H. D. 1.25 D. 1.50	R. E. 20/20— L. E. 20/30	Tenotomy of left int.	2 years.	same	parallelism	Full correction.
461. M.	9	Ash. Co.	R. E. 20/70 L. E. 5/100	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	conv. 10°	Full correction.
462. M.	6	H. D. 2.50	B. E. 20/20—	Tenotomy of left int.	2 years.	same	conv. 3°	Full correction.
463. M.	6	H. D. 5.50	R. E. 10/200 L. E. 20/70	Tenotomy of right int., and advancement of right ext.	4 years.	same	parallelism	R. E. full correction.
464. F.	14	H. D. 2.50	B. E. 20/20	Tenotomy of left int.	1 year.	same	conv. 5°	Full correction.
465. F.	15	H. D. 2	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	18 mos.	same	parallelism	R. E. full correction.
466. M.	24	Ash.	B. E. 20/40—	Tenotomy of left int. " right int., 3 wks. later.	1 year.	same	slight conv.	Full correction.
467. M.	15	H. D. 6	R. E. 10/200 L. E. 20/70	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	R. E. full correction.
468. M.	14	H. D. 3	R. E. 20/40+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 3°	Full correction.
469. F.	6	H. D. 3	R. E. 20/30— L. E. 5/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
470. M.	44	H. D. 2.25	R. E. 20/200— L. E. 20/70+	Tenotomy of right int., and adv. of right ext. 3 w. later.	8 mos.	same	conv. 5°	Retinal hem.; low grade of neuritis R. E.
471. M.	14	H. D. 1	B. E. 20/20—	Tenotomy of right int.	4 years.	same	conv. 5°	R. E. full correction.
472. M.	42	H. D. 2.50	R. E. 20/200 L. E. 20/30—	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	L. E. full correction.
473. F.	6	H. D. 2.50	R. E. 20/70 L. E. 20/200	Tenotomy of left int. " right int., 3 wks. later.	5 years.	R. E. 20/40+ L. E. 20/200	conv. 5°	Full correction.
474. M.	14	H. D. 1.50	R. E. 20/30 L. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
475. F.	18	H. D. 2.50	R. E. 20/20 L. E. 20/70—	Tenotomy of left int.	5 years.	same	conv. 5°	Full correction.
476. F.	11	H. D. 7	R. E. 20/50 L. E. 15/200	Tenotomy of left int., and advancement of left ext.	5 years.	same	parallelism	Measles and diphtheria 7 yrs. age; full correction.
477. F.	14	H. D. 1 D. 3.50	R. E. 20/20 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	L. E. full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
478. F.	6	H. D. 1.50	R. E. 20/30 L. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 3°	R. E. conj.; full correction.
479. M.	13	H. D. 2	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
480. F.	12	H. D. 1.25	B. E. 20/20	Tenotomy of left int.	1 year.	same	slight conv.	L. E. full correction.
481. M.	14	H. D. 1.50	R. E. 20/20— L. E. 20/100	Tenotomy of left int. " right int., 3 wks. later.	2 years.	R. E. 20/20 L. E. 20/40 —	conv. 5°	L. E. ulcer of cornea: full correction.
482. M.	8	H. D. 2.25	R. E. 20/30— L. E. 20/100	Tenotomy of left int., and advancement of left ext.	18 mos.	same	parallelism	Full correction.
483. F.	7	H. D. 3	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	4 years.	same	parallelism	Full correction.
484. F.	14	H. D. 1.50	R. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 3°	R. E. full correction.
485. F.	8	H. D. 2	B. E. 20/20—	Tenotomy of right int.	18 mos.	same	conv. 5°	Full correction.
486. M.	9	H. D. 4 D. 5	R. E. 20/50 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
487. M.	9	H. D. 2.50 D. 1.50	R. E. 20/40 L. E. 20/30+	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 3°	R. E. full correction.
488. F.	7	H. D. 3 D. 1	R. E. 20/100 L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	Full correction.
489. M.	13	Em.	B. E. 20/20	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 5°	Paresis of left ext. from diphtheria 5 weeks ago.
490. M.	13	M. D. 5.50 D. 6	R. E. 20/70 L. E. 20/200	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	divergence 5°	Full correction.
491. F.	14	H. D. 2	B. E. 20/30	Tenotomy of right int. " left int., 2 wks. later.	2 years.	same	slight conv.	Full correction.
492. F.	6	H. D. 1.50	B. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	3 years.	same	parallelism	Full correction.
493. F.	18	H. D. 3.50	R. E. 20/20 L. E. 20/70—	Tenotomy of left int. " right int., 4 mos. later.	2 years.	same	slight conv.	Full correction.
494. M.	12	H. D. 1.75	R. E. 20/40 L. E. 20/20	Tenotomy of right int.	2 years.	same	conv. 5°	R. E. full correction.
495. M.	34	Ash.	R. E. 20/70 L. E. 20/30	Tenotomy of right int., and advancement of right ext. 2 weeks later. Tenotomy of left int.	8 mos.	same	diverg. 3°	Full correction.
496. M.	13	H. D. 3	R. E. 20/50 L. E. 20/50+	Tenotomy of right int.	2 years.	same	conv. 3°	R. E. full correction.

497. M.	8	H. D. 5 D. H.	R. E. 20/100— L. E. 20/50+	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	Full correction.
498. F.	13	H. D. 4.50	R. E. 3/200 L. E. 20/50	Tenotomy of right int., and advancement of right ext.	2 years.	same	conv. 3°	R. E. full correction.
499. F.	6	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	4 years.	same	conv. 5°	L. E. full correction.
500. F.	8	H. D. 5	B. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	slight conv.	Full correction.
501. M.	6	H. D. 2 D. 1	R. E. 20/30— L. E. 20/20	Tenotomy of right int. " left int., 2 wks later.	4 years.	same	conv. 5°	R. E. full correction.
502. M.	12	Ash.	B. E. 20/50+	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 3°	R. E. full correction.
503. F.	8	H. D 2	B. E. 20/30+	Tenotomy of right int. " left int., 3 wks. later.	2 years.	same	parallelism	Full correction.
504. F.	15	H. D. 3	R. E. 10/200 L. E. 20/50+	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 20/70 L. E. 20/30—	parallelism	R. E. keratitis; full correction later.
505. M.	15	H. D. 1.50	R. E. 20/20 L. E. 20/30—	Tenotomy of left int. " right int., 8 mos. later.	2 years.	same	conv. 3°	Full correction.
506. F.	6	H. D. 2	B. E. 20/20	Tenotomy of left int.	4 years.	same	parallelism	Full correction.
507. F.	16	H. D. 2.25	R. E. 20/30 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
508. F.	15	H. D. 1	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 5°	R. E. full correction.
509. M.	13	H. D. 5	B. E. 20/100	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
510. F.	15	H. D. 2	B. E. 20/30—	Tenotomy of left int.	1 year.	same	conv. 5°	Full correction.
511. M.	12	H. D. 1.50	R. E. 20/40— L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	parallelism	R. E. full correction.
512. M.	13	H. D. 1.25	R. E. 20/20 L. E. 20/40	Simultaneous tenotomy both interni.	18 mos.	same	conv. 3°	B. E. very marked conv. Full correction.
513. F.	9	H. D. 1.50	B. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Maculæ corneæ B. E.
514. M.	8	H. D. 1.75	R. E. 20/30+ L. E. light	Tenotomy of left int., and advancement of left ext.	3 years.	same	conv. 3°	L. E. detached retina downward and outwards.
515. M.	7	H. D. 1	B. E. 20/20	Tenotomy of right int.	2 years.	same	parallelism	R. E. full correction.
516. F.	7	H. D. 1.25 D. 2.25	R. E. 20/30+ L. E. 20/200	Tenotomy of left int.	3 years.	R. E. 20/20 L. E. 20/200	div. 3°	Rotary nystagmus; full correction.
517. F.	30	H. D. 2	R. E. 20/20 L. E. fingers	Tenotomy of left int. 12 years ago. Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Both ext. weak; full correction.
518. F.	14	H. D. 3	B. E. 20/100 unimproved	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 5°	Nystagmus. Dau. of preceding. Full correction.
519. M.	6	H. D. 3	B. E. 20/70	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Son of preceding. Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS.—CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
520. M.	18	H. D. 1.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	No fixation with L. E. Occasional transient total loss of vision in L. E. Full correction.
521. M.	17	H. D. 4 () D 2 ax. 90° D. 3.50 () D 0.50 ax. 90°	R. E. 20/100+ L. E. 20/20	Tenotomy of right int. and advancement of right ext.	8 years.	same	parallelism	Weak right ext. Full correction.
522. F.	10	H. D. 5	B. E. 20/50+	Tenotomy of right int., and advancement right ext.	9 years.	same	parallelism	Full correction.
523. F.	9	H. D. 2.50	R. E. 20/100 L. E. 20/20	Tenotomy of right int. " left int., 2 wks. later.	1 year.	same	conv. 5°	Full correction.
524. F.	12	Em.	B. E. 20/20+	Tenotomy of right int.	2 years.	same	parallelism	Followed pertussis R. E.
525. M.	8	H. D. 6	B. E. 20/100	Tenotomy of left int., and advancement of left ext.	18 mos.	same	conv. 5° R. E.	Full correction.
526. M.	11	H. D. 6 D. 5	R. E. 20/200 L. E. 20/100	Tenotomy of right int. " left int., 1 week later.	1 year.	R. E. 20/200 L. E. 20/70−	conv. 3°	Full correction.
527. F.	13	H. D. 3	R. E. 20/40+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	L. E. full correction.
528. F.	14	H. D. 5	B. E. 20/100	Simultaneous tenotomy both interni.	1½ years.	same	conv. 3°	Full correction.
529. F.	15	H. D. 3.50	B. E. 20/50+	Tenotomy of right int. " left int., 1 week later.	1 year.	same	slight conv.	R. E. full correction.
530. F.	6	H. D. 5.50	R. E. 20/100 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	3 years.	R. E. 20/50 L. E. 10/200	parallelism	L. E. full correction.
531. M.	14	H. D. 1.50	B. E. 20/20	Tenotomy of right int.	1 year.	same	conv. 3°	R. E. full correction.
532. M.	7	H. D. 4	R. E. 20/50+ L. E. 20/70−	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 5°	Paresis left ext. Full correction.
533. M.	18	H. D. 1	B. E. 20/20	Tenotomy of right int.	8 mos.	same	parallelism	Full correction.
534. F.	15	H. D. 5 D. 4.50	R. E. 20/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	7 years.	same	parallelism	Full correction.
535. F.	17	H. D. 4	R. E. 20/50 L. E. 20/200	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Weak ext. rect. Full correction.
536. M.	15	H. D. 1.50	B. E. 20/20	Tenotomy of left int.	2 years.	same	conv. 3°	L. E. full correction.
537. F.	14	H. D. 4 D. 5.50	R. E. 20/50 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	R. E. 20/30— L. E. 20/100	parallelism	Full correction.

538. M.	13	H. D. 5	B. E. 20/70 +	Tenotomy of right int. " left int., 1 week later.	1 year.	same	conv. 5°	Full correction.
539. M.	6	H. D. 3	R. E. 20/30 + L. E. 20/50—	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	conv. 3°	Full correction.
540. M.	10	H. D. 2 D. 1	B. E. 20/20	Tenotomy of right int. " left int., 1 week later.	2 years.	same	parallelism	Full correction; at first div.; later parallelism.
541. M.	68	Co. asm.	R. E. 20/50 L. E. fingers	Tenotomy of left int., and advancement of left ext.	6 mos.	same	parallelism	Cataract; extraction subsequently made with good result.
542. F.	32	H. D. 1.50	R. E. 20/20 L. E. fingers	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
543. M.	6	M. D. 2	B. E. 5/200	Tenotomy of right int. " left int., 2 wks. later.	2 years.	B. E. 20/200	conv. 5°	Ophthalmia neonat.; now interstitial keratitis.
544. M.	15	H. D. 3	B. E. 20/30—	Tenotomy of left int. " right int., 1 week later.	1 year.	same	conv. 3°	Full correction.
545. M.	15	H. D. 6	B. E. 20/200	Tenotomy of right int., and advancement of right ext.	2½ years.	same	parallelism	Encanthis; full correction.
546. M.	25	H. D. 3 H. D. 6	R. E. 20/20 L. E. fingers	Tenotomy of left int., and advancement of left ext.	3 years.	same	conv. 3°	Followed scarlatina at 3; full correction.
547. M.	7	H. D. 4 D. 2.50	R. E. 20/100 L. E. 20/20	Tenotomy of right int.	2 years.	same	parallelism	Full correction.
548. F.	11	H. D. 1.25	B. E. 20/20	Tenotomy of left int.	1 year.	same	conv. 3°	Full correction.
549. F.	18	H. D. 3 () D. 1 ax. 45° H. D. 5	R. E. 20/70— L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1½ years.	same	conv. 2°	Full correction.
550. M.	15	H. D. 3	R. E. 20/40 + L. E. 2/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
551. M.	15	H. D. 2.50 D. 3.50	R. E. 20/40 L. E. 20/200	Tenotomy of left int., and advancement left ext.	1 year.	same	slight conv.	Full correction.
552. M.	15	H. D. 5	B. E. 20/100	Tenotomy of right int. " left int. 1 week later.	18 mos.	same	conv. 5°	Full correction.
553. F.	15	H. D. 2 D. 3	R. E. 20/20 L. E. 20/50	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
554. F.	14	H. D. 3.50 () D. 1 ax. 90° B. E.	R. E. 20/40 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
555. M.	8	H. D. 2	R. E. 20/100 L. E. 20/50	Tenotomy of right int., and advancement of right ext.	3 years.	R. E. 20/100 L. E. 20/30 +	parallelism	Followed general chorea; full correction
556. F.	22	H. D. 1	R. E. 20/30— L. E. 20/20—	Tenotomy of right int. " left int., 2 wks. later.	7 years.	same	parallelism	Full correction.
557. F.	11	H. D. 7	R. E. 2/200 L. E. 10/200	Tenotomy of right int., and advancement of right ext. Difficult operation.	2 years.	same	conv. 3°	Very narrow palpebral slit; pupil of R. E. displaced downwards and inwards; very shallow chambers; full correction.
558. M.	19	H. D. 3	R. E. 20/20 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
559. F.	22	H. D. 2.50	B. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	divergence 3°	Paresis right ext.; full correction; crossed diplopia.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
560. M.	7	H. D. 1.50	R. E. 20/20— L. E. 20/30—	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	parallelism	Following continued fever 3 years before.
561. M.	9	H. D. 2.50	B. E. 20/30+	Tenotomy of right int.	2 years.	same	slight conv.	Full correction.
562. F.	14	H. D. 3.50	R. E. 20/70 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
563. F.	7	H. D. 6	R. E. 20/200 L. E. 20/70	Tenotomy of right int., and advancement of right ext.	4 years.	same	parallelism	Full correction.
564. F.	11	H. D. 5	R. E. 20/20— L. E. 20/30—	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
565. M.	7	H. D. 5.50	R. E. 5/200 L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	2 years.	same	conv. 3°	Full correction.
566. F.	12½	H. D. 1.50	B. E. 20/30—	Tenotomy of left int. " right int., 1 wk. later.	1 year.	same	conv. 3°	B. E. full correction.
567. M.	10	H. D. 2.25	R. E. 20/20 L. E. light	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 3°	L. E. detached retina. Full correction.
568. M.	6	H. D. 4	R. E. 20/40+ L. E. 10/100	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
569. M.	7	H. D. 2	R. E. 20/20 L. E. 20/70	Tenotomy of left int. " right int., 3 wks. later.	2 years.	same	slight conv.	Full correction.
570. F.	17	H. D. 1.50	B. E. 20/40	Tenotomy of right int. " left int., 1 wk. later.	1 year.	same	parallelism	Full correction.
571. F.	7	H. D. 2	R. E. 20/20 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	3 years.	same	parallelism	Full correction.
572. F.	12	Em.	B. E. 20/20	Tenotomy of left int.	1 year.	same	conv. 3°	L. E. full correction.
573. F.	12½	H. D. 1	B. E. 20/20	Tenotomy of left int.	1 year.	same	conv. 3°	L. E. full correction.
574. F.	10	H. D. 2.75	R. E. 20/70 L. E. 20/20	Tenotomy of right int. " left int., 1 wk. later.	2 years.	same	parallelism	Full correction.
575. M.	9	H. D. 1.50 D. 2.75	B. E. 20/30—	Tenotomy of left int. " right int., 1 wk. later.	18 mos.	same	parallelism	Full correction.
576. M.	6	H. D. 4	R. E. 20/100 L. E. 20/40+	Tenotomy of right int., and advancement of right ext.	4 years.	R. E. 20/100 L. E. 20/30+	parallelism	R. E. full correction.
577. F.	8	H. D. 6.50	R. E. 20/100 L. E. 6/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 5°	L. E. full correction.
578. M.	26	M. D. 2.50	R. E. 20/200 L. E. light	Tenotomy of left int., and advancement of left ext.	1 year.	same	div. 3°	Nystagmus rotary; Choroidal atrophy.
579. F.	14	H. D. 1.50	R. E. 20/20 L. E. 20/200	Tenotomy of left int.	2 years.	same	conv. 5°	Full correction.

580. F.	14	H. D. 1	R. E. 20/20 L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	2 years.	same	parallelism	R. E., after diphtheria, two years ago. Full correction.
581. M.	42	H. D. 3 D. 3.50	B. E. 20/50	Simultaneous tenotomy of both interni.	1 year.	B. E. 20/30—	parallelism	Full correction.
582. F.	13	H. D. 1.50 D. 2.75	R. E. 20/20 L. E. 20/70	Tenotomy of left int. " right int., 4 wks. later.	18 mos.	R. E. 20/20 L. E. 20/40—	conv. 3°	L. E. acute purulent conj. Full correction.
583. M.	14½	H. D. 4	R. E. 10/200 L. E. 20/50+	Tenotomy of right int., and advancement of right ext.	1 year.	R. E. 10/200 L. E. 20/40+	parallelism	R. E. full correction.
584. M.	21	H. D. 2	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
585. F.	22	H. D. 2 () D. 2.50 ax. 80° D. 2.50 () D. 1.50 ax. 90°	R. E. 20/200 L. E. 20/40	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
586. F.	11	H. D. 4 () D. 1 ax. 90°	R. E. 20/20— L. E. 20/50—	Tenotomy of left int. " right int., 2 wks. later.	3 years.	same	conv. 3°	Full correction.
587. M.	10	H. D. 5 D. 3	R. E. 10/200 L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	2 years.	same	slight conv.	Full correction.
588. M.	25	H. D. 1.50	R. E. 20/20 L. E. 20/70	Tenotomy of left int. " right int., 1 wk. later.	1 year.	same	parallelism	Full correction.
589. M.	12	H. D. 4.50 D. 4	R. E. 2/200 L. E. 20/20—	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Paresis right ext. Full correction.
590. M.	31	M. and Asm.	R. E. 20/30— L. E. fingers	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	R. E. keratitis.
591. F.	12	H. D. 2.50	R. E. 20/70 L. E. 20/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	conv. 3°	Full correction.
592. F.	19	H. D. 2 D. 4.	R. E. 20/20 L. E. 6/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	parallelism	Full correction.
593. M.	7	H. D. 5	R. E. 20/200 L. E. 20/50+	Tenotomy of right int., and advancement of right ext.	2 years.	R. E. 20/200 L. E. 20/30—	slight conv.	Full correction.
594. M.	9	H. D. 3	R. E. 20/200 L. E. 20/30—	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	Unusual venous engorgement and coil of veins on disc B. E.
595. F.	14½	H. D. 5	B. E. 20/70—	Tenotomy of left int. " right int., 2 wks. later.	1 year.	same	conv. 5°	Full correction.
596. F.	15	H. D. 2.50	B. E. 20/30—	Tenotomy of left int. " right int., 1 wk. later.	8 mos.	same	conv. 3°	L. E. full correction.
597. F.	7	H. D. 1	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	2 years.	same	div. 3°	L. E. full correction.
598. M.	8	H. D. 4	R. E. 10/200 L. E. 20/30—	Tenotomy of right int., and advancement of right ext.	18 mos.	same	parallelism	Full correction.
599. F.	6	H. D. 4	R. E. 20/200 L. E. 20/30+	Tenotomy of right int., and advancement of right ext.	3 years.	same	parallelism	R. E. full correction.
600. F.	15	H. D. 1.50	B. E. 20/20—	Tenotomy of left int.	1 year.	same	conv. 3°	L. E. full correction.
601. M.	10	H. D. 7	R. E. 20/40 L. E. 10/200	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.

DR. BULL'S PAPER ON RESULTS OF SQUINT OPERATIONS. — CONTINUED.

Sex.	Age.	Refraction.	Vision.	Operations.	Length of time under Observation.	Ultimate Vision.	Result as to Squint.	Remarks.
602. M.	37	M. D. 9	R. E. 20/100 L. E. 20/200 M. corrected	Tenotomy of left int. " right int., 1 wk. later.	6 mos.	same	slight conv.	Rapidly increasing amblyopia with pain and squint in L. E.
603. M.	10	H. D. 1 ⟨ D. 1 ax. 90°	R. E. 20/20 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	2 years.	same	parallelism	Full correction.
604. F.	14	H. D. 2.50 D. 5	R. E. 20/30+ L. E. 20/200	Tenotomy of left int., and advancement of left ext.	1 year.	same	conv. 3°	Full correction.
605. F.	30	H. D. 3	R. E. 20/200 L. E. 20/30	Tenotomy of right int., and advancement of right ext.	8 mos.	same	parallelism	Full correction.
606. F.	16	H. D. 3 ⟨ D. 1 ax. 90° D. 5 ⟨ D. 1 ax. 120°	R. E. 20/20— L. E. 20/40—	Tenotomy of left int. " right int., 2 wks. later.	2 years.	same	conv. 5°	Full correction.
607. M.	48	H. D. 4	R. E. 20/200 L. E. 20/70+	Tenotomy of right int. " left int., 1 wk. later.	6 mos.	same	conv. 3°	Full correction.
608. F.	7	H. D. 2.75	R. E. 20/30+ L. E. 20/100	Tenotomy of left int., and advancement of right ext.	2½ years.	same	parallelism	Full correction.
609. F.	12	H. D. 3 D. 5	R. E. 20/70 L. E. 20/100	Tenotomy of left int., and advancement of left ext.	1½ years.	same	conv. 3°	Full correction.
610. F.	8	H. D. 3.50	R. E. 20/20 L. E. 20/50—	Tenotomy left int. " right int., 2 wks. later.	3 years.	same	parallelism	Full correction.
611. F.	13	H. D. 2	R. E. 20/200 L. E. 20/20	Tenotomy of right int., and advancement of right ext.	1 year.	same	parallelism	Full correction.
612. F.	11	H. D. 1.75	R. E. 20/30+	Tenotomy of left int. " right int., 1 wk. later.	2 years.	same	conv. 3°	Ophthal. neonat. followed by squint L. E.; full correction.

AMBLYOPIA EX ANOPSIA.

BY WALTER B. JOHNSON, M.D.,

PATERSON, N. J.

At the twenty-ninth annual meeting of this society a case of amblyopia ex anopsia was reported under the title of "Amblyopia from suppression of the visual image"; subsequently another case under the same title was presented at the November meeting of the New York Academy of Medicine, and published in the *American Journal of Ophthalmology*, January, 1894. These cases, in each of which the useful eye was destroyed by accident, established the fact that loss of vision from the amblyopia of disuse certainly could and did exist without any diseased condition being present either in the eye itself or in the cerebral centers, as was indicated by the resumption of normal vision. The rapid recovery of perfect vision in the amblyopic eye in each case, within fifteen days, admitted no explanation except that loss of physiological sensibility had occurred, through psychical exclusion resulting from unconscious suppression of the visual image; this amblyopia ex anopsia was immediately overcome when the stimulus of exclusive perception incited the functional activity of the dormant, but not diseased, cerebral centers. The case here reported is one of amblyopia ex anopsia which was undoubtedly the result of confusion of the visual image from a conjugate deviation to the left, occurring at an age when definite and positive statements could be made by the patient under examination. The vision in each eye was perfectly normal at the time of examination, which was made seven months after an injury to the brow had occurred; this would preclude the possibility of any structural change either in the eye or cerebral centers, as a result of the accident, entering as an etiological factor in the production of the amblyopia. The left eye of this patient, which, at the first examination had perfectly normal vision, became progressively amblyopic after the severe disturbance of the ocular muscles, developed the con-

dition of discomfort resulting from confusion, which necessitated suppression of the visual image to reëstablish comfort.

The question of the time when amblyopia will begin to develop or when vision will be lowered, after absolute suppression of the visual image has been attained, is difficult of solution. In the case reported the improvement in the distressing symptoms occurred before the vision in the left eye was affected, and was without doubt the result of mental suppression, although the amblyopic condition was not yet present.

Psychical exclusion, it would appear, must be constant and continued in order that a loss of physiological sensibility may induce the amblyopic condition. A very intelligent patient, whose occupation as an engraver upon zinc necessitated the use of a magnifying glass for the right eye constantly each day, stated that he thought he could suppress the vision of the left eye in single vision at will. He writes as follows: "I have found by repeated trial that my left eye sees nothing after I have looked continuously through the magnifying glass with my right. It seems as if a fog passed before it, but this only happens while my attention is concentrated upon the magnified object; as soon as I relax attention from the object, even slightly, the sight appreciably returns to the left eye. I cannot suppress the sight of the left eye singly at will." His business is of an unusual character, and can only be performed by two other men in this country, who are compelled to close the left eye while at work; he has been engaged in it for years, and the vision in the left eye remains perfectly normal. The magnifying glass used is a strong lens situated at a distance from the eye, and is not placed before the eye like the well-known watchmaker's monocular.

The inference that loss of sight increases in a ratio proportionate to the time of the existence of the suppression of the visual image is clearly sustained in the case reported by the quality of the vision in the left eye, 20/20 — up to the period of time when the patient was enabled to resume her school work without any material discomfort.

There would seem to be no doubt but that the existence of the deviation being a source of irritation to the cerebral centers resulted in the production of the symptoms described in the

history of the case which follows, and that the unconscious mental suppression of the visual image in the course of time induced *per se* the amblyopic condition.

L. P., female, 10 years of age, born in the United States, applied for treatment July 11, 1885. She stated that she had always enjoyed good health, but had suffered from more or less frequent headache, attended by nausea since childhood; at four years of age she had scarlet fever; her mother and father gave a history of migraine.

The patient, seven months prior to her present visit, fell, striking the left forehead and inflicting a lacerated wound over the frontal eminence about one inch in length, extending in an oblique direction from within, upwards about one and one-quarter inches above the left brow. The wound united in the usual manner without the development of any complications, leaving a cicatrix, which is plainly visible at the present examination.

The mother thinks the child has suffered from more frequent and severe headaches since the time of the injury, although she has been able to constantly attend school until one week ago, when she returned complaining of left frontal headache, which was so severe that she was unable to use her eyes for anything, and was very much distressed by nausea and vomiting.

The headache persisted daily, and, on the third day after the onset, was attended by bleeding from the left nostril. Her nose bled ten times during the next five days, a few minutes each time; she had been affected by nose bleed previously, but not since the time of the injury, except as here noted. On the third day after the onset of these severe headaches her mother also noticed that she could not turn her eyes to the left side and carried her head to the left; she could neither turn her head to the right or carry her eyes to the left, and complained that it caused severe pain and discomfort whenever she attempted to do so.

Upon examination a marked conjugate deviation to the right was disclosed; she could neither carry the left eye out nor the right eye in even to the median line, either conjointly or singly with either eye covered.

R. V. = 20/20. No improvement with glasses.

L. V = 20/20. No improvement with glasses.

The ophthalmoscopic examination revealed a perfectly normal fundus in each eye.

July 18th the case was referred to Dr. R. W. Amidon, whose examination resulted in a confirmation of the previous examination, and, to the best of my recollection, a diagnosis of a probable hysterical element as an etiological factor in the production of the condition; his report in detail has been unfortunately mislaid.

Oct. 18th. In response to a letter of enquiry from Dr. Amidon the following was sent in reply: "The patient called yesterday, and, upon examination, was able to carry the pupil of the left eye 1‴ to the left of the median line, which is 2‴ better than she could do when you examined her; she is in good health and has attended school regularly for the last two months, during which time she has taken no medicine. Her mother has decided that since all of the distressing symptoms have disappeared and the child feels well, and has even less frequent headaches than she had before the time of the inquiry, she will not resort to any treatment for the turning of the head to the left, which still persists, but promises to call again in case the symptoms should return."

R. V. = 20/20. No improvement with glasses.

L. V. = 20/20. No improvement with glasses.

Feb. 4, 1895. Ten years after her first visit the patient called with her mother, who had a subacute laryngitis, and, upon request, consented to an examination; she still carries her head slightly to the left, and cannot carry the left eye out to the full extent; she can carry the right eye in; she complains of no headaches and no especial discomfort.

R. V. = 20/20. No improvement with glasses.

L. V. = 20/100. No improvement with glasses.

The ophthalmoscopic examination is absolutely negative, the fundus in each eye is perfectly normal, and there is no apparent error in the refraction of either eye.

The condition present is amblyopia ex anopsia, which has progressively developed as a result of inability to attain parallel-

ism in ocular excursion, followed by psychical exclusion of the visual image, which in time has resulted in physiological loss of perceptive sensibility, but not, it is believed, in any structural change in the eye itself or in the cerebral centers. The vision in the left eye would become normal providing the stimulus of exclusive sight perception should be permanently established in that eye by loss of vision in the right eye, or in case an operation should be performed which resulted in the attainment of perfect binocular fixation.

DISCUSSION.

DR. HENRY D. NOYES of New York. — I would like to ask what was the age of the patient at the time of the injury?

DR. JOHNSON. — Ten years.

DR. NOYES. — When seen, subsequently, at the age of twenty was she examined in regard to color sense and scotoma? The case being traumatic affords a very considerable probability that the lesion had taken place more deeply than can be, perhaps, directly located. Not only must one expect to find a lesion of the nuclei that preside over these muscles, but inasmuch as we know that their cortical centers are close to the cortical centers for vision there is a possibility that the injury had reached up to and injured the primary ganglia of the cortex, and therefore it seems to me that this case is not a proven one of amblyopia ex anopsia. As to the assumption contained in the paper to the effect that exclusion of the good eye and use of the bad one would restore vision, these assumptions are not proven and do not belong to the paper itself, and it would have been better to have left them out. They are points that I would look upon with grave suspicion and would be quite as well justified in saying that the contrary conditions would result. It seems to me a matter not justified by logic to say that when an eye with defective sight and squinting, upon use becomes better in vision, that the defect was due to non-use, and therefore was not congenital. Nobody will say that there is not a very large class of cases having no squint conceded to be congenital, because their history and absence of lesion leave us no other explanation, but my point is that an eye with defective sight, and which has not been used, and which improves upon use, that fact does not prove that the defect was not a congenital one. The explanation of improved vision is one not hard to understand. This point may be illustrated by a case: A boy ten years of age, the son of a physician, has the

ordinary form of convergent squint, one eye amblyopic, the other normal, but with three dioptries of hypermetropia. Operation was performed on one internal rectus, full correction of refraction made, and he had binocular vision. He went to school and was kept under observation. He is now twenty-one years old and in business, and, while for the most part wearing his glasses, he will sometimes squint and sometimes not. Never has double vision except momentarily, and the eye that was improved by the operation or the glasses has again retrograded to the condition in which it was before the operation. His vision is back again to two-tenths, which it was before operating. I therefore think that his amblyopia was congenital, and not an acquired condition. His retention of improved sight depended upon his keeping the eye in use, but the amount of amblyopia was so great that he was always under temptation to abandon its use. It may be said that the case proves that use improves defective vision. This is not disputed, and it may be admitted that non-use abolished that gain in sight which resulted from treatment and exercise. But that all the defect was to be ascribed to non-use is not proven, while the assumption that an important amount of amblyopia is congenital is borne out by a variety of considerations, to wit: the great majority of converging squint cases have one amblyopic eye; second, in many of these instances distinct evidences of a morbid condition are found in the optic nerve which are known to be congenital; thirdly, an unrecognized monocular amblyopia revealed by accident in adult life can only be accounted for by assuming it to be congenital, and if this is admitted when no squint exists it makes unnecessary the supposition that non-use causes amblyopia with squint; finally, non-use does not impair vision of eyes which have at any period possessed good sight, as in cases of cataract and some other cases.

DR. W. F. MITTENDORF of New York. — In support of Dr. Noyes's position in regard to these cases I think we can all remember cases with high degrees of error of refraction where it is impossible to get true correction. A child may have only vision of twenty-fiftieths, and with continued use of glasses for two, three, or four years, will probably have normal vision with the same glasses that before gave only twenty-fiftieths, which will show that congenital amblyopia may exist in both eyes and be improved by glasses. If this occurs in both eyes, why not in one, and the amblyopia be congenital?

DR. SAMUEL THEOBALD of Baltimore. — I am inclined to agree with Dr. Noyes that the case just reported is not a good

one to prove Dr. Johnson's position, but the case he reported three years ago seems to me a most valuable one in this connection. The man had squinted for years, when, as a result of accident, he suddenly lost his good eye. The vision of the squinting eye, which previously had been very poor, improved rapidly, going, in fifteen days, to normal vision. It is almost inconceivable that this eye could have been defective from birth and recover its sight in such a short time. This case seems to me to afford very strong evidence in favor of the doctrine that the amblyopia of squinting eyes is a consequence of the squint, due to suppression of the retinal image. The point that Dr. Noyes speaks of I would take exception to. Central scotoma, which he thinks indicates congenital defect, is one of the forms of amblyopia we should expect, and which we almost invariably find in the squinting eye, from suppression of the retinal image. It is the image formed on the yellow spot of the squinting eye, which it is all-important to suppress; hence the central scotoma.

DR. LUCIEN HOWE of Buffalo, N. Y. — The case Dr. Johnson reported two years ago made a deep impression upon me also. While I do not think that the evidence in the present case is as strong as then, still it brings up the question of the formation of a new macula, whether there is another spot in the eye which we can bring into use. We know that double fovea are not uncommon. Quite a number of varieties of the swallows have them, also one of the hawks, and recently I have seen a section of the retina of a yellow-bellied swallow, in which it was beautifully shown. They use one macula for near objects and one for distant ones. This may yet be a question for microscopical anatomists to decide.

DR. O. F. WADSWORTH of Boston. — There is much to be said on this subject, but I fear there is little chance of our convincing each other by discussion. One point I would refer to, however. There are cases of squint in which careful and repeated examination having shown at one time a certain defect of vision a decidedly less defect is found six months or a year later, no operation having been done, and the squint having continued precisely the same. It is not easy to explain these in any manner compatible with the theory of amblyopia from suppression.

DR. S. D. RISLEY of Philadelphia. — I agree with Dr. Noyes that in some instances the amblyopia is due to organic lesion, sometimes localized at the macula, in others possibly of central origin. Certainly some of them have marked defects of the central field, as has been pointed out by Dr. de Schweinitz.

But that they are congenital in origin I submit is not susceptible of demonstration, although it may be a reasonable surmise for some cases of amblyopia. That all cases of amblyopia in converging eyes are of congenital origin is harder for me to believe than that they are in many cases due to psychical suppression of the image. I have too often seen restoration of vision in the amblyopic squinting eye, after restoring parallelism of the visual axes, to accept the theory either of its organic lesion or congenital origin in all cases. I have published one case (*Medical Times*, Philadelphia, April 19, 1873, p. 453) in which the amblyopia alternated between the two eyes. A tenotomy had been performed in 1869 at the Wills Eye Hospital. At that time the right eye was markedly amblyopic, the left being the fixing eye, and enjoying normal vision. The eyes remained straight for a few months and then the left converged, and, when seen by me in 1872, V = 1/10, while the right had nearly normal acuity. The patient had a high grade of hypermetropia, which was corrected by glasses, and subsequently a tenotomy of both interni performed. The left amblyopic eye was carefully exercised by bandaging the right for an hour twice daily, with the result of restoring the vision to nearly normal acuity. Recently I observed in one of my private patients, a lad, upon whom I had performed tenotomy of both interni, the vision in the squinting eye rise from 1/4 to normal in the course of a few weeks. He was taken to the seashore for the summer, and, in the autumn, I found a positive tendency to outward deviation, and the vision had once more sunk to 1/4. He had a considerable hypherphoria, which was temporarily corrected by vertical prisms, with the result of removing the tendency to outward deviation, and the vision again rose to normal.

Having such instances in mind I feel very sure, while some cases of amblyopia may be congenital or possibly due to incurable organic lesions, that it is not true for all cases.

DR. W. B. JOHNSON of Paterson. — I wish to say that I do not claim that squint is not produced by, or is not seen as a condition accompanying, congenital amblyopia, but I do feel positive that my own cases are different, and that the manner of their origin is of simple explanation, upon the theory of suppression of the visual image. As regards the scotoma I am sorry to say no examination was made. In this particular case the inference of disease of the cerebral centers was present, and I referred the case to a neurologist on that account. He did not believe that cerebral disease was present, and I feel that if it had existed in this case it would not have transpired that just as soon as the child could suppress the visual image all

symptoms of discomfort pointing to such a disease would have disappeared, and the patient have been enabled to resume her school work. I think that if at a period of seven months after the original injury the child had not developed any cerebral trouble, and two months later nothing had occurred to indicate a difficulty affecting the visual centers, it is fair to infer that it is not probable that any cerebral lesion existed in the cortical centers for vision, and that the suppression was due to the confusion resulting from the continuance of the conjugate deviation. I only offer this case in addition to the other two, which proved that a condition was present, the recovery from which was so rapid that it seemed to preclude the possibility of any organic lesion being present. The assumption that loss of sight in the good eye would result in restoration of normal vision in eyes with amblyopia ex anopsia has been proven, and is justified if amblyopia ex anopsia is the condition present in such cases.

RECURRENT OCULO-MOTOR PALSY: WITH A CASE.

By G. E. DE SCHWEINITZ, M.D.,

OF PHILADELPHIA.

Recurrent oculo-motor palsy is of sufficient rarity and interest to justify the record of each additional case, and therefore I report the following example of this affection:

"Kate Y., unmarried, aged 30, American born, a cigar-maker by trade, applied to the Ophthalmic department of the Jefferson Medical College in the latter part of December, 1894, for relief from violent attacks of neuralgia and complete oculo-motor palsy of the right side.

Family History.— Her mother suffered from right hemiplegia at the age of 41, never fully recovered, and died suddenly three years later; two brothers and one sister are living and in good health; one brother died in infancy from an accident. The history on the paternal side of the family was not obtainable.

Personal History.— When one and one-half years of age, the patient became violently ill with the following symptoms: vomiting, convulsions, right divergent strabismus and ptosis.

At the end of six weeks the ptosis disappeared and the eye returned to its proper position.

Since this date, she has suffered from frequent attacks of neuralgia, almost always associated with divergence of the right eye and closure of the corresponding lids; occasionally, although the pain was severe, the ocular symptoms were absent.

During childhood the explosions of pain were frequent, occurring as often as three times a week; lately the maximum number of attacks has been five or six a year, and sometimes she has been free from them for six months at a time.

With the exception of whooping-cough, measles, scarlatina, and epidemic influenza (three years ago), each disease being associated with a violent attack of migraine and recurrence of the ocular palsy, she has enjoyed good health. Menstruation was established at thirteen years of age, is regular in appearance, and unaccompanied by pain. A history of syphilis was not obtained.

When she was about four years of age (although she is somewhat uncertain as to the date), the divergence, which had before that time disappeared *pari passu* with the subsidence of the ptosis, became more or less permanent, as may be noted from the accompanying diagram, Fig. I, although she thinks that in her best condition, even though the eye turned outward, power still remained to bring it to the median line.

In September, 1893, an unusually severe attack of neuralgia occurred, accompanied, as usual, by ptosis, but when the pain disappeared the ptosis remained. (Fig. II.) Since the date of permanent ptosis she has suffered about half a dozen mild attacks of neuralgia, unaccompanied by notable ocular changes.

The Neuralgic Attack.— Preceded by dizziness, a full feeling of the head, swelling of the periorbital tissues and distension of the cutaneous veins, the pain begins in the right eye and travels around the right side of the head to the occiput, where it finally settles and remains until the subsidence of the nerve-storm. Immediately following the onset of the pain, there is vomiting, which lasts from twelve to twenty-four hours, and leaves the patient utterly dejected and exhausted.

FIG. 1.

When examined (December, 1894) the following conditions were present:

Complete paralysis of the oculo-motor nerve, the divergence being extreme, and the eyeball slightly prominent. (Fig. III). It can be rotated outward 1^{cm}, and there is slight rotary movement noticed when an attempt is made to turn the eye downward and outward. From the position of extreme divergence, the right eye can be rotated inward about 2^{mm}.

The pupil is absolutely fixed, horizontally oval, its long diameter 6^{mm}, and its short $4\frac{1}{2}^{mm}$. The central color perception is good and the form field normal. Vision is 6/60, or somewhat better, if the test card is held downward and to the right. The optic disc is gray-red in color, nearly round, and contains a small physiological cup. The scleral ring is sharply cut to the temporal side, and there is a slight remnant of the choroid ring on the nasal edge of the nerve-head. The general retinal circulation is normal.

The left eye presents no abnormality, vision and accommodation being natural and the opthalmoscopic changes unimportant, — possibly slight grayness in the deeper layers of the disc, with superficial capillarity. The iris-movements are normal.

Briefly recapitulated, the points of this case are the following: Right oculo-motor palsy at the age of one and one-half years; recovery in six weeks; frequent recurrence of the ocular palsy, associated with severe neuralgia and followed by complete recovery of the paralyzed muscles during the intervals, until about the patient's fourth year, when the divergence became stationary, but the ptosis successively recurs and disappears as heretofore; finally, permanent ptosis, at the twenty-eighth year, after the most violent attack of pain of the whole series, and the present appearances of complete permanent right oculo-motor palsy. Other nerves were not involved, for example, the abducens, facial, or trifacial.

It is unnecessary to review the literature of this affection, as this has recently been done in a masterly manner by Dr. Philip Coombs Knapp (Boston *Medical and Surgical Journal*, Vol. CXXXI, pp. 308–312, 1894). From Dr. Knapp's researches we learn that about forty cases of this affection have been re-

ported; that it affects the two sexes nearly equally (twenty-one women, eighteen men); that in the majority of cases the disease begins in early life, and usually, as in my case, with vomiting and severe pain, and that soon after the pain oculo-motor palsy has occurred.

According to Knapp, after a varying interval, from a week to four years, the attack recurs, rarely, however, at a definite period, for example, the menstrual epoch. If the clinical history of my patient may be trusted, in her early life the attacks recurred with even greater frequency than the shorter intervals just mentioned, viz., bi-weekly.

In a certain number of the cases, although there was complete recovery from the ocular palsy in the intervals between the earlier attacks, a gradually increasing paralysis was observed, which finally became permanent (Roosa's case and my own).

At three autopsies thus far reported (Knapp, loc. cit.), the following lesions were found: inflammatory thickening of the nerve (Gubler); tubercular mass pressing on the nerve (Weiss); fibro-chondroma separating, without destroying, the nerve fibres (Thomson and Richter). Knapp concludes "that recurrent oculo-motor palsy is due to some vascular change, inflammatory or œdematous, in a focal lesion involving the root of the third nerve. As the œdema or exudation subsides, the conducting power of the nerve is wholly or partially restored, and the paralysis disappears. In some cases the lesion may involve several nerves, and the exudation may affect only a part of the lesion, involving different nerves at different times. As the lesion progresses, it may finally affect the nerve so far as wholly to destroy its conducting power, leading, as in Roosa's case, to permanent and total paralysis." The last sentence describes accurately the course of events in the case reported to-day.

Treatment — mercury, iodides, strychnia — was faithfully tried without avail, and Dr. Bochroch, Chief of the Clinic for Diseases of the Nervous System, carefully and skillfully used electricity for several months without favorably affecting the paralyzed levator.

FIG. 2.

FIG. 3.

A CLINICAL AND EXPERIMENTAL STUDY OF THE SO-CALLED OYSTER-SHUCKERS' KERATITIS.

BY ROBERT L. RANDOLPH, M.D.,

BALTIMORE, MD.

The extent of the injury inducing the so-called oyster shuckers' keratitis does not explain the violent reaction that follows. This fact seems to have impressed every ophthalmologist who has been brought into frequent contact with the disease. Cinders and small particles of steel or of sand when they lodge on the cornea, often remain in situation for several days without causing apparent infiltration of the surrounding tissue and not infrequently does one meet with a case where a cinder has been imbedded in the cornea a considerable length of time without giving rise to anything but unpleasant subjective symptoms.

The most common foreign bodies removed from the cornea are the filing or chippings of iron or copper or particles of emery, sand, and cinders. It is rare that we see an area of infiltration about the foreign body, and when this latter condition exists it usually means that the foreign substance was infected with pathogenic bacteria, or by its continued presence and consequent irritation has brought about conditions favoring the invasion and growth of micro-organisms. When we consider the remarkable resources of the eye for nullifying the effects of pathogenic bacteria we may safely say that a foreign body of the nature just mentioned when it lodges in the cornea will, as a general rule, give rise to an appreciable keratitis, only after it has remained in situation for a number of days.

What is known as oyster shuckers' keratitis is distinctly a traumatic affection, due to an injury from a particle of the oyster shell. The disease is chiefly remarkable for the rapidity with which an area of infiltration appears at the site of the injury in marked contrast to the history of wounds by other kinds of foreign bodies of the same size and in the same location.

The existing evidence indicates that oyster shuckers' keratitis is found more frequently in Maryland than in any other part of this country. Dr. Jas. A. Spalding of Portland, Me., writes me that the affection is practically unknown in that part of the United States, and the same can be said of the disease in Charleston, S. C., from information kindly furnished me by Dr. Kollock of that city. The reports of the New York and Philadelphia eye hospitals contain now and then a few cases, but Baltimore seems to carry off the palm. In New Orleans the disease, as such, appears to be unknown. The reports of the eye hospitals of Baltimore contain the records of several hundred cases during the past few years, and I have been informed by one of the staff of the Presbyterian Eye and Ear Hospital that twenty-four cases have been treated at that hospital during the last three months.

The frequency of the disease in Maryland may be explained by the fact that the oyster industry is a more extensive one in that state than anywhere else in the world. Cases of the disease probably do occur, no doubt, in New Orleans and Portland, Me., so that probably latitude has nothing to do with determining its existence, nor is there any reason for supposing that the keratitis is to be traced to some organic or inorganic property peculiar to the oyster shell of the Chesapeake Bay.

Baltimore is the greatest oyster market in this country, and, according to Ingersoll ("The Oyster Industry," by Ernest Ingersoll, Washington, 1881), there are at least six thousand shuckers in Maryland and most of these are found in the shucking houses of Baltimore. In many of the northern cities, as, for instance, in Portland, Boston, and New York, oysters are received in great quantities that have been shucked in Baltimore, so that oyster shucking in those cities does not exist as a trade to the extent that it does in Baltimore. The magnitude of the oyster industry in this city may be said to account for the frequency of oyster shuckers' keratitis.

In a large number of the cases reported here, the shuckers had been plying their trade for many years and had been struck for the first time. In two cases the men had shucked for eighteen years without being struck, and it is surprising to note the

fact that in none of the sixty-five cases reported were there any novices (new hands). It will be seen, then, that it is possible to shuck oysters for many years and still to escape injury from a particle of shell, and that the great majority of oyster shuckers escape altogether. Hence, we cannot regard the disease as a very common one. It is more than probable that long familiarity with the work breeds contempt of its dangers, and this may explain why, in nearly all cases, it is the veteran who is wounded and not the recruit. It is very much the same kind of danger that surrounds the mechanic at the emery wheel — possibly the danger is a little greater in the case of the oyster shucker. Considering, then, the number of oyster shuckers in Maryland, and the quantity of work done, it may be said that the disease is of exceptional occurrence.

Causes: As I have said, the disease is distinctly of traumatic origin; that is, a minute particle of the oyster shell is violently chipped off by the hammer that is used in the shucking process and it flies into the eye.* The particle is generally too small and too light to penetrate to any distance into the cornea. Large pieces, however, are sometimes detached and are driven through the entire thickness of the cornea, and when such a thing happens, loss of the eye usually results. This occurrence is happily rare. Unlike other foreign bodies that lodge in the cornea, the particle of shell can seldom be detected. This, I think, is due to the fact that in the rapid infiltration that takes place, the particle of shell is thrown off. It is no uncommon thing to see a particle of steel that is surrounded by a necrotic area drop out at the slightest touch, and sometimes we meet with these small points of infiltration where no foreign body can be detected, it evidently having been dislodged or thrown off in the suppurative process. In two or three instances I have succeeded in removing from the center of one of these areas of infiltration a small particle of what was undoubtedly a piece of shell. My friend, Dr. B. W. Goldsborough, who lives in Cam-

* The use of the hammer to break off the edge of the shell before introducing the knife-blade constitutes the chief danger in oyster shucking as practised here in Maryland. In other sections, as, for instance, in the far South, and down East, the shucker dispenses with the hammer and sticks in the point of the knife at once in order to pry open the shell. This, no doubt explains why the disease is seldom seen in the portions of the country just mentioned.

bridge, Md., one of the smaller oyster shucking centers, tells me that he has more than once removed small particles of shell from these infiltrated areas. No doubt, in many cases, the piece of shell simply strikes and wounds the cornea without lodging in it. The superficial nature of the injury readily explains why the particle of shell would be apt to drop out as soon as infiltration began.

SYMPTOMS: The photophobia in oyster shuckers' keratitis is marked. The patient tells us that he has a defined sensation of having been struck in the eye. This sensation is not usually followed by pain until a few hours later. Frequently the exposure to artificial light, as for instance the lighting of the gas or lamp the evening of the same day will mark the time when the unpleasant symptoms begin. From now on the pain is usually intense, and the clinical symptoms resembles those of phlyctenular keratitis somewhat intensified.

In an article that appeared in the *Virginia Medical Monthly*, about fifteen years ago, (Oyster Shuckers' Corneitis, by W. J. McDowell, M.D., *Va. Med. Month.*, Vol. V, page 883), the writer states that the position of the ulcer is a constant one that it is always found in one place, and this is the center of the cornea. The most exposed part of the cornea is the point that is struck, and as this point represents an area through which the visual line is passing at the time, and as the visual line always passes through the cornea somewhere near the center the location of the wound will be here and for no other reason, though this explanation does not seem to have occurred to the writer of the article referred to, he attributing this location of the wound to other reasons. As a matter of fact, though, the location of the ulcer is not an invariable one, for I have often seen cases where it was peripherally situated. There is usually more or less circumcorneal hyperæmia. The ulcer is white, whiter than other corneal ulcers, and its size no doubt is dependent more or less upon the size of the particle of shell. I have never seen such an ulcer with blood-vessels running into it. It is sharply circumscribed as to its borders, which instead of fading off gradually into the surrounding tissue will be seen to lie adjacent to perfectly transparent cornea. Such an ulcer sug-

gests more strongly a chemical than a parasitic origin. It does not show the same tendency to spread as do other corneal ulcers, and when the keratitis becomes diffused it is probably an evidence that bacteria have invaded the tissue at this point, and such complications do occur. I have seen such an ulcer remain absolutely localized for two or three weeks without any apparent departure from its original borders. On this account the prognosis is favorable, though this is largely governed by the size and depth of the wound. A perforating wound of the cornea, or a wound involving a large area is generally followed by loss of the eye, and this is especially true when the former condition is present.

Treatment: The yellow salve has proved useless in our hands. The galvano cautery was used in a certain number of cases, but it did not seem to exercise any specific influence for good. A compress bandage and a mild sublimate solution (1-4000) used every four hours together with an occasional drop of a solution of atropia 1 per cent. have given the best results. I have never noticed any special improvement in those cases where eserine was employed. To the compress bandage and sublimate solution, however, the keratitis responds promptly, and in a week or ten days the subjective phenomena have been so ameliorated that the shucker can resume work.

The opacity can be detected by oblique illumination and it is permanent. In several cases where the shuckers had been struck more than once I found the old nebulæ.

The striking point in these cases is the rapidity with which an area of infiltration makes its appearance at the site of the injury. These areas range in size from a pin's head to twice these dimensions, and even larger. The condition differs so entirely from what we are accustomed to see from injuries caused by other kinds of minute foreign bodies that it has occurred to me that the oyster shuckers' keratitis might be due to some specific micro-organism. With this idea in view, I made microscopical examinations and inoculations on culture-media, using chiefly nutrient agar from sixty-five cases of oyster shuckers' keratitis, of which the following fifteen cases may be taken as a fair sample of what the bacteriological examinations dis-

closed. In making inoculations, a sterilized dropper and cocaine solution were used for anæsthetizing the cornea. The point of the platinum needle was well forced into the necrosed tissue, and in nearly all cases small particles of the wall of the ulcer were brought away and carried into the agar tube. In every case Esmarch tubes were made, which were promptly placed in the thermostat.

F. H.: Struck in left eye three days ago. Central ulcer. Pain and photophobia intense. There was nothing definite in the cover-slips, and after twenty-four hours there was no growth on the agar.

J. R.: Struck in right eye yesterday with a particle of shell. Large ulcer and marked area of infiltration. Eye very painful. Inoculations into three agar tubes, which I designate as tubes A, B, and C. Two cover-slips were made, and one stained with methylene blue, and the other with gentian violet. In both cover-slips small micrococci were to be seen, occurring as diplococci. In tube A there was a diffuse growth, and at some points the colonies looked round and flat, and an examination of several of the colonies showed the same organism, a short bacillus. There was no growth in tube B. In tube C, where the inoculation was made directly from the ulcer, there was an abundant growth of what was evidently an impurity. Tube B was inoculated from tube A.

J. H.: Struck in the left eye three weeks ago. At the present time there is a violent kerato-iritis, the pupil being contracted and pus in the anterior chamber. Two ulcers on the cornea. Cover-slips from the ulcers showed nothing. In tube A there was a large, round, and slightly iridescent colony with reddish center and yellow halo, and this was the only colony present in this tube. This turned out to be an enormous micrococcus. In tube B the agar was dotted with a fine growth, the colonies being very numerous and revealing under the microscope bacilli of at least three varieties. Both these tubes were inoculated direct from the ulcers.

P. S.: Large ulcer in the center of left cornea from an injury received yesterday. Cover-slips showed nothing definite. In tube A there was a vigorous growth of several varieties

of bacteria. In tube B (inoculated from tube A) there were two kinds of bacilli, one staining very deeply, and having rounded ends, and the other bacillus being more slender, and having sharply cut ends. Tube C (inoculated from tube B) contained nothing.

A. G. : Struck in left eye yesterday. Small central ulcer. Cover-slips negative. In tube A, after twenty-four hours, there was a small round, white colony that turned out to be the staphylococcus pyogenes albus. In tubes B and C, representing the second and third dilutions of tube A, there was nothing.

R. L. : Left eye. Small central ulcer. Pain intense. Struck for the first time, though he has shucked oysters for fifteen years. Cover-slips and cultures negative.

G. L. : Struck in right eye yesterday, and now there is a large ulcer somewhat below the equator of the cornea. The staphylococcus aureus was found in this case.

G. J. : Struck in left eye six days ago. Small ulcer on periphery of the cornea. On the second day tube A was found to be dotted with small white colonies which turned out to be a short stumpy bacillus. Tube B (inoculated from tube A) contained nothing. Tube C (inoculated from tube B) also contained nothing.

W. H. W.: Struck in left eye yesterday. Minute ulcer on the nasal side of the center of the cornea. Cover-slips showed nothing. Tubes A and B contained numbers of small white colonies scattered over the surface of the agar, and examination showed them to be bacteria of various kinds and shapes. (B was inoculated from A.) Tube C was inoculated direct from the eye and contained two colonies of a long, slender bacillus.

G. B. : Struck two days ago, and the pain did not come on till he went home that evening and faced the lighted lamps in his house. The staphylococcus aureus and two varieties of bacilli were found in the agar, one a short heavy bacillus, and the other a short slender bacillus.

J. B. : Struck three days ago in the left eye, and now there is a small central ulcer. In tube B (inoculated from tube A) there were small colonies of two kinds of bacteria. One of these was the staphylococcus aureus, and the other was a large bacillus.

A. S.: Struck in the right eye three days ago. Small ulcer nearly central. Has been shucking for eighteen years, and was struck in the same eye a year ago. Cover-slips vague, but in tube C (the second dilution of tube A) there grew the staphylococcus albus and a bacillus.

F. R.: Struck three days ago in the left eye. Central ulcer. There was nothing on the cover-slips, and in tubes A and B there was a large stumpy bacillus (B inoculated from A).

W. J.: Struck in right eye yesterday. Large central ulcer. One of the cover-slips showed a large micrococcus that was also found in tube B (inoculated from tube A).

T. W.: Struck yesterday. Central ulcer. Pain intense. Struck for the first time, though he has shucked oysters for fifteen years. Cover-slips and cultures negative.

In eleven cases out of the sixty-five there was absolutely no growth on the agar. This is not surprising when we consider the very small surface or area from which the inoculations were made. I took particular care never to touch any part of the cornea but the ulcer, and as this always occupies a very prominent position on the cornea, it is likely that most bacteria would be swept off into the conjunctival sac by the constant movements of the lids. In thirty-nine cases the bacteria were of various kinds, and there were no two cases presenting the same bacteriological conditions. As a rule, bacilli were the predominating organisms, and usually they were large and coarse. In three of the fifteen cases given in full, I found the same bacillus, about the size of the bacillus subtilis, possibly somewhat shorter. I made a suspension of this organism in sterilized water, and injected a few drops of it into the cornea and conjunctiva of a rabbit's eye, but scarcely any reaction followed.

In several of the cases where there appeared to be some similarity between the organisms, I tried the effect of injecting a suspension of the organism into the cornea, but always with negative results. In five cases the staphylococcus pyogenes aureus or albus was found. The injection of a suspension of this organism into the cornea was followed by suppuration, a thing of course to be expected. Inasmuch as the pyogenic staphylococci are found in several other external diseases of the eye,

and even in the normal conjunctival cul-de-sac, to say nothing of their association with inflammation in other parts of the body ; and, moreover, the fact that they were found in only five cases out of sixty-five justifies the conclusion that the pus organisms had nothing specifically to do with the inflammation in those cases where they were discovered.

Were oyster shuckers' keratitis a parasitic disease, certainly its specific organism, if recognizable by our present means of investigation, would have been found in several of the cases, but as has been said in only three cases was the same organism present, and the experiments with this organism seemed to show that it was possessed of slight, if any, pathogenic properties.

It may be added that being once struck did not produce immunity, as there were several shuckers among the sixty-five who had been wounded twice in the same eye.

Is the disease of chemical origin? Is there any chemical substances in the juice or shell that produces this immediate and intense reaction in the human cornea?

To test this hypothesis, I obtained about an ounce of the oyster juice to which I added a teaspoonful of the clippings and dirt from the shells, and then passed this mixture through a Pasteur filter. I always made the shucker open the oyster into a vessel so that I could obtain the juice fresh. This fluid after being filtered was injected from a sterilized hypodermic syringe into the cornea and conjunctiva of a rabbit's eye. Fifteen experiments of this character were made, and the result in every case was negative, a fact that goes to show that in so far as the rabbit's cornea is concerned, the juice of the oyster manifests no pathogenic effect when injected into that part of the eye. It may be well to state that in only one or two series of experiments did I use the same filtrate. Fresh juice was obtained and filtered for every experiment. In the first case I obtained a beautiful kerato-iritis in one eye, and in the other eye an ulcer not unlike what we see in oyster shuckers' keratitis. On examining the filtrate I found that it contained two varieties of bacteria, in other words, that it was infected. The injection though of these bacteria (both were bacilli) into the

cornea of the rabbit was in no instance followed by a keratitis, so that the inflammation in the first case must have been due to some organism not found in the oyster. In the other fourteen cases I obtained a filtrate free from micro-organisms, and as I have said this filtrate was shown to possess no pathogenic properties when injected into the cornea of a rabbit.

The bacteriological study of these cases would seem to indicate that the so-called oyster shuckers' keratitis is not of parasitic origin. A number of experiments with the oyster juice after the latter has been freed of its living organisms goes to show that the juice of the oyster probably has nothing to do with the causation of the keratitis seen among oyster shuckers, and furthermore that the injection of this juice, even as much as a syringe full, under the skin of a rabbit, was in no case followed by inflammation. Nor when the unfiltered juice was injected into the cornea was it followed by any irritating effect. It remains to be seen whether there was any chemical ingredient in the shell that is capable of calling forth this inflammation.

Several fresh oysters were procured and the edges were chipped off and ground up fine. The edge of the shell was selected, as it is this part that is chipped off by the shucker. These particles were then sterilized in a test tube. The heat did not seem to alter the size of the particles. The reaction of this substance was decidedly alkaline. I made a very small wound in the cornea of a rabbit with a cataract knife and rubbed in gently with a platinum needle a few particles of the powder. This experiment was performed eighteen times and in every case I succeeded in getting an appreciable keratitis. This keratitis was absolutely localized and its borders were sharply cut and separated from the healthy cornea. There was little or no circumcorneal injection. These experiments show, beyond a doubt, that there is something in the oyster shell that, when introduced into the cornea, will produce keratitis.

It is difficult to imitate successfully all the conditions connected with a foreign body in the cornea. In the first place, the size of the foreign body is problematical, and the most difficult thing to imitate is the manner and force with which it strikes the cornea. I thought that it would be possible to approach

this latter condition by using what the boys call a blow-gun or spit blower. It was seldom that I succeeded in blowing the particles of shell with force sufficient to drive them into the cornea. Twelve experiments of the following character were performed:

One long blower was loaded with cinders from a locomotive smoke-box and another blower was loaded with particles of oyster shells. I may add that the cinders and shells were sterilized. At a distance of six inches from the cornea, the load was blown into the latter. In a few cases a cinder remained sticking in the cornea, but in only one case did a particle of shell stick. The pieces of shell were too fine to be blown with force sufficient to make them lodge in the cornea. It was noticeable, though, that the reaction was more or less intense in the eye into which the shells had been blown, while there was practically no reaction in the eyes into which the cinders were blown. In the case of the eyes where the shell was used redness of the conjunctiva and increased secretion were seen, while in the other class of cases the conjunctiva remained normal. The reason that I failed to get an ulcer was that I never succeeded in wounding the cornea to any extent.

It could hardly be expected that the reaction in the case of a rabbit's cornea would be as intense as that following similar injuries in man. I have always been impressed with the promptness with which injuries to the eyes of dogs and rabbits heal. Injuries that in the case of human beings necessitate long and careful treatment get well readily in rabbits and dogs. Spontaneous affections of the rabbit's conjunctiva and cornea are comparatively rare. This is not the case to the same extent with dogs which, like man, are not unfrequently seen with eye affections. The tissues, too, of a rabbit's eye are certainly more resistant to infected wounds than those of man. This fact I have demonstrated elsewhere again and again. It is not likely, then, that we would get a keratitis in a rabbit that resembled exactly what we are accustomed to see in the oyster shucker. The keratitis in the shucker would be more intense in its clinical history simply because it is the human cornea that is affected, this intensity being due, perhaps, to the frequent

presence in the conjunctival sac of pathogenic bacteria and to the feebler resisting powers of the tissues.

It is reasonable to suppose that any agent that will produce an ulcer in a rabbit's cornea will certainly have the same effect on the human cornea. It has been shown that, with the exception of the pus organisms, none of the organisms found in the sixty-five cases of oyster shuckers' keratitis produced keratitis when injected into the cornea of a rabbit; that is to say, there was no apparent infiltration of the cornea at the point of injection, and this, added to the fact that no one organism was found constantly present, inclines one to the opinion that the disease is probably not of bacteric origin,—this in the light of our present bacteriological knowledge. It has been shown that the oyster shell contains a material that does produce keratitis when introduced into the corneal tissue—a material of unorganized nature.

The analysis of Chatin and Muntz (Comptes Rendus, Tome CXX, 531–541), shows among other things that the oyster shell contains very small quantities of silicon, fluor, bromine, iodine, and iron, and it is well known that at least 90 per cent. is carbonate of lime. I obtained some pure carbonate of lime (not the chalk, such as is furnished by the druggist), and after making a sterilized wound of the cornea, powdered some of the lime between the lips of the wound, and in every instance I succeeded in obtaining an appreciable keratitis. This experiment was repeated with positive results a number of times. It would seem, then, that the carbonate of lime, of which the oyster shell is largely composed, is in itself sufficiently irritating to call forth an inflammation of the cornea under certain conditions.

I may say, in this connection, that on the eastern shore of Maryland, in the latter part of September and during October, when the winds are high and the roads dusty, that a form of ophthalmia is very common, which is attributed to the fine particles of oyster shell dust that fill the air and get into the eyes of those who drive along the roads. The roads in that section are, for the most part, shell roads. The ophthalmia is characterized by great redness of the conjuntiva and profuse secretion.

Not infrequently both eyes are involved, and it is a very painful affection. I am indebted to Dr. Goldsborough of Cambridge for information on the subject of this interesting eye disease, which he tells me he often sees at certain seasons. This certainly shows that the oyster shell possesses irritating qualities.

It has been suggested that the mud which covers the oyster probably flies into the eye and causes the trouble. Any one who has visited an oyster-shucking establishment will at once be struck with the appearance of the shuckers. Their hats, faces, and upper the portions of the body are simply peppered with fine particles of mud, and I have been told over and over again that the mud frequently flies into the eyes, but other than a little temporary burning no inconvenience follows. The face is often the seat of hundreds of little points where a drop of mud has struck and hardened. I am sure that were the injury inflicted in this manner that we would meet with the disease far oftener, in fact oyster shuckers' keratitis would be a very common affection; but, as has been shown, it is of exceptional occurrence.

As to any other ingredient of the oyster shell playing a rôle in the production of the keratitis I am unable to give any evidence at this time. Positive evidence does exist that shows that the carbonate of lime possesses properties irritating enough to produce keratitis in the corneæ of rabbits and dogs — a keratitis of a sluggish character. And though I failed to get a typical picture of oyster shuckers' keratitis in these animals, it is highly probable that the peculiar aspect of the disease as seen in man is due to conditions belonging to the human eye alone — conditions which help to intensify the process. It is more than likely that some one or more of the chemical ingredients of the shell may play a part. From the analysis made by Chatin and Muntz it is evident that the oyster shell contains ingredients besides the carbonate of lime which might be irritating to the cornea and conjunctiva.

Conclusions.

1. Oyster shucker's keratitis may be defined as a traumatic keratitis where the injury is produced by a particle of the oyster-shell.

2. The disease is chiefly remarkable for the rapidity with which the cornea undergoes necrosis at the site of the injury, this area of necrosis being usually very small, owing, no doubt, to the small size of the foreign body. Small foreign bodies of copper, steel, and sand usually produce no appreciable keratitis; and even when they lodge in the cornea, commonly require several days to cause a noticeable inflammation. On the other hand, the oyster shucker presents a marked infiltration of the cornea at the point of injury within twenty-four hours after the accident.

3. This decided reaction on the part of the cornea makes the injury a peculiarly dangerous one when a large area is wounded, or when entrance has been made into the anterior chamber, such conditions in my experience being invariably followed by the loss of the eye through panophthalmitis. How often do we see the cornea injured in the same degree by other kinds of foreign bodies and still the vision not entirely destroyed.

4. Bacteriological investigations failed to discover any specific organism, nor did any of the organisms obtained from cases of oyster shucker's keratitis manifest any pathogenic properties when introduced into the corneæ of rabbits, with the exception of the pyogenic cocci. It is not likely then that the disease is of parasitic origin.

5. The carbonate of lime, of which the oyster shell is almost entirely composed, was found to possess qualities irritating enough to call forth a keratitis when introduced into the cornea of a rabbit, and it is more than probable that several other chemical ingredients of the shell would be more or less irritating to the cornea.

6. It is certain that bacteria always play a part in traumatic keratitis, but it is evident that in this variety of traumatic keratitis the cornea is rendered especially susceptible to the effects of micro-organisms by the irritating chemical ingredients of the oyster-shell, notably the carbonate of lime.

I may state that the clinical observations were made, for the most part, in the Presbyterian Eye and Ear Hospital where, at the time, I was one of the attending surgeons. The experimental part of the work was conducted in the pathological laboratory of the Johns Hopkins University.

DISCUSSION.

DR. SAMUEL THEOBOLD, Baltimore.— I have frequently met with these cases in Baltimore and can testify to the severity of the inflammation following the oyster shell injuries. Usually, the reaction is much more severe than that which follows an equal amount of traumatism produced by other injuries. I have not been struck with the central location of the ulcers to which Dr. Randolph has referred. In the more severe cases hypopion frequently develops. It is interesting to note that it is a common practice in Baltimore for patients to use oysters as a poultice to the eye for various troubles.

DR. W. S. DENNETT, New York.— In different localities they have different methods of handling the oyster. In New England they pry the oyster open with a knife, while in New York or Baltimore they first crack the shell. This may account for the greater frequency of the trouble in the latter places.

DR. W. H. CARMALT, New Haven.— We have a large oyster trade in New Haven, but I must say I have never seen one of these cases as Dr. Randolph describes it. We have a few cases of keratitis in oyster shuckers, but I do not know of anything peculiar in them, and I have never been struck with any particular obstinacy. Several thousand people are engaged in that industry. They break the shell, too, before inserting the point of the knife. Down East I believe they stick the point of the knife in at once.

DR. H. G. MILLER, Providence.— I have never seen any disease of this nature among the oyster shuckers of our vicinity. With us, however, the oyster is opened entirely by prying with the knife, and never by breaking the shell.

REPORT ON WORSTEDS FOR HOLMGREN'S TEST

The undersigned would hereby respectfully report, that, at the fifteenth meeting of the American Ophthalmological Society at Newport, July 25, 1879, it was —

"*Resolved*, That Dr. B. Joy Jeffries be requested to make such arrangements as he may find practicable to enable the members of the Society and others to procure suitable collections of colored worsteds for testing for color blindness."

In compliance with this request he, as soon as possible, made arrangements with the firm of N. D. Whitney & Co.,

worsted dealers in Boston, to keep on hand a complete set of worsteds for the test. Every set was carefully made up from the type set, the same worsteds being used. This was possible then, as fashion called for great varieties of colors in large quantities.

Till very recently there has been no time when a perfect set of worsteds for Holmgren's test could not be at once had. During the past year, however, that firm has ceased to exist. No other one in this country had all the needed colors, and he found that they could not even be obtained from the Berlin manufacturers, the colors having gone out of fashion.

Under these circumstances a member of the firm of Andrew J. Lloyd & Co., Opticians, Boston, went to Europe this spring, 1895, carrying one of the type sets, and found, as was supposed, that there were no such complete sets obtainable in Vienna, Berlin, Paris, or London. The Berlin manufacturers would only produce the required colors upon a large order. This order was given by the firm, and they have received the worsteds, which have been carefully compared and sets now made up ready for sale. The members of the Society will probably receive their circular.

The undersigned warns against the reputed "Holmgren's worsteds," advertised by opticians and medical booksellers in the present as in the past, the world-wide use of the test still offering inducements for fraud.

He regrets the necessity of distinctly stating that he has no pecuniary interest in the sale of these worsteds. He simply desires, as ever, that physicians may be able to procure what is positively needed for the application of Holmgren's test, and that this should not be interfered with by tradesmen's ignorance or cupidity.

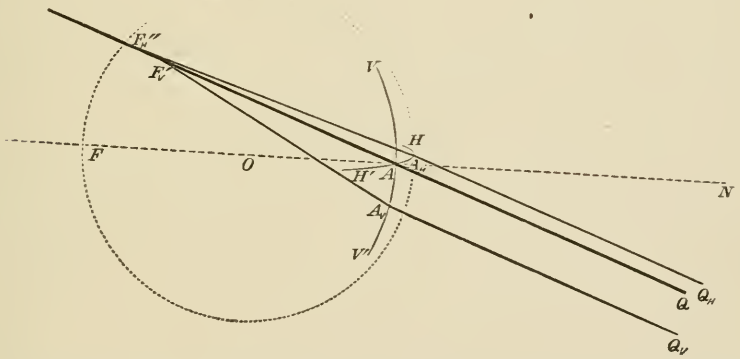
B. JOY JEFFRIES.

NOTE ON THE VARIATIONS IN THE POWER AND IN THE ASTIGMATISM OF THIN SPHERICAL, TORIC, AND CYLINDRICAL LENSES IN PRINCIPAL CASES OF OBLIQUE CENTRICAL REFRACTION.

BY JOHN GREEN, A.M., M.D.,

ST. LOUIS, MO.

Let VAV' and HAH' represent two arcs of great circles of a sphere, intersecting, at right-angles, at A, which we will take as the centre* of a thin convexo-plane lens; let NAF, cutting the spherical surface normally at A, represent the axis, and let F represent the principal focus, of the lens.



Designating the index of refraction from the rarer into the denser medium by μ, the radius of curvature of the spherical surface by r, and the principal focal length of the lens by f, we have, neglecting the thickness of the thin lens,

$$f = \frac{1}{\mu - 1} r^{\dagger} \quad . \quad . \quad . \quad . \quad . \quad . \quad . \quad [1]$$

$$r = (\mu - 1) f$$

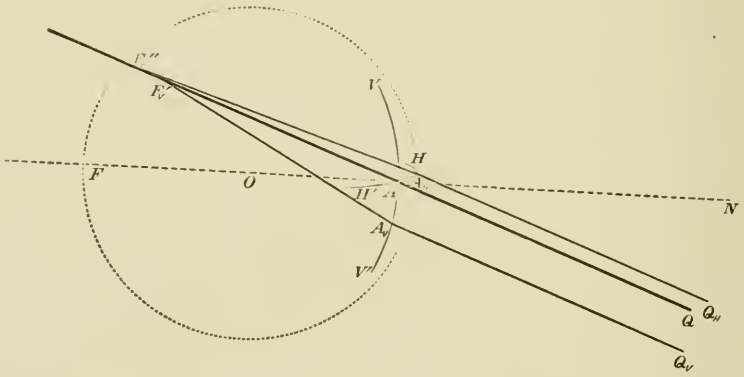
* The centre of any lens is a point, on the axis of the lens, so situated that any right line drawn through it and the two lens-surfaces cuts both surfaces at the same angle; in the case of a lens having one of its surfaces plane, the centre lies on the curved surface. A pencil whose axial ray passes through the centre is said to be centrically refracted through the lens.

† Parkinson's Optics, London and Cambridge, 1859, § 101.

Let QA represent the axial ray of a small parallel pencil, incident obliquely and centrically on the spherical surface of the lens, consequently continuing, after two opposite and equal refractions at the two lens-surfaces, in its original direction, to pass through F_V' and F_H''.*

Let $Q_V A_V F_V'$ represent a ray of the small parallel pencil, refracted obliquely and excentrically through the lens, in the plane of the arc VAV', to cut the axial ray of the pencil at the principal primary focus, F_V'.

Let $Q_H A_H F_H''$ represent another ray of the small parallel pencil, incident obliquely and excentrically on the spherical surface on the arc HAH', and refracted, at the two lens-surfaces, to cut the axial ray of the pencil at the principal secondary focus, F_H''.



Designating the primary focal length of the lens by f_1, the secondary focal length by f_2, the angle of incidence, QAN, by ϕ, and the angle of refraction (within the lens) by ϕ',† we have, neglecting the thickness of the lens,

* In the construction of the figure, we have supposed A_V and A_H to be taken very near to A, so that the thickness of the thin convexo-plane lens may be treated as a negligible quantity; the letters A, A_V and A_H represent, therefore, not only the points of incidence, on the first lens-surface, but also the points of emergence, at the second lens-surface, of the axial ray and the two other rays, respectively, of the small parallel pencil. The twice-refracted axial ray is accordingly shown as the incident ray produced, and the sum of the two refractions of the ray $Q_V A_V F_V'$ is shown as a single refraction in the plane of the arc VAV'; similarly the plane $F_H'' A A_H$, of the twice-refracted axial ray and the emergent ray $A_H F_H''$, is shown as continuous with the plane $Q_H A_H A$, of the incident axial ray and the incident ray $Q_H A_H$.

† By Snell's law, $\sin \phi = \mu \sin \phi'$.

$$f_1 = \cos^2\phi \frac{1}{\mu \cos \phi - \cos \phi} r^* \quad \text{[ii]}$$

$$f_2 = \frac{1}{\mu \cos \phi' - \cos \phi} r^* \quad \text{[iii]}$$

Substituting for r its value in terms of f [i], we have

$$f_1 = (\mu - 1) \cos^2\phi \frac{1}{\mu \cos \phi' - \cos \phi} f \quad \text{[II]}$$

$$f_2 = (\mu - 1) \frac{1}{\mu \cos \phi' - \cos \phi} f \quad \text{[III]}$$

It is evident, from inspection of the figure, that the position of F_V', the primary focus of the thin convexo-plane lens, is determined by the direction of the curved surface at A_V, and that the position of F_H'', the secondary focus of the lens, is determined by the direction of the curved surface at A_H.

Again, it is evident that we may vary at pleasure the radius of curvature of either of the two arcs, VAV' or HAH',

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* The equations for the general case of a small homocentric pencil centrically refracted through a thin spherical lens are — Parkinson's Optics, §112,

$$\frac{1}{v_1} - \frac{1}{u} = \frac{1}{\cos^2\phi} (\mu \cos \phi' - \cos \phi) \left(\frac{1}{r} - \frac{1}{s}\right) \quad [2]$$

$$\frac{1}{v_2} - \frac{1}{u} = (\mu \cos \phi' - \cos \phi) \left(\frac{1}{r} - \frac{1}{s}\right) \quad [3]$$

r and s representing the radii of curvature of the first and second lens-surfaces, and v_1 and v_2 the primary and secondary conjugate focal lengths for a pencil whose origin is taken at a distance u, from the centre of the lens.

For the case of a small parallel pencil we have

$$\frac{1}{u} = 0$$

$$[2a] \quad \frac{1}{v_1} = \frac{1}{f_1} = \frac{1}{\cos^2\phi} (\mu \cos \phi' - \cos \phi) \left(\frac{1}{r} - \frac{1}{s}\right)$$

$$[3a] \quad \frac{1}{v_2} = \frac{1}{f_2} = (\mu \cos \phi' - \cos \phi) \left(\frac{1}{r} - \frac{1}{s}\right)$$

For the case of a small parallel pencil centrically refracted through a thin spherico-plane lens, we have

$$\frac{1}{u} = 0 \qquad \frac{1}{s} = 0$$

$$[2b] \quad \frac{1}{v_1} = \frac{1}{f_1} = \frac{1}{\cos^2\phi} (\mu \cos \phi' - \cos \phi) \frac{1}{r}$$

$$f_1 = \cos^2\phi \frac{1}{\mu \cos \phi' - \cos \phi} r \quad \text{[ii]}$$

$$[3b] \quad \frac{1}{v_2} = \frac{1}{f_2} = (\mu \cos \phi' - \cos \phi) \frac{1}{r}$$

$$f_2 = \frac{1}{\mu \cos \phi' - \cos \phi} r \quad \text{[iii]}$$

When $\phi = 0$ (case of direct refraction of a small parallel pencil through a thin spherico-plane lens), equations [ii] and [iii] reduce to

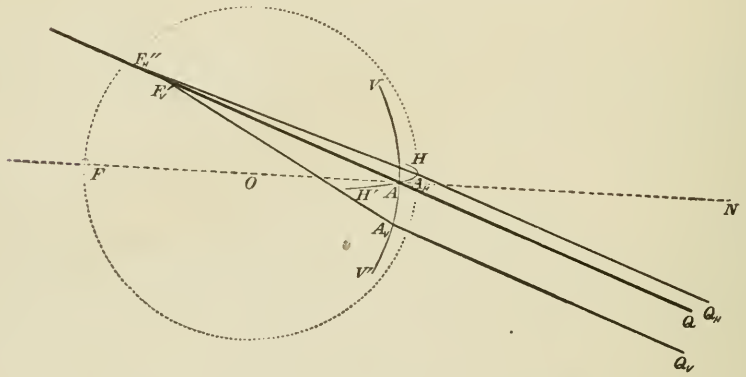
$$f_1 = f_2 = f = \frac{1}{\mu - 1} r \quad \text{[i]}$$

without affecting the direction of the curved surface at points taken on the other arc, thus transforming the spherical surface into a toric surface. The plane of one of the arcs will then be the equatorial plane, and the plane of the other arc a meridional plane of a right torus.

In the special case in which the radius of one of the arcs is assumed to be infinite, the surface becomes a right cylinder of which the arc of infinite radius is an element.

Regarding the sphere and the right cylinder as special cases of the right torus, we recognize the following possible modifications of the curved surface.

(*a*) Both radii *positive*, and *equal*: ..... *Convex Spherical* surface.
(*b*) " " *negative*, and *equal*: ..... *Concave Spherical* surface.
(*c*) " " *positive*, and *unequal*: ..... *Convex Toric* surface.
(*d*) " " *negative*, and *unequal*: ..... *Concave Toric* surface.
(*e*) One radius *positive*, the other *infinite*: ..... *Convex Cylindrical* surface.
(*f*) " " *negative*, the other *infinite*: ..... *Concave Cylindrical* surface.
(*g*) " " *positive*, the other *negative*: .....A *Toric* surface, *convex* in one of its principal sections and *concave* in the other; one of the arcs representing an arc of a meridian, and the other an arc of the lesser equator, of a torus of the ordinary, or anchor ring form.



Designating the radius of curvature of the curved lens-surface in the principal plane VAV' by rv, the radius of curvature in the principal plane HAH' by rh, the principal focal length and the primary focal length of the thin toric-plane lens as determined by the radius of curvature in the plane VAV' by fv and fv_1, respectively, and the principal and the second-

ary focal length as determined by the radius of curvature in the plane HAH' by fh and fh_2,* respectively, we have

$$[\text{i}] \ldots\ldots \begin{cases} fv = \dfrac{1}{\mu - 1} rv \\ fh = \dfrac{1}{\mu - 1} rh \end{cases}$$

$$[\text{ii}] \ldots\ldots fv_1 = \cos^2\phi \ \frac{1}{\mu \cos\phi' - \cos\phi} rv$$

$$[\text{iii}] \ldots\ldots fh_2 = \frac{1}{\mu \cos\phi' - \cos\phi} rh$$

$$[\text{II}] \ldots\ldots fv_1 = (\mu - 1) \cos^2\phi \ \frac{1}{\mu \cos\phi' - \cos\phi} fv$$

$$[\text{III}] \ldots\ldots fh_2 = (\mu - 1) \ \frac{1}{\mu \cos\phi' - \cos\phi} fh$$

Designating the power of the lens (as expressed by the reciprocal of the focal length) in the principal plane VAV' by Dv, and in the principal plane HAH' by Dh, we have

$$Dv_1{}^\dagger = \frac{1}{fv_1} = \frac{1}{\mu - 1} \frac{1}{\cos^2\phi} (\mu \cos\phi' - \cos\phi) Dv \quad [\text{II}]$$

$$Dh_2{}^\dagger = \frac{1}{fh_2} = \frac{1}{\mu - 1} (\mu \cos\phi' - \cos\phi) Dh \quad [\text{III}]$$

Comparing these equations,

$$\frac{Dv_1}{Dh_2} = \frac{1}{\cos^2\phi} \frac{Dv}{Dh} \quad [\text{IV}]$$

* When the curved surface is concave in either or in both of its principal sections the corresponding symbols (rv, fv, fv_1, or rh, fh, fh_2, or both) take the minus sign.

† When the curved surface is concave in the principal section VAV', Dv and Dv_1 take the minus sign; when the curved surface is concave in the principal section HAH', Dh and Dh_2 take the minus sign.

Every thin lens, whatever may be the configuration (whether spherical, toric, or cylindrical) of its curved surface or surfaces, may be represented by an equivalent thin lens of the spherico-plane, the toric-plane, or the cylindric-plane form. Again, each of these thin lenses may be represented by an equivalent lens having a toric and a spherical surface, or by a lens having two toric surfaces, with the planes of their principal sections (of greatest and least curvature) coincident or crossed, as the case may be. Referring to page 331, Note, we may write

$$[2a] \ldots\ldots \frac{1}{fv_1} = \frac{1}{\cos^2\phi} (\mu \cos\phi' - \cos\phi) \left(\frac{1}{rv} - \frac{1}{sv}\right)$$

$$[3a] \ldots\ldots \frac{1}{fh_2} = (\mu \cos\phi' - \cos\phi) \left(\frac{1}{rh} - \frac{1}{sh}\right)$$

Solutions [II], [III], and [IV] are valid, therefore, for lenses presenting any combination of spherical, toric, cylindrical and plane surfaces.

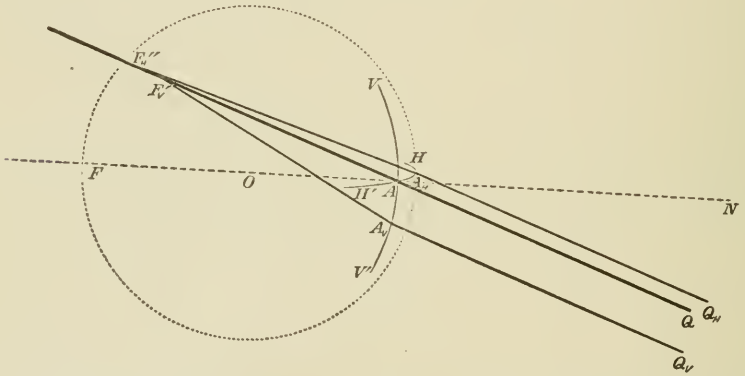
SPECIAL CASES:—

A.—For decreasing values of ϕ approaching zero, $\cos\phi$, $\cos\phi'$, and $\cos^2\phi$ increase, and $\frac{1}{\cos^2\phi}$ decreases; all approaching unity as a common limit. For vanishing values of ϕ the coefficients of Dv and Dh reduce, therefore, to unity, and disappear as factors; we have then, for the case of direct refraction,

[II] . . . . . $Dv_1 = Dv$

[III] . . . . . $Dh_2 = Dh$

[IV] . . . . . $\frac{Dv_1}{Dh_2} = \frac{Dv}{Dh}$



Taking $Dv = Dh = D$:— Case of direct refraction through a spherical (or other equivalent) lens, we have, taking $\phi = 0$,

[II] . . . . . $D_1 = D$

[III] . . . . . $D_2 = D$

[IV] . . . . . $\frac{D_1}{D_2} = 1$

Taking $Dv = 0$:— Case of direct refraction through a cylindrical (or other equivalent) lens, the axis of the cylinder being in the principal plane VAV', we have, taking $\phi = 0$,

[II] . . . . . $Dv_1 = 0$

[III] . . . . . $Dh_2 = Dh$

Taking $Dh = 0$:— Case of direct refraction through a cylindrical (or other equivalent) lens, the axis of the cylinder being in the principal plane HAH', we have, taking $\phi = 0$,

[II] . . . . . $Dv_1 = Dv$

[III] . . . . . $Dh_2 = 0$

B. — For increasing values of ϕ, approaching 90°, $\sin\phi$ increases, approaching unity; $\cos\phi$ and $\cos^2\phi$ decrease, approaching zero; and $\frac{1}{\cos^2\phi}$ increases, approaching infinity; but

$$\sin\phi' = \frac{1}{\mu}\sin\phi$$

$$\cos\phi' = \sqrt{1 - \left(\frac{1}{\mu}\sin\phi\right)^2}$$

In the limit, $\phi = 90°$,

$$\sin\phi = 1$$

$$\sin\phi' = \frac{1}{\mu} = \frac{2}{3}\ *$$

$$\cos\phi' = \sqrt{1 - \left(\frac{1}{\mu}\right)^2} = \sqrt{\frac{5}{9}} = 0.7454\ *$$

We have, then, taking $\phi = 90°$,

[II] . . . . . $Dv_1 = \infty$

[III] . . . . . $Dh_2 = 3\cos\phi'\, Dh = 2.2361\, Dh$

[IV] . . . . . $\frac{Dv_1}{Dh_2} = \infty$

Taking $Dv = Dh = D$: — Case of a spherical (or other equivalent) lens, we have, taking $\phi = 90°$,

[II] . . . . . $D_1 = \infty$

[III] . . . . . $D_2 = 3\cos\phi'\, D = 2.2361\, D$

[IV] . . . . . $\frac{D_1}{D_2} = \infty$

Taking $Dv = 0$: — Case of a cylindrical (or other equivalent) lens, the axis of the cylinder being in the principal plane VAV', we have, taking $\phi = 90°$,

[II] . . . . . $Dv_1 = 0$

[III] . . . . . $Dh_2 = 3\cos\phi'\, Dh = 2.2361\, Dh$

Taking $Dh = 0$: — Case of a cylindrical (or other equivalent) lens, the axis of the cylinder being in the principal plane HAH', we have, taking $\phi = 90°$,

[II] . . . . . $Dv_1 = \infty$

[III] . . . . . $Dh_2 = 0$

* Assuming the approximate value, $\mu = \frac{3}{2} = 1.5$, for the index of refraction from air into glass.

C.— In general, for varying values of ϕ, between the limits zero and 90°, cos ϕ, cos ϕ', and $\cos^2\phi$ vary inversely with the angle, but each at a rate which varies directly with the angle. Thus, for increasing values of ϕ we have cos ϕ, cos ϕ', and $\cos^2\phi$ decreasing (and $\frac{1}{\cos^2\phi}$ increasing), all at progressively increasing rates; conversely, for decreasing values of ϕ, we have cos ϕ, cos ϕ', and $\cos^2\phi$ increasing (and $\frac{1}{\cos^2\phi}$ decreasing), all at progressively decreasing rates. We have, then,

$$\frac{Dv_1}{Dh_2} = \frac{1}{\cos^2\phi}\,\frac{Dv}{Dh}$$

increasing with the angle of obliquity of refraction, but at a higher rate, or decreasing with the angle of obliquity of refraction, but at a lower rate.

Examples: —

(*a*) — Taking $\phi = 60°$, we have

$$\cos\phi = 0.5 \qquad \cos^2\phi = 0.25 \qquad \frac{1}{\cos^2\phi} = 4$$

[IV] . . . . . $\frac{Dv_1}{Dh_2} = 4\frac{Dv}{Dh}$

$$Dv_1 = 4Dh_2\,\frac{Dv}{Dh}$$

For the case of a spherical (or other equivalent) lens,

$$\frac{D_1}{D_2} = 4$$

$$D_1 = 4D_2 = D_2 + 3D_2$$

D_2 representing the increased power, and $3D_2$ the astigmatism of the lens, when the axis of the pencil cuts the plane of the lens at an angle of 60°.

(*b*) — Taking $\phi = 45°$, we have

$$\cos\phi = \sqrt{0.5} \qquad \cos^2\phi = 0.5 \qquad \frac{1}{\cos^2\phi} = 2$$

[IV] . . . . . $\frac{Dv_1}{Dh_2} = 2\frac{Dv}{Dh}$

$$Dv_1 = 2Dh_2\,\frac{Dv}{Dh}$$

For the case of a spherical (or other equivalent) lens,

$$\frac{D_1}{D_2} = 2$$

$$D_1 = 2\,D_2 = D_2 + D_2$$

D_2 representing the increased power, and D_2 the astigmatism of the lens, when the axis of the pencil cuts the plane of the lens at an angle of 45°.

(*c*) — Taking $\phi = 30°$, we have

$$\cos\phi = 0.8660 \qquad \cos^2\phi = 0.7500 \qquad \frac{1}{\cos^2\phi} = 1.3333$$

[IV] . . . . . $\dfrac{Dv_1}{Dh_2} = 1.3333\,\dfrac{Dv}{Dh}$

$$Dv_1 = 1.3333\,Dh_2\,\frac{Dv}{Dh}$$

For the case of a spherical (or other equivalent) lens,

$$\frac{D_1}{D_2} = 1.3333$$

$$D_1 = 1.3333\,D_2 = D_2 + 0.3333\,D_2$$

D_2 representing the increased power, and $0.3333\,D_2$ the astigmatism of the lens, when the axis of the pencil cuts the plane of the lens at an angle of 30°.

(*d*) — Taking $\phi = 15°$, we have

$$\cos\phi = 0.9652 \qquad \cos^2\phi = 0.9330 \qquad \frac{1}{\cos^2\phi} = 1.0718$$

[IV] . . . . . $\dfrac{Dv_1}{Dh_2} = 1.0718\,\dfrac{Dv}{Dh}$

$$Dv_1 = 1.0718\,Dh_2\,\frac{Dv}{Dh}$$

For the case of a spherical (or other equivalent) lens,

$$\frac{D_1}{D_2} = 1.0718$$

$$D_1 = 1.0718\,D_2 = D_2 + 0.0718\,D_2$$

D_2 representing the increased power, and $0.0718\,D_2$ the astigmatism of the lens, when the axis of the pencil cuts the plane of the lens at an angle of 15°.

Comparing (*a*), (*b*), (*c*), and (*d*), it will be remarked that the four assumed values of ϕ are as

$$4 : 3 : 2 : 1$$

but that the ratios of the increased power of the spherical lens in the primary plane to the increased power in the secondary plane are as

$$4 : 2 : 1.3333 : 1.0718$$

and that the ratios of the astigmatism to the increased power of the spherical lens are as

$$3 : 1 : 0.3333 : 0.0718$$

Comparing (*a*) and (*c*), it will be remarked that the two assumed values of ϕ are as 2 : 1, but that the astigmatism of the spherical lens, as measured by its increased power, is as 3 : 0.3333, or as 9 : 1.

Comparing (*c*) and (*d*), it will be remarked that the two assumed values of ϕ are as 2 : 1, but that the astigmatism of the spherical lens, as measured by its increased power, is as 0.3333 : 0.0718, or as 4.64 : 1.

If we suppose a spherical (or other equivalent) lens mounted in a spectacle-frame, so that, in the act of looking through it at an object at the level of the horizon, the axis of the lens shall coincide with the axis of the eye, the lens will be in its normal position (of least refraction) and will be free from astigmatism. If, however, we suppose the eye to be rotated downwards, as in the act of reading with a single eye, the normal position (of least refraction) will be that in which the lens is set a little lower, and is tilted forwards.

Designating the power of the spherical lens by D, and its angle of inclination to the vertical in the second position by ϕ, if we assume for ϕ the value 30°, the power of the tilted lens will be raised, in distant vision, to $D_2 = 1.096D$* in its horizontal meridian and to $D_1 = 1.462D$* in its vertical meridian. In other words, the power of the lens will be raised to $1.096D$, and the lens will show an astigmatism of $1.462D - 1.096D = 0.366D$.

If we take the angle of inclination of the lens equal to $\frac{1}{2}\phi = 15°$, the power of the lens will be raised, both for distant vision and in the reading position of the eye, to $D_2 = 1.023D$*

* The effect of the slight excentricity of refraction, due to the change in the direction of the eye, is supposed to be neglected.

in its horizontal meridian and to $D_1 = 1.096D$ * in its vertical meridian. In other words, the power of the lens will be raised to $1.023D$, and the lens will show an astigmatism of $1.097D - 1.023D = 0.074D$.

Comparing these two solutions, it will be remarked that when a spherical (or other equivalent) lens is tilted forwards through an angle of 15°, the maximum increase in the power of the lens, corresponding to the extreme changes in the direction of the eye, is less than one-fourth of the maximum increase in power when the plane of the lens is vertical or when it is tilted forwards through an angle of 30°.

Again, the maximum astigmatism of the lens, when tilted forwards through an angle of 15°, is only about one-fifth of the maximum astigmatism when the lens is tilted forwards through an angle of 30°.

This example illustrates the very important advantage to be derived, in particular cases, from the so-called pantoscopic mounting of spherical spectacle-lenses.

Equations [II], [III], and [IV] enable us to estimate the effect of wearing spectacle-lenses, whether of symmetrical or asymmetrical refraction, in a tilted position, provided that, in cases of asymmetry, the principal lens-meridians (of greatest and least refraction) are vertical and horizontal. They also yield useful approximate results when the principal meridians of the lens are approximately vertical and horizontal.

Solutions of [II] and [III], for different values of ϕ between zero and 45°, are given in a table printed on page 717 of Vol. V of these TRANSACTIONS.

DISCUSSION.

DR. H. D. NOYES of New York. — I desire to express my thanks to Dr. Green for this paper. It is to me the explanation of a fact that came under my notice in a patient twenty years ago, who had been through a great deal of eye trouble. He was the subject of cataract and a high grade of compound hypermetropic astigmatism. No glasses prescribed were satisfactory. When the ophthalmometer came into use, I thought I had found something to help him. It showed an astigmatism of about eight diopters in the eye he chiefly used, and I joyfully selected from the test case the corresponding glass. It proved

to be a very heavy glass, and after wearing it two weeks, he came back, saying it was no good, and he had gone back to a resource of his own. He had picked up an eye glass with spherical lenses of four inches focus and wore it greatly tipped, and got more comfort from its use than I could give him by compound cylinders. I knew, of course, that it produced the same result as a cylinder and corrected his astigmatism, but did not know the amount of power he obtained by that means. That case has always been to me difficult of explanation. On the other hand, it is common to see myopes of rather high degree correct an accompanying usually moderate astigmatism by the same maneuvre.

DR. W. F. MITTENDORF of New York. — I would like to ask whether the laws given for convex lenses apply also to concave lenses?

DR. GREEN. — They do.

DR. MITTENDORF. — Then that explains why so many myopes tilt their glasses, and require stronger glasses if required to wear them straight.

DR. W. S. DENNETT of New York. — I know more than one patient who manages to wear a weaker lens than he needs by tilting it. I also have a patient to whom I gave lenses calculated in accordance with a tilting formula, which I worked out some years ago, but he does not wear them because I neglected the element at right angles to the direction of tilting. I have a patient now who is wearing a lens which he tilted himself with good results and who refuses to wear an astigmatic glass. I am very glad to hear Dr. Green's article. I have often thought that if I had a table made out I might prescribe these glasses properly tilted.

DR. C. H. WILLIAMS of Boston.—Some years ago I published, with Professor Pickering, an article on the "Foci of Lenses Placed Obliquely." It was the result of some experimental work. I have seen patients voluntarily tilt their glasses to improve vision.

The difficulty of setting glasses to be worn constantly, which is due to the astigmatism caused by looking obliquely through the glass, is known to all of us. We have to compromise on a position intermediate between the one best for distance and that best for reading. But there is a form of astigmatism that some patients correct for themselves by looking obliquely through the glasses near the edge. At first it would seem that they are simply looking through a tipped glass, and that the in-

creased refractive power produced by the tipping, much more marked in the meridian at a right angle to the axis on which the glass is tipped, should explain the improvement in vision. Yet, simply tilting the glasses does not give the same result, and it appears that another factor comes into play. I would ask Dr. Green if he has studied the conditions in these cases also.

Dr. John Green of St. Louis. — The cases referred to by Dr. Williams, in which an astigmatic patient wearing a spherical glass learns to supplement the imperfect correction by looking obliquely through the lens near its edge, are instances of oblique excentrical refraction such as occurs in looking through a decentrated lens placed obliquely in front of the eye. When the point at which the visual axis cuts the plane of the lens lies in the vertical lens-meridian, a decentration of the lens upwards or downwards, conjoined with a tilting of its plane about the horizontal meridian, may be expected to give a practically equivalent optical result. In other cases, in which the wearer looks obliquely through a peripheral portion of the lens lying in a meridian other than the vertical, the rotation which may be expected to reproduce the optical conditions must be about some meridian other than the horizontal; such a rotation of the lens is obviously impracticable in the case of spectacles.

FOUR THOUSAND CASES OF OCULAR HEADACHES AND THE DIFFERENT STATES OF REFRACTION CONNECTED THEREWITH.

BY DR. W. F. MITTENDORF,

NEW YORK.

About four years ago I reported to the State Medical Society of New York the result of one thousand examinations of persons afflicted with headaches and other symptoms, which are usually spoken of as asthenopic troubles, and which were due to some errors of refraction or disturbances of the muscular apparatus of the eyes. The favorable reception which this article received both from the members present and the medical press in general has encouraged me to continue my observations, and, to-day, I propose to lay before you the results of the examination of three thousand (3,000) patients seen since the reading of the former paper. These patients came to me for the relief of asthenopic symptoms, and especially on account of headache. I have not thought it best to include in this list those patients who came to me merely because they needed glasses on account of age or near-sightedness, and in which there were no headaches or other asthenopic symptoms complained of, and only those presbyopic or myopic cases in which headache was a more or less prominent symptom are included in this list. The purpose of the paper is simply to give the statistics of the different refractive errors and their relative frequency, which were at the bottom of the eye-strain leading to the manifestation of asthenopic symptoms and to headaches especially.

The different states of refraction were as follows:

		Per cent.
Antimetropia,	103	2½
Myopia,	105	2½
Compound Myopic Astigmatism,	213	5½
Simple " "	226	5½
" " more than 0.5,	111	3
" " less than 0.5,	115	3
Myopic, Astigmatism of, 0.5,	46	1
" " " 0.25,	57	1½
" " " 0.12,	...	...
" with the rule,	180	4½
" against "	34	1
" Astigmatism oblique axis,	21	½
Presbyopia,	188	4½
Hypermetropia,	499	12
" with Presbyopia,	223	5½
Compound Hypermetropic Astigmatism,	265	6½
Simple " "	1,978	50
" Astigmatism more than 0.5,	391	10
" " 0.5 or less,	1,587	40
" " 0.5 with the rule,	482	12
" " 0.5 against "	105	2½
" " 0.25 with "	687	16½
" " 0.25 against "	120	3
" " 0.12 with "	24	⅔
" " 0.12 against "	12	¼
Hypermetropic Astigmatism oblique axis,	138	3½
Mixed "	126	3

In reviewing these figures some explanations are necessary. The most striking feature is, of course, the great frequency of the lower degrees of hypermetropic astigmatism. In speaking of the lower degrees I refer only to those cases where a cylindrical lens stronger than half a diopter was absolutely refused by the patient, but where a cylinder 0.5 or 0.25, or even 0.12, gave perfect relief, and here we have the grand total of 1,587 astigmatics of the 4,000 patients, whereas the number requiring more than a 0.5 cylinder was only 391.

It is somewhat surprising that patients with much higher degrees of astigmatism are, at times, apt to go through life without even complaining much of eye-strain, whereas so many eyes, in which there is only the slightest aberration of the normal curvature, should be troubled to such an extent as these statistics show. The reason of this is probably not only the greater frequency of the existence of slight degrees of astigmatism, but also the fact that persons with marked astigmatism have found out early in life that their eyes are weak, and that they must

take care of them, and they learn early to husband their strength, and thus they do not abuse their eyes as persons who imagine that their eyes are very strong are apt to do.

On the other hand, persons with slight degrees of astigmatism are apt to have the most perfect vision for near and far. I have very frequently heard these patients remark that they do not know why their family physicians suspect that their eyes are at fault, when they can see as well as anybody else, and even a great deal better than many of their friends who are never troubled with headaches. Or patients will tell us that they think that their headaches are not due to eye-strain, but that they have inherited this tendency to headaches, as their father and grandfather have had similar attacks of headaches, forgetting, of course, that they, in all probability, inherited the parent's eyes, and that the defects of the father's eyes was not suspected to be the cause of headache complained of, and the error of refraction not being corrected or even recognized, they had to go through life with the headache unrelieved by the proper glasses, which, in the child, if properly used, will give perfect and prompt relief in most cases. Then, again, we meet with patients quite frequently who, perhaps, call on us on account of presbyopia or some disease of the eyes, in whom we discover quite a good deal of astigmatism; and, upon questioning them whether they had never experienced any unpleasant symptoms on using their eyes, they are apt to answer no; or they will answer, that knowing that their eyes were not very strong they would never read in the evening and otherwise take good care of their eyes.

In regard to the weakest cylinder which I used, that of an eighth of one diopter, the fact that the number of it in these statistics is so small is due to the fact that I have used it only for the last six months. I was led to its employment by the inability to relieve some of my patients by either the weakest concave cylinder in the one or the weakest convex cylinder in the other meridian. I have seen such satisfactory results with it in some of these cases that I would not like to be without it now. In a great many of these cases the use of a cylindrical lens may not mean the permanent use of such a glass for near and for

far; in fact, in the majority of cases the use of such a glass for near work will be sufficient to relieve all the unpleasant symptoms; for one must not forget that astigmatism is in a great many cases inherited, and perhaps, in the majority of cases, congenital; and that the patients have been able to do quite an amount of work with their eyes without the slightest inconvenience for many years, until, from excessive use of the eyes, causing a tiring of the muscle of accommodation or from some general debilitating cause, an insufficiency of the ciliary muscle is produced, so that the astigmatism cannot be easily overcome by an accommodative effort, and that as a result of this weakening of the ciliary muscle the asthenopic symptoms, such as headaches, etc., become manifest.

Now if by proper hygienic measures and especially by gymnastic exercises, rest of the eyes, and an active outdoor life, the condition of the ciliary muscle is improved, the eye may for the rest of the patient's life perform its function in a most perfect manner without causing any inconvenience whatever. However, it is not often possible to relieve our patients in such a way, and an accurate correction of the refractive error, and especially if this is of the astigmatic kind, becomes necessary. This is all the more necessary if it is not convenient to take the patient away from his work, for the cessation of or a break in the studies of a young person may have an injurious effect upon the whole future of the patient.

In regard to the question of how long an astigmatic patient is to use his glasses I would like to answer that in a great many cases the glasses should be used only as long as the manifestation of unpleasant symptoms call for their use, and, in most of the cases, only as long as the eye is called upon to do any fine work. For instance, during the time I had been connected with our medical college I have sometimes had as many as ten or twelve students come to me quite discouraged because they could not use their eyes for more than a few minutes at the time, and fearing that they would have to give up their studies. Upon examining their eyes I would perhaps find a slight degree of astigmatism, prescribe for them the proper glasses, and they would be able to go through college without any difficulty.

Meeting some of these doctors later in life and inquiring how they got along with their eyes after leaving college, they would very frequently tell me that they were soon able to leave the glasses off entirely, and that they had not used them at all for years. The reason of this is that after leaving college their hunt after patients or the care of them after they found them would take them outdoors, and they would recover the power of accommodation, which enabled them to overcome the existent irregularity of the cornea without difficulty. It is for this reason that I allow my astigmatic patients, when their attendance at school is not necessary, for instance, during the summer vacations, to go without their glasses, provided they will promise me not to read much during this time, but live a healthy outdoor life as much as possible. I have likewise had occasion to observe that astigmatics doing a good deal of gymnastic work in schools or colleges will be able to do a moderate amount of studying without glasses and experience no inconvenience; but if the time for examination approaches and they devote most of their time to their books, they will soon become quite dependent upon their glasses.

These are exactly the cases which, before we learned to recognize and appreciate the importance of the lower degrees of astigmatism and for which we had no lenses in our trial cases, we were obliged to take away from college or school and advised them to turn their energies into some other direction, such as farming or sheep-raising, for instance. Now I am happy to say we are able to relieve them and leave them at their studies. In fact, in young people, gymnastic exercises, good, but plain, diet, and a certain amount of exercise are nearly as important as the use of glasses. Mild stimulating tonic applications to forehead and temples will greatly add to the relief of the headaches, and acting as mild counter irritant may relieve the congested condition of the muscular apparatus of the eye.

In regard to anisometropia I have included only such cases in this section where there was hypermetropia in one eye and myopia in the other eye. These cases Dr. H. D. Noyes has proposed to call antimetropia, and my experience is that some of them will cheerfully and comfortably use full correction for

both eyes, but still it is doubtful whether it is often possible to give these patients binocular vision; most of them will only accept correction for the eye which they are in the habit of using. Later in life they are apt to use the myopic eye for near work and the hypermetropic eye for the distance. Very often they are not aware of this fact, and it is sometimes amusing to convince them of this fact. I remember very well an old clerical gentleman who had one very myopic eye, which he supposed to be entirely blind, and who called to get a distance glass for his hypermetropic eye, which he thought he was using for near as well as for far. He accepted for this eye a +2 D. lens; when told to read he would do it without glasses by holding the book close up to his eyes. When I told him to close his supposed blind eye he could not see to read fine print, but, upon closing the hypermetropic eye, he saw, of course, the finest print with the highly myopic eye.

The proportion of astigmatism with and against the rule does not, as I suppose, vary very much from other statistics, but I have been struck by the fact that in old people the astigmatism against the rule occurs much more frequently than in young persons, in fact, it is met with so often that it becomes almost the rule in old people to find the axis of the hypermetropic astigmatism at 180° and that of the myopic astigmatism at 0°. This is a fact which should not be overlooked in the selection of reading glasses for old people; for although in the majority of cases a slight degree of astigmatism may be better overlooked, especially if strong convex lenses are required for reading, yet, in some cases the additional correction of the astigmatism, especially if it is against the rule, will give us a much better reading glass. The frequent occurrence of astigmatism against the rule in old people is undoubtedly due to senile changes in the lens and the frequency of its occurrence in such patients has been almost entirely overlooked in nearly all text-books on ophthalmology.

The percentage of mixed astigmatism is perhaps a little higher in my statistics than we are accustomed to see them, and this requires a few words of explanation. Some patients with a high degree of astigmatism, where the other meridian is ap-

parently emmetropic, find the use of a strong cylindrical lens at times very trying, especially for distant vision. A very weak concave cylinder in the emmetropic meridian obviates this at once, and the patient is not only able to use the glasses better for the distance, but likewise for near work, and may even accept a stronger convex cylinder proportionately. I suppose the reason for this is that the ciliary muscle, which has been used to an excessive amount of work before the correcting glass is used, cannot relax its fibres so promptly, and although increasing apparently the difference between the two meridians, yet allows some display of accommodation.

The following two cases, which illustrate this, have been under my observation for some time, and have resisted all attempts to remove the concave lens for the opposite meridian, and although the vision is $=20/xx$ with the plain convex cylinder, yet the addition of the concave glass makes vision much clearer both for far and near.

Mr. L., merchant, 35 years of age, accepts C + 3 ax. 90° in each eye; he has been using his present glasses for nearly eight years with a C — 0.25 ax. 180° added.

Miss W. of Boston, teacher, accepts C + 1.50 ax. 90°, which gives vision $=20/xx$; but the sight is a little blurred, and an increase or decrease of the convex cylinder does not give such good results as A. C — 0.25 ax. 180° added; this gives clear vision and is much more agreeable to the eye, and relieves not only the headache, but other nervous symptoms which she had complained of.

DISCUSSION.

DR. H. D. NOYES of New York. — I am quoted in this paper as the author of a new term for anisometropia. In 1876 I prepared an article in which I advised the term anti-metropia to indicate that on one side we had myopia and on the other hypermetropia, whether mixed with astigmatism or not. I do not know whether the author gave that definition. It merely means a division of aniso-metropia.

DR. W. F. MITTENDORF. — Yes, sir. That is the way I used it.

DR. F. BULLER of Montreal, Canada. — I would like to ask Dr. Mittendorf how he determines fractional parts of a diopter?

I think one rarely finds patients capable of distinguishing between an eight and quarter diopter.

DR. W. F. MITTENDORF. — It is hardly possible with the ophthalmoscope, or Javal's instrument, to determine one-eighth of a diopter. If the patient finds that one-quarter diopter gives blurred vision and one-eighth does not, I prefer to order the latter. Very few persons require such a weak lens, but we do have such cases, nevertheless. I had a patient from the South a few months ago who at first wore a plus one-quarter diopter cylinder axis ninety degrees, but, getting no relief went to another oculist in Atlanta, who ordered one-half diopter. He found that after using these a short time his asthenopia increased, so went back to his old glasses. He could not wear them with comfort, however, and, when in the light, had to put on dark glasses. In this case one-eighth diopter removed all the symptoms, and he was able to wear his glasses without any inconvenience. I have found that patients, as a rule, are very prompt to distinguish between one-eighth and one-quarter of a diopter if the amount of astigmatism is only very slight, and they discover even more promptly the difference between one-quarter and one-half of a diopter of a cylinder if there is only the slighter degree of astigmatism present. If the degree of the astigmatism is, however, greater than the difference between the correcting glass and the next number weaker, it is not always so readily distinguished.

DR. F. P. CAPRON of Providence. — I have been explaining to my patients that they can overcome the slight degrees by an effort, but cannot the higher ones without suffering. That seemed to me a plausible explanation. It was the effort, I suppose, which gave them the headache. I have been accustomed to explain the pain attending slight degrees of astigmatism upon the ground that in such cases the eyes are so nearly normal that they can be made so by a muscular effort, but the very effort causes the pain, while, in higher degrees, no effort will bring about such a result, and the patients content themselves with their imperfect vision and make no attempt to improve it.

DR. SAMUEL THEOBALD of Baltimore. — In one respect Dr. Mittendorf's statistics are unique. I believe he said that in fifty per cent. of his cases there was *simple* hypermetropic astigmatism. I think if he had taken the same care to look for slight degrees of hypermetropia that he did to discover low grades of astigmatism his cases of compound hypermetropic astigmatism would have been greatly increased and his cases of simple hypermetropic astigmatism cut down. His statistics certainly are at variance in this respect with my own.

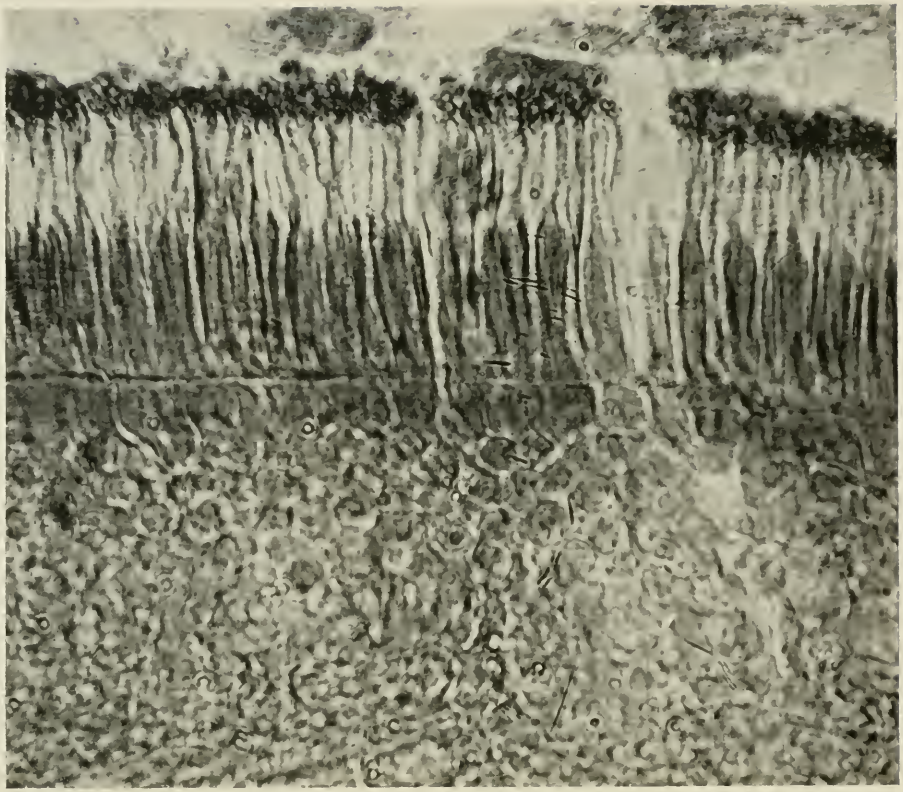


FIG. I. HUMAN RETINA. TERMINAL LOOPS OF CONES IN THE MACULAR REGION.

DR. RISLEY. —These cases were corrected without mydriatic. Perhaps that accounts for it.

DR. THEOBALD. — I think not.

DR. MITTENDORF. — Only the manifest hypermetropia was taken into account. Weak convex lenses absolutely were refused and cylinders accepted and gave perfect vision.

THE TERMINAL LOOPS OF THE CONES AND RODS OF THE HUMAN RETINA, WITH PHOTOMICROGRAPHS.

BY W. F. NORRIS, M.D.

PHILADELPHIA.

In March, 1894, in collaboration with Dr. James Wallace, I published in the University Medical Magazine a paper on this subject. Having since that time, by repeated examinations of retinal tissue, become still more convinced of the correctness of the statements therein made, and having other photomicrographs for demonstration, I desire to call the attention of the society for a few minutes to what seems to me an important advance in our knowledge of the minute anatomy of that complex end organ, the retina.

It is well known that the external segments (members) of the cones and rods are usually described as ending in free extremities or tips which are in close proximity to the pigment layer of the retina, and often covered by and enveloped in it. Some investigators have spoken of them as ending in a swelling or knob.

The photomicrographs, which I herewith exhibit, show that the external extremities of the cones and rods are loops, the outer member of a cone bending over to become continuous with the outer member of an adjacent rod, or less frequently with the outer member of another cone (twin cones). Adjacent rods unite also by their curved outer segments, ending thus also in peripheral loops.

Taking a portion of the retina in the macular region we find the outer segment of each cone becoming cylindrical, apparently

with a woolly surface and with delicate transverse, or, at times, spiral markings. Such a looped outer member in most instances enters the retinal pigment which is often adherent to it for a considerable distance, thus hiding the loop from our view. It is only when we are fortunate enough to find them partially or entirely free from pigment that we can determine their true shape, as they readily break at the loop and thus appear to have blunt or knobbed extremities.

The outer member of a cone, having thus curved on itself, runs down along the side of the inner segment as a cylinder having about the same caliber as at the turn, and after perforating the external limiting membrane passes alongside of the nucleus at the base of the cone, and may be followed for some distance in a tortuous course between the nuclei of the so-called outer nuclear layer, anastomosing, at times, with some of the other nerve fibrils of this layer. In the more peripheral parts of the retina the bacillary layer is still more or less conical in shape, at times nearly cylindrical, the outer extremity bending over to become continuous with the adjacent rod.

In some places, as shown in the osmic acid preparation, we find double or twin cones like those described in the retinæ of fishes, and, in these instances, the bodies of the cones are flattened where they are in contact with each other.

Most of the photomicrographs are from the eye of a boy of twelve years of age, enucleated on the third day after a wound involving the cornea, lens, iris, and ciliary body, caused by a chip of iron which entered the eye and embedded itself in the sclerotic. The wound does not appear to have been infected, as very little inflammation was manifest. The eyeball, after enucleation, was immediately dropped into Müller's fluid, at a temperature of 100° F.

The specimen from which Fig. VI was obtained was from the eye of a child which died of scarlet fever, and was removed about half an hour after death. Notwithstanding the fact that it was in cold weather, lethal changes had probably commenced in the bacillary layer. The rods and cones presented an appearance quite different to that presented by these organs in the eye which had been dropped into the warm Müller's fluid immediately after enucleation. In the former the bodies of the

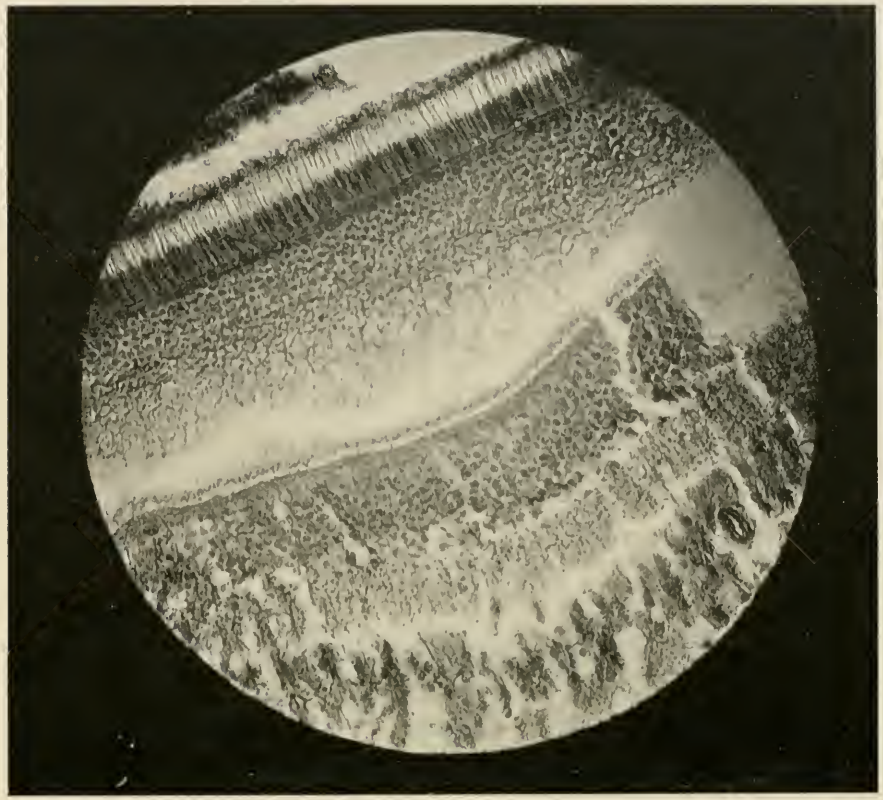


FIG. II. HUMAN RETINA. TERMINAL LOOPS OF CONES IN THE MACULAR REGION.

cones are bulging and thick, with an even surface, making very conical figures, while in the latter they present longitudinal grooves on their surface. Faint longitudinal markings are described by almost all observers, and the exceedingly marked character of these may possibly be due to the shrinking influence of Müller's fluid. Indeed, most of the recent writers on the subject recommend either a 3 per cent. solution of nitric acid or a mixture of osmic acid with bichromate of potassium, either with or without the use of nitrate of silver, as more likely to fix the retinal elements in their true form. I am inclined to think, however, that cones so swollen and turgid as those represented in the osmic acid preparation are undergoing degenerative change, and am confirmed in this opinion by the fact that another perfectly fresh eye, hardened in Flemming's solution (osmic acid and bichromate of potash), gave a picture essentially the same as that found in the specimen hardened in Müller's fluid, and also by a comparison with Pacini's drawings, which were made from an eye obtained twenty-four hours after death and not treated with any hardening agent, the retina having been cut, teased, and mounted for examination in vitreous humor.* Pacini was the first to discover the terminal loops of the cones and rods, but his description appears to have been neglected or rejected as inaccurate. It gives me much pleasure to be able to present to the society for comparison photographs of the drawings in his essay on the intimate structure of the retina.† In Fig. VII, which represents a human retina, we have some swollen cones bending at their outer extremities to form loops and becoming continuous with an adjacent rod; while other rods are depicted as ending in blunt points.

The sections of the human retina, of which I have exhibited photographs, further show that the looped outer extremities of the rods and cones are not all of the same length, but that some reach further out towards the choroid than do others. Almost all writers agree that even allowing for any distortion from the action of the hardening fluid, the cones in the fovea are longer than those in other parts of the retina.

* H. Müller (Gesammelte Schriften, S. 76), in discussing the retina of a pigeon speaks of this degenerative swelling of the cones, and Hannover makes their tendency to swell a characteristic to distinguish them from the rods.

† Sulla Tessitura intima-della retina — memoria di Filippo Pacini — di Pistoja, Bologna, 1845.

Differences in the length of the rods and cones may be seen, however, in many other parts of the retina, even in places where the section is so clearly at right angles to the plane of the retina that there is no room for any mistake, owing to the obliquity of the cut.

The accompanying photomicrographs, six in number, illustrate admirably what I have endeavored to describe in text. They are all from the human retina.

Fig. I is a highly magnified section of a part of the macular region. There are longitudinal folds in the inner members of the cones. The tips of the outer members are more or less hidden by retinal pigment, but in many places are only slightly veiled by it, so as to permit us to see the curve at their outermost part, and to follow the recurrent portion of the loop down along the body of the inner member to its perforation of the limitans externa, and entrance into the outer nuclear layer. Some of these recurrent loops may be seen to anastomose with other nerve fibres in the outer nuclear layer.

Fig. II shows a less magnified view of the macular region, exhibiting distinctly the arrangement described in text to Fig. I. The cones have been but little disturbed by the section; much pigment still adheres to their outer members. In places the loops may be seen projecting beyond the dense pigment which still adheres firmly to the outer member just within the position of the loop. The nucleus at the base of each cone is beautifully distinct.

Fig. III represents a similar portion of the retina less magnified than Fig. I, but more magnified than Fig. II. The loops, in places, show distinctly.

Fig. IV shows the looped extremities of the cones at a point where the preparation has been accidentally broken by pressure of the immersion lens on the cover glass.

Fig. V exhibits a more peripheral portion of the retina, showing the looped extremities of the rods. In both the outer and inner nuclear layers bipolar cells can be seen, and in the fibre layer both multipolar and bipolar cells.

Fig. VI, osmic acid preparation, showing swollen inner members of the cones, well-marked loops of their outer members, and near the center of the plate is seen a twin cone.

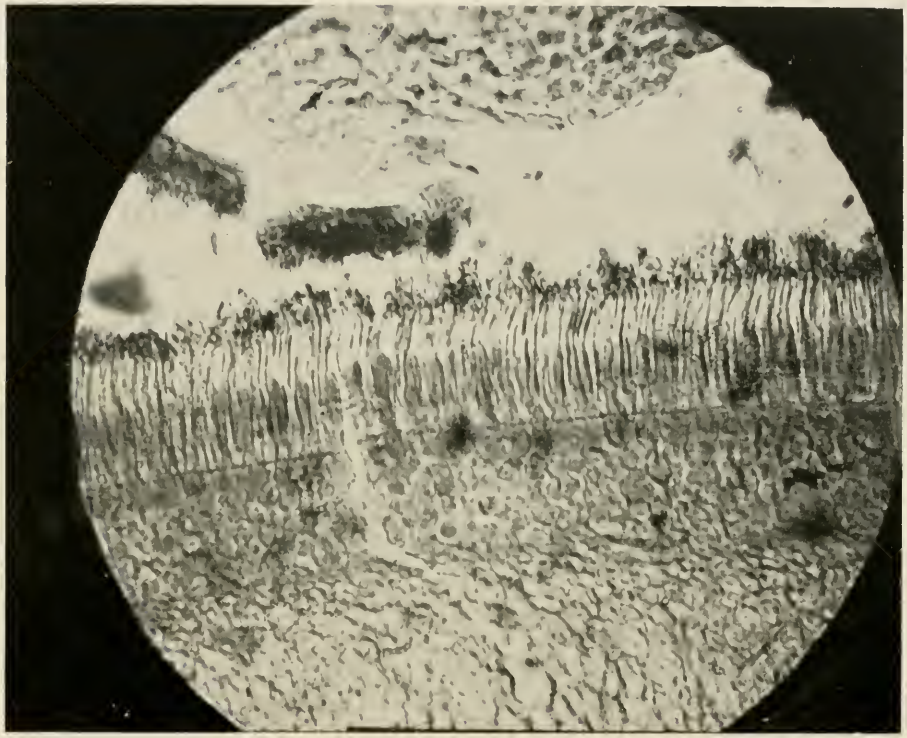


FIG. III. HUMAN RETINA. TERMINAL LOOPS OF CONES IN THE MACULAR REGION.

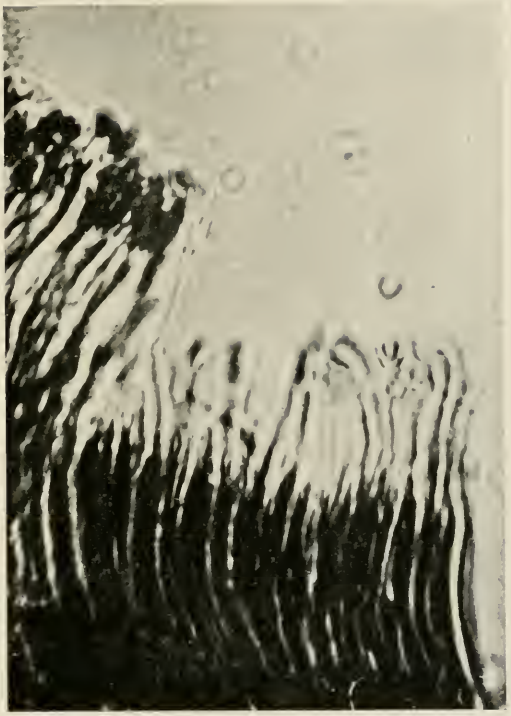


FIG. IV. HUMAN RETINA. TERMINAL LOOPS OF CONES IN THE MACULAR REGION PREPARATION BROKEN BY PRESSURE OF IMMERSION LENS ON COVER GLASS.

FIG. V. HUMAN RETINA. PERIPHERAL PORTION. TERMINAL LOOPS OF RODS.

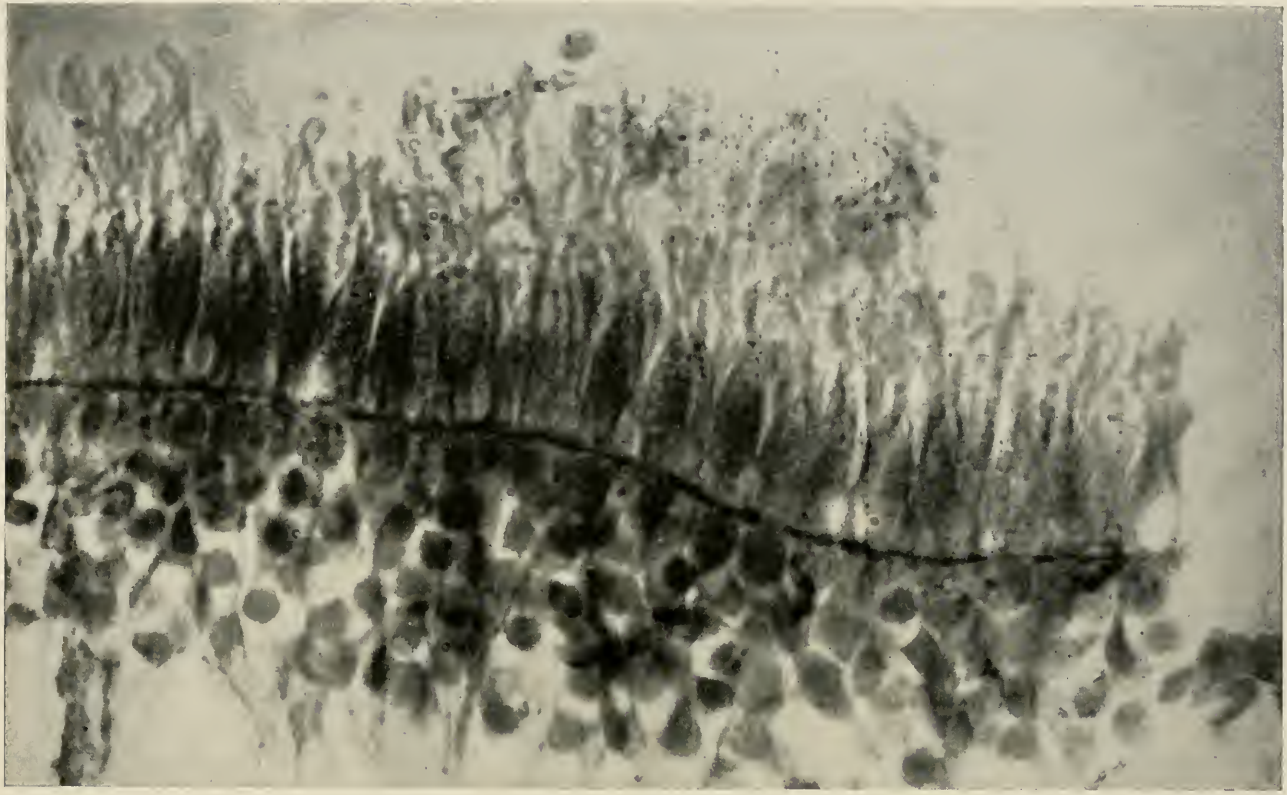
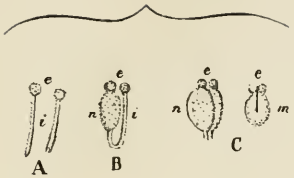


FIG. VI. HUMAN RETINA. OSMIC ACID PREPARATION. LOOPED EXTREMITIES OF CONES, AND NEAR THE CENTRE A TWIN CONE.



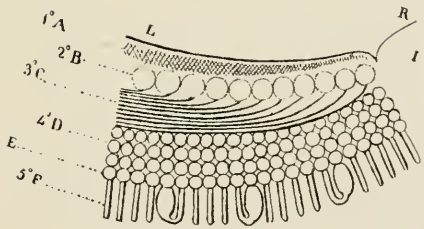


FIG. VII. PHOTOGRAPHIC REPRODUCTION OF PACINI'S FIGURES OF THE HUMAN RETINA.

Fig. VII is a photographic reproduction of Pacini's drawing of the human retina, from sections and teasings of the fresh unhardened retina examined in vitreous humor. The upper figure represents knobbed rods, a cone whose outer member becomes cylindrical and continuous with a rod, also twin cones. The lower figure is his diagrammatic view of the human retina.

Helmholtz, Czermak, Nuel, Wolffberg, Olshausen, Exner, and Dimmer all agree in describing a shadow or a mosaic work, like shagreen leather, made visible entoptically by rays coming through the pupil and moving in the same direction as the diaphragm which is held in front of the eye. Probably this appearance is due to the perforations in the external limiting membrane made by the rods and cones. This would prove that the percipient element must lie still further out towards the choroid, and the seat of light perception is therefore probably in the outer segments of the rods and cones, which, as is well known, are the only parts of the retina which are bathed in visual purple (rhodopsin).

We are all familiar with the effect of a diminution in the caliber of an electric wire or the substitution of a less good conductor in a circuit in which a strong current of electricity is passing, in increasing the manifestations of heat and light. It has appeared to the writer that possibly the rapid diminution in the caliber of the outer members of the cones and rods may have a similar function as regards the perception of light and the making of light undulations more palpable.

In conclusion, I desire to state that the negatives of all the photomicrographs which I have exhibited have been prepared by Dr. James Wallace. I think they are so excellent as to convince anyone examining them of his great skill as a microscopist and photographer.

DISCUSSION.

Dr. J. E. Weeks of New York. — I would like to ask Dr. Norris if he made his observations in specimens where the pigment layer was still attached to the retina?

Dr. W. F. Norris. — The photographs show that they were made both where it was and was not attached. The loops show best where the pigment layer was detached. In many of the

photographs, however, you can see the outer segment of the cone or rod running up into the pigment layer and in some instances, veiling it so slightly that you can still follow the loop around.

DR. J. E. WEEKS. — The terminal parts of the rods and cones are so delicate that any interference with them may easily lead one astray. Has S Ramon Y. Cajal, in his extensive study of the retina, made any mention of terminal loops? I have examined his work carefully, and, as I have not found mention of terminal loops, am surprised that such a careful observer should have failed to note such an important fact if it existed.

DR. O. F. WADSWORTH of Boston. — Dr. Norris's communication is certainly very interesting. Formerly I gave considerable study to the rods and cones, but I never saw anything like terminal loops where the rods and cones could be supposed to be in their normal positions. I must confess that, in the brief opportunity I have had to look at these photographs, I still cannot see them.

DR. W. F. NORRIS. — I have only to say that I have spoken of this matter with considerable diffidence, knowing that it was an extremely difficult subject, and that many able observers have worked over it with different results, and I should not have any hope of convincing this society but for the photomicrographs. If you look at these carefully and follow any one cone or rod up into the pigment layer you can convince yourself that the outer member of a cone in this situation curves and becomes continuous with the adjacent rod.

SPONTANEOUS RUPTURE OF THE CHOROID COAT.

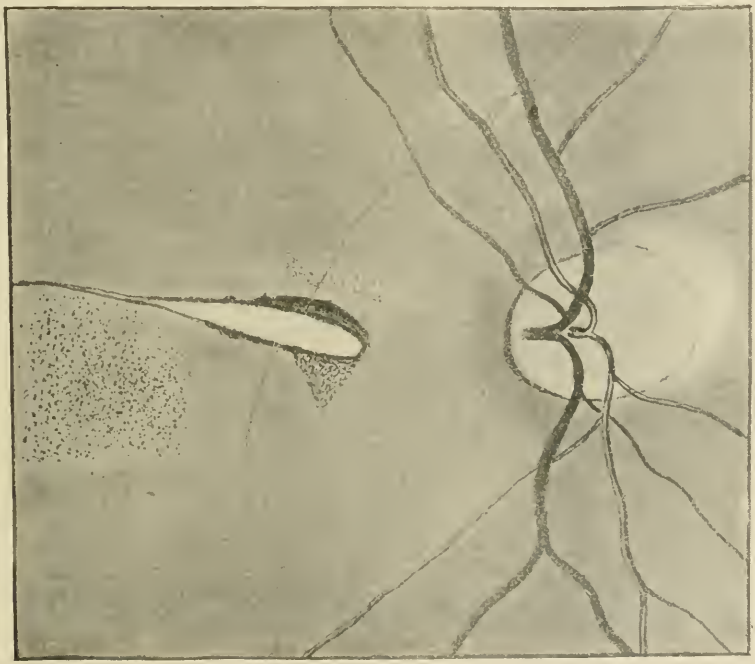
BY ALBERT G. HEYL, M.D.,

OF PHILADELPHIA.

Spontaneous rupture of the choroid coat is one which occurs through the agency of forces set in operation by the eye itself, and differs from the traumatic rupture both in the direction of the tear and in the application of the forces by which it is brought about.

The patient, Barbara Bohner, æ. 65, applied at the eye department of the Episcopal Hospital Sept. 7, 1893. Has always been short-sighted, but less so in the R. E. than in the

L. E. Has never worn glasses steadily. About nine days ago noticed a spot in front of the R. E., and that in walking in the garden the boards of the fence seemed crooked. Status praesens, R. E., M. 1.5 D.; L. E., M. 6 D. Media cloudy in each. In the R. E. there was a choroidal rupture starting at



SPONTANEOUS RUPTURE OF CHOROID.

the macula lutea and running practically in a *horizontal* direction toward the equator of the ball. There was eccentric fixation and a central scotoma. I saw the patient a week later and thought the rupture was beginning to close at the end nearer the equator.

A glance at the picture will show the peculiarities of the rupture. It is, in shape, like the longitudinal section of a pear, the base involves the macula lutea, and thence the rupture tapers out toward the equator. The macular end of the lower lip of the rupture has adjacent to it a triangular collection of pigment, the base joining on to the lower lip, while slightly

above the upper lip is an oblong collection of disturbed retinal pigment. Toward the equator and below the rupture is a large collection of disturbed pigment. This disturbed condition of the retinal pigment is a very common lesion in the traumatic rupture and indicates that the breaking force is largely expended on the pigment coat of the retina. The triangular collection of disturbed pigment on the lower lip is peculiar in form, and, evidently, indicates that the macula lutea was exposed to the traction of two vertical forces, the one pulling directly up and the other directly down. The upper portion gave way and the rupture was extended out toward the equator, the lower remained fast, but the force of the traction was sufficient to stretch the pigment at the macula end sufficiently to cause the disturbed pigment to assume the triangular shape.

The direction of the rupture should be noted. L. E. nearly horizontal. A traumatic rupture in this position would be almost vertical, indicating that the mechanism in the two cases is entirely different. The traumatic rupture tends to be crescentic, the curve being more or less concentric with the margin of the optic disc; the latter has evidently something to do with its formation. The spontaneous rupture has an entirely different position, as may be seen from the drawing. The traumatic rupture may occur in any quadrant of the fundus. The spontaneous rupture, so far as my experience as yet has gone, has its seat in the macular region. I believe the reason for this, as well as the peculiar direction of the rupture, is to be found in the action of the external rectus muscle.

Remarks. 1. It is possible that the rare condition delineated in figure 96, Jaegar's Hand Atlas, represents what had originally been a spontaneous rupture. The details of the case are somewhat meagre, but defective sight had been noticed four years previous to the time when the drawing was made. The drawing suggests that originally a horizontal rupture had existed, which finally had partially closed, leaving two gaping ends.

2. It seems probable that a sudden spasmodic action of the external rectus was the cause of the spontaneous rupture. The sclera posterior to the insertion of the externus was relaxed to

such an extent that horizontal rupture occurred. It is interesting to note that the traction seems primarily to have been at the macula lutea and in the vertical meridian.

If, instead of one sudden snap-like contraction of the externus, we conceive of a large number of minute spasms constantly recurring for months and years, we might have, instead of a rupture, simply pigmentary changes occurring in the macular region, and, perhaps, such macular changes as are seen in certain cases of myopia, are to be referred to the abnormal action of the externus.

3. The more accurate designation of choroidal rupture is retino-choroidal rupture. How far, indeed, the choroid coat is involved seems to be unknown, but, undoubtedly, it is the splitting the pigmentary layer of the retina, which is the conspicuous feature of the lesion.

ALBUMINOID (?) DEPOSIT IN THE OPTIC DISC AND RETINA.

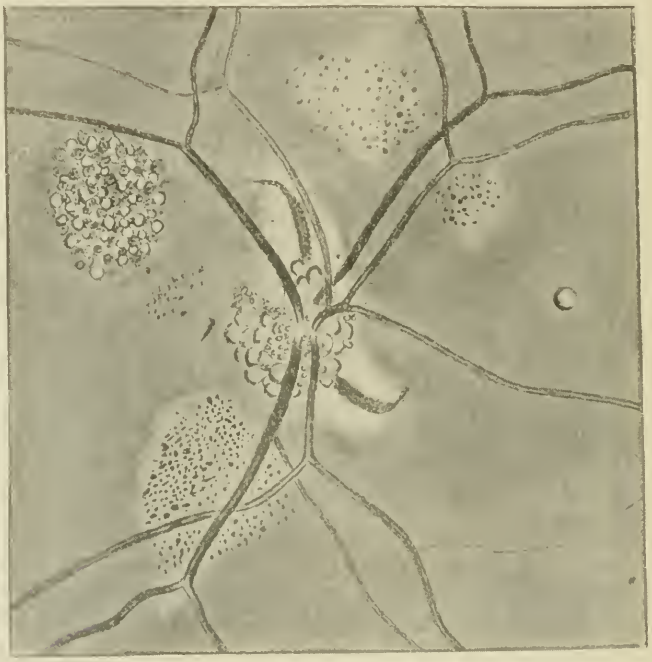
BY ALBERT G. HEYL, M.D.,

OF PHILADELPHIA.

The term albuminoid, as descriptive of the rare lesion described in this paper, is used with hesitation, owing to the absence of chemical proof of its existence. The general appearance of the deposits, as observed with the ophthalmoscope, seemed to indicate them to be a derivative of the albumen of the blood.

The history of the case is as follows: Mrs. ——, æ. 49, applied at the eye dispensary of the Episcopal Hospital Feb. 25, 1895, for glasses for near work, O. D. 20/15, O. S. 20/20. A glance in the O. D. revealed the condition shown in the drawing. The optic disc was covered with a series of round bodies, many of them of a diameter slightly greater than that of a retinal vein. They were apparently flattened and piled one upon the other; those immediately adjacent to the periphery being overlapped by those more centrally located. The ring-like limit

of the disc was concealed by them, although the general outline was preserved. The larger bodies had a narrow white ring on the periphery, inside of which they were of smoky hue, deepening toward the center into a dark point, whether depended on the form of the body, or its nature, or to a turbid fluid en-



ALBUMINOID (?) DEPOSIT IN OPTIC NERVE AND RETINA.

closing them could not be determined. Certain portions of the disc seemed to have this smoky hue, and it seemed to be those in which the bodies were smaller in size, and, during the months the case has been under observation, this smoky hue seems to have extended until the whole disc is turbid, and the size of the large bodies has decreased, so that it may be that a turbid fluid has been forming in the process of retrogression.

Situated upon the pigmentary layer of the retina and adjoining the disc margin were four patches of white waxy-looking material. They were underneath the nerve fibre layer. Two

were above and two below, and each two were separated by a black interval of retinal pigment. This streak of pigment was peculiar in appearance; beginning at the disc with an apparent breadth of 1.5 millimeters, it gradually tapered to a point; it may have been produced by the absorption of the white material, or it may have been that originally the four masses were deposited as shown in the drawing. It seems to me that the latter is the better hypothesis. Close examination showed that the retina was extensively infiltrated with a faint white deposit, closely connected with the pigmentary layer, and lying underneath the nerve-fibre layer. This deposit, which I think was to great extent at first evenly diffused over the fundus, was essentially of the same nature as the white masses adjacent to the optic disc, but not nearly so thick and white. Four months later the white masses were becoming absorbed perceptibly. At this time, over the fundus punctate black spots began to show themselves, and then the existence of a milky deposit over the fundus was more clearly shown. A patch of these punctate spots are shown in the drawing below the disc. In the temporal region above the macula a group of white round bodies were observed, appearing to have been originally deposited in this form. They were somewhat smaller than the largest rounded bodies upon the optic disc, but whether identical with them could not be ascertained. In the nasal half of the fundus there was a solitary rounded body very similar in appearance to the disc bodies, and I judge of the same nature. It is represented in the drawing.

The surface of the disc was convex, owing to the deposits. The blood-vessels on the disc were not overlapped by them. This is in accord with the results of microscopic investigation, which show that the masses of deposit are anterior to the lamina cribosa, and push the nerve fibre layer before them.

In the L. E. the same condition existed, but in much less marked degree. Urine examined when the patient first seen and also four months later showed no albumen or tube casts. There was œdema of both lower extremities below the knees. Examination of the heart, by Dr. Harvey Shoemaker, showed the existence of a mitral systolic murmur. The patient was

given Fowler's solution of arsenic, and, under its use, the œdema of the lower limbs subsided and the white patches on the fundus began to disappear. Examination of the visual field showed a marked limitation of the nasal half of each eye, recalling the form of limitation seen in incipient glaucoma.

Remarks. The pathological change observed in the right optic nerve and figured in the drawing is a conspicuous example of the "drusen" of the optic nerve. Under this name German writers have described small, round bodies situated in the optic nerve head; they occur in clusters and also singly, occupy the plane just anterior to the lamina cribosa, but posterior to the nerve fibre layer of the optic disc; cross sections show them to be laminated in structure, destitute of cells or nuclei; also they have within them a lime salt. A complete account of this lesion may be found in the paper by Hirschberg and Cirincione,* and also in that by G. De Schweinitz.† The significance of this pathological product is a mystery; why it should be located just anterior to the lamina cribosa, why it pushes the disc nerve fibres before it and does not infiltrate into retinal structure, and what is the real source of the hyaline material of which these bodies are composed may be looked upon as unanswered questions.

The association in my case with a peculiar retinal deposit is worthy of note. The latter gave the impression as if from the inner surface of the pigmentary layer a white material had exuded, and in a special degree immediately about the periphery of the disc. There is a glistening white exudate lying upon and closely connected with the pigmentary layer of the retina, which I have several times seen, and which seems ophthalmoscopically to be different from the white masses seen in the retinitis of Bright's disease. It may be likened in appearance to the milk-curd produced by the action of rennet upon milk. It is unaccompanied by signs of acute inflammation, but seems to have the power, probably through pressure, to erode the pigmentary layer and to cause absorption of its cells. It is to this form of exudation that the white deposit seen in the drawing belonged,

* Centralblattf. Prakt. Augenheilk., June and July, 1891.

† Trans. Amer. Ophthalmolog. Soc., p. 349.

and it seems to me, therefore, this latter was not an inflammatory exudation, but one depending upon an abnormal state of the blood and analogous to what is commonly known as amyloid deposit, such as is seen in the liver or kidneys.

Taking, then, this view, what remains to be said may be put in the form of question and answer.

1. From what vessels was this white material transuded? Evidently it was from the chorio-capillaris system. This system is adjacent to the pigmentary layer of the retina and no doubt is concerned in its tissue changes. Included in this system is what is usually described as the circle of Zinn, which furnishes a capillary net-work immediately about the optic disc, and also to the lamina cribrosa. Supposing, now, a transudation to occur from all parts of this system, we should expect to find it over the whole extent of the pigmentary layer and also anterior to the lamina cribrosa; accordingly, I think the white transudation seen in the fundus and the rounded bodies on the disc are of the same nature.

2. Why, then, does the transudation assume the form of rounded bodies in the disc and a diffuse layer-like deposit in other parts of the fundus? I think this depends upon the size of the capillary net-work. Any one who will glance at Leber's drawings of the net-work of the chorio-capillaris will find that the meshes over the lamina cribrosa are very large; immediately around the optic disc they are very fine, further away from the disc they become coarser. The result of this is that over the lamina cribrosa the transudation occurs in minute isolated points which again become coated with successive layers of transuded material until the body has become quite large; thus is explained the lamellated structure of these bodies. The latter is well shown in the microphotograph in deSchweinitz's paper. It would follow that if in the other parts of the fundus the capillary meshes were sufficiently large, we should find there the same rounded bodies. It may be that the rounded white bodies observed above the macula were of this nature as well as the single one to the nasal side of the disc. If, again, the meshes were very fine we might expect a confluent transudation,

and this, I think, was the case over a large part of the fundus, especially immediately around the disc.

3. If this transudation depended upon an altered condition of the blood how does it happen that the chorio-capillaris system was involved, while the retinal capillary system was unaffected? The answer is found in the different characters of the two systems. The chorio-capillaris system is supplied by from one to two dozen arteries, and the retinal system by one. The result of this, other things being equal, would be at least to increase the velocity of the capillary current as well as the escape of constituents of the blood into the surrounding tissues. The more one ponders this fact the more distinct will appear the physiological distinction which, no doubt, exists between these two systems. Thus, it might happen that in a certain abnormal state of the blood, transudation of the white material observed in this case might take place from one capillary system and not from the other.

4. What is the nature of this transudation? (*a*) It can hardly exist within the capillaries in the form in which it was observed in the fundus, otherwise it would have formed capillary emboli. (*b*) It is capable of being absorbed. (*c*) Examination of the "drusen" of the nerve-head have demonstrated the existence of a lime-salt in them. When one remembers that the clotting of blood is due to interaction of two proteids, the fibrogen and another derived from the white corpuscles (wooldridge) in the presence of a lime-salt, or that the clotting of milk from the action of rennet requires also the presence of a lime-salt, we might readily suppose that the white deposit seen in this case was clotted material caused by the interaction of two proteids in the presence of a lime-salt. The albumen of of the blood may be one of these proteids.

References: (1) Centralblat. f. Pract. Augenheilk, June and July, 1891; (2) Trans. Amer. Ophth. Soc., 1894, p. 349.

THE USE OF STRYCHNINE IN INSUFFICIENCY OF THE INTERNI.

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In our practice we find, not very rarely, that after we have corrected the refraction of a patient never so carefully, with or without the use of mydriatics, and after having made one or more minor modifications of our original prescription, and after looking most carefully to the perfect adjustment and fitting of the glasses, the patient persists in coming with complaints of discomfort in the use of the eyes, with or without glasses. These symptoms complained of range, as we all know, from the slight burning or smarting of the eye, over the gamut of pain in various portions of the head, running down the neck and spine in instances, to dizziness and nausea in others, even to the degree of being mistaken for chronic gastritis, etc.

We encourage the patients in persistent use of the glasses ordered, and in some of the cases we succeed in convincing them that they can comfortably use their eyes, and they go and leave us in peace. But there remain some who refuse to be so convinced, and who remain unhappy about their eyes, and who look well to it that we shall share their misery.

It goes almost without saying that these people are usually of a highly nervous organization, and there can be no doubt that their sufferings are real, annoying as they may be to their oculist and physician. The basis of this paper consists of the study of 28 such cases. These patients are not old folk, nor feeble folk, nor yet folk with poor eyesight. They are young people, in reasonable health, and with No. 1 eyesight as the rule. In most instances they had used their eyes as much as was possible to them, and they are nearly all workers. They all had interni muscles which were insufficient to bear the strain put upon them, and, contrary to the expectation of some, perhaps, they were nearly all hyperopic; 21 of their number, or 75 per cent., had hyperopia, or hyperopic astigmatism. 3 were emme-

tropic, 1 had mixed astigmatism, 2 myopic astigmatism, and 1 was myopic. The remedies used heretofore for exophoria (this is a shorter word and describes the condition, so I shall use it in this paper) were *general tonics* such as iron, quinine, strychnine, phosphorus, etc., graduated tenotomies, and gymnastic exercise of the muscles to be toned up. On the suggestion of Dr. E. C. Seguin, I began, about 4 years ago, to use strychnia in these cases, systematically and persistently, in gradually increased doses. I have used it since then extensively, and I think I have in this paper cases to prove the fact that strychnia sulphate has a specific effect upon the interni of the eye, toning them up especially, and far beyond the effect it has upon other ocular muscles. A short abstract of the cases will be the best demonstration, perhaps. My mode of testing is the following: To test for hyperphoria use the double prisms, with bases inwards, set in a spectacle frame and surmounted by a spirit level. This instrument is devised by Dr. Wilmer, formerly of this city. To test the balance of the lateral muscles, I use square-cut prisms, which I hold before the eyes with my fingers, while testing for distance. In finding the ability of the muscles to overcome prisms at a distance, I begin with prisms easily overcome, and increase their strength by degrees until the muscles are no longer able to merge the images. The tests are always made in the same way. For testing at reading distance, I use the stereoscope into which I insert the prisms used, also gradually increasing their strength, until binocular vision can no longer be attained. I make no effort to train or strengthen the muscles at these sittings, but simply to test their power at the time. I shall spare you the recital of the near tests, and confine myself to those for distance, as this seems to me more essential. I give here only cases in which A was about normal, and I have left out cases which would tend to confuse the object of this paper, namely, to show the effect upon the internal recti of large doses of strychnia, given cautiously but persistently to strengthen them. And so I will proceed to the recital of the cases:

CASE I. Miss F. A., 39, (painter and illuminator,) grows dizzy when riding, and can no longer do her work on account

of headaches, etc. Has hyperopia of 1/60, v. 16/10 o. u., reads Jæger; from 18″ to 6″. R. Hph., 1°. Ex., 4°. Ab., 10°. Add., 20°; s.s. 1/30 carried to 1/12 tid. In three months had Ab., 9°., Add., 40°. No headaches, no dizziness. Wears 1° prism, base up, 10/2/92; on 28/12/94. Came with conj. Has used eyes constantly and comfortably.

Case II. Miss M. H. B., 25. Pains in temple and forehead. Eyes inflame easily, and are sensitive to light when used. *Atrop.*, $\frac{+1.25}{+1.50}$ s. = 16/10. R. hyperph., 1°. Ex., 3°. Ab., 7°. Add., 9°. s. s., 1/30 to 1/10 in thirteen weeks irregularly. V. E. L. E. Ab., 8°. Add., 30°. Says she has no further pain or eye-trouble. Refused to wear glasses, and said she felt no need of them.

Case III. C. B., brother of M.D. Architect. Frontal headache when using eyes. V= 16/10. H. m. 0.50 s. V. E. L. E. Ab., 6°. Add., 14°. s. s. to 1/8, seven weeks. V. E. L. E. Ab., 6°. Add., 24°. Perfect comfort at work.

Case IV. Mrs. I. B., 42. Stout woman, exceedingly nervous. Has had some pelvic trouble and operations. Has had headaches for nine years; and, although fond of the theatre, has not been to one during that time. Complains of pain in occiput and vertex. Cannot hold up her head long enough for examination, and has to be propped with pillows, + 0.75 s. ⌒ + 0.25 c. 90° = 16/16 o. u. No. hyph. Ex., 2° to 3½° at different examinations. Correction given with prism 1° base in.

Ab., 15°	Add., 12°.	15/11/92 s. s. 1/16	
12	" 11°		
10	" 15°		
8	" 11°		

8/2/93 s. s. to gr. 1/10. Ab., 15°. Add., 30°. Refuses tenotomy, says she is comfortable with her glasses, takes long walks, and is about to go to Europe.

Case V. Miss A. C., 25. Nurse. Headaches and pain on use of eyes. *Under Atrop.*, $\frac{\text{O.D.} - 0.50 \text{ s.}}{\text{O. S.} - 1.00 \text{ s.}}$ = 16/15. V. E. L. E. Ex., 10°. Ab., 7°. Add., 16°, 1/8. s. s. June 4th to

25th, '91. Ab., 6. Add. 30°. Headaches absent, eyes used with comfort.

CASE VI. Miss C. F. D., 24. Student. Pain on close application of eyes. Under Atrop., R. E., 16/15 Em. O. S. — 1.75 cy. 145° = 16/40. R. hph., 1½, corrected with prism 1cyl. Ex., for near. Ab., 6. Add., 15°. Did not return for six months because she could use her eyes, and was busy with her studies. s. s. to 1/12 for one month. V. E. L. E. Ab., 7°. Add., 23°. Said she felt perfectly well, and could use eyes comfortably. Staid away.

CASE VII. J. R. C., 44. *Silk house.* Pain on use of eyes. O.D. + 0.50 cyl. 180° / O. S. + 0.50 cyl. 90° = 16/10. No hph. Ex., 4°. Ab., 11°. Add., 24°. s. s. to 1/8 gr. tid., irreg. three months. V. E. L. E. Ab., 11°. Add., 35°. Felt well, and used eyes with comfort. This man returns every year, during his busy season in practically this condition, and s. s. tones his interni muscles up so he can resume his work comfortably; and he says he does not care for tenotomy.

CASE VIII. Mrs. J. F., 33. Pain in forehead, photophobia and somnolence. *Under Atrop.* O. D. + 2.00 cyl. 180° / O. S. + 0.75 s. = 16/10. Did well with this correction for several years. Then returned with the old symptoms. Same refraction. No hph. Ex., 3. Ab., 8°. Add., 7°, s. s. to gr. 1/8 for two months, then no hph. Ex., 3°. Ab., 71°. Add., 25°. Feels well and uses eyes with comfort. But the somnolence remained the same.

CASE IX. Mr. J. F., 36. Lawyer. Pain and photophobia. *Under Atrop.* — 0.50 cyl. 180° / — 0.75 cyl. 180° = 16/10. V. E. L. E. Ab., 11°. Add, 12°. s. s. to 1/8 for seven weeks. After five weeks, V. E. L. E. Ab., 10°. Add., 45°. At the end of seven weeks Eso., 3°. L. E. Ab., 8°. Add., 45°. Uses his eyes with comfort.

CASE X. J. H., 16. Student. Eyes pain, on reading. Has chorea and is pale and anæmic. ℞. Iron., Arsenic and s. s. 1/20. *Under Atrop.* O. D. + 2. 50s. ◯ + 0.75 cyl. 90° / O. S. + 2. 50s. ◯ + 0.50 cyl. 75° = 16/15+; this

correction was used with comfort for two years. V. E. L. E. Ab., 4°. Add., 15°. After above medication 21 days, V. E. L. E. Ab., 6°. Add., 30°. Again comfortable.

Case XI. H. H., 19. Student. Had to leave college on account of his eyes. Is thin, nervous, and has headaches. *Under Atrop.*, + 1.25 s. o.u. = 16/10. No hph. Ex., 11°. Ab., 16°. Add., 5°. His father will not permit tenotomy. Ordered out-of-door life, rowing and wheeling, and s. s. to gr. 1/12, which he took during seven months. Then V. E. L. E. Ab., 11°. Add., 41°. It may be interesting to hear how the differferent testings read during this time. He came at first every week, and after that every fortnight. Beginning with

	Abduction,	Adduction,	He went to
	16	5	15 — 9
Then	12	13	to 13 — 15
	13	16	13 — 15
	13	20	13 — 22
	12	26	11 — 27
	12	30	13 — 30
	12	33	12 — 34
	11	41.	

Then he asked to be allowed to return to Cornell, where is now completing his studies in comfort.

Case XII. Mrs. H. H., 33. Dressmaker. Dizziness and headache, on use of eyes. *Under Atrop.* O. D. + 0.75 cyl. 90°. O. S. + 0.50 cyl. 90°. (1889.) No hph. Ex., 3°. Ab., 11°. Add., 15°. Correction and prism 1° base in. Worn with comfort. Returned again in 1894, with story of more or less pain for a year. Refraction the same. V. E. L. E. Ab., 9°. Add., 17°. s. s. to 1/12 for five weeks. V. E. L. E. Ab., 7°. Add., 30°. No pain on use.

Case XIII. Miss E. H., 17. Student. Eyes tired and painful towards evening. *Under Atrop.* O. D. + 1.50 cyl. 90° = 16/30. O. S. + 0.75 cyl. 90° = 16/20. V. E. L. E. Ab., 9°. Add., 19°. s. s. 1/30. Took s. s. for nine weeks. Then V. E. L. E. Ab., 8°. Add., 30°. V = 16/10 — 3 with glasses. Studies with comfort now.

CASE XIV. Mrs. H. J., 35. Headaches over eyes for years, besides various other nervous symptoms. Recently, these are more severe and neuralgic in character. Looking up or down gives relief from direct vision. + 1.50 S. = 16/10. No hyph. Ex., 2°. Ab., 8°. Add., 15°. s. s. 1/60. Continued in an irregular way for about two months. After that, V. E. L. E. Ab., 7°. Add., 30°. Uses eyes with comfort.

CASE XV. Mrs. G. M. K., 29. A very nervous and hysterical patient. Complains of severe, constant headache, etc. *Atrop.* O. D. + 1.00 s. ◯ + 0.50 cyl. 90° / O. S. + 1.25 s. ◯ + 0.25 cyl. 90 = 16/10 o. u. No hyph. Ex., 1°. Ab., 9°. Add., 17°. s. s. March 14 to April 27, six weeks. V. E. L. E. Ab., 7°. Add., 55°. Had no more headaches, excepting at the time of menstruation.

CASE XVI. Miss J. W., 14. Student. Headaches over eyes and her parents had to take her out of school. Periods have just appeared. *Under Atrop.* O. D. + 1/60 = 16/15 +. / O. S. + 1/42 = 16/30. Peculiar haze around left macula. Headaches returned when Atrop. was left off. No hyph. Ex., 1½°. Ab., 8°. Add., 15°. R. Iron and s. s. to 1/12 one month. Then V. E. L. E. Ab., 8°. Add., 35°. V. = 16/10 o. u. No further headaches and goes to school.

CASE XVII. Miss P. B., 20, a healthy-looking young lady who is very nervous. Has some uterine trouble. Headaches on using eyes. Under Atrop.,

O. D. + 1.00 s. ◯ + 0.75 cyl. 90° / O. S. + 1. s. ◯ + 1. cyl. 90° = 16/10 o. u.

No hph. Ex., 1°. Ab., 7°. Add., 12°. s. s. to 1/10 during three months. Then V. E., L. E. Ab., 6°. Add., 25°. No more headaches, and can read as long as she likes. I noticed, in this case, that improvement began only when the Strych. had reached gr. 1/12 tid. And I feel obliged to say that this same patient came two years later, with the same symptoms. On this occasion she complained of stiffness of the muscles when she took s. s., 1/16, and refused to take more medicine, and left unrelieved.

Case XVIII. Miss E. R. B., 39. Nurse. After a fortnight's very hard work she found that she could no longer read to her patient, and was greatly depressed by this.

Wears O. D. + 1.25 cyl. 90° ◯ — 0.25 cyl. 180°
O. S. + 1.00 cyl. 90° = 16/10 o. u.

No hyph. V. E. Ab., 7°. Add., 22°, s. s. In five weeks gr. 1/12 V. E. L. E. Ab., 6°. Add., 28°. Reads with comfort.

Case XIX. Mrs. W. A. C., 46. Has suffered from headaches since childhood, more especially on reading. O. U. + 0.50 cyl. 180° = 16/10 V. E. L. E. Ab., 6°. Add., 14°, s. s. to 1/16. Six weeks, V. E. L. E. Ab., 7°. Add., 37°. Can read with comfort, and has no headaches except at her periods.

Case XX. Miss H. M. H., 18. Student. Eyes ache constantly for the last year. O. U. Em. V = 16/10 — 4. No hyph. Ex., 2°. Ab., 10°. Add., 13°. Ord. prism 2°, base in, which gave relief immediately, and enabled her to resume work. s. s. 1/30 to 1/16. Her latest test shows no hyph. Ex., 4°. Ab., 9°. Add., 30°. She is still under treatment; but does not yet like to go without her prisms very long.

Case XXI. Miss M. K., 16. Student. Has had to leave school on account of pain in her eyes. o. u. — 4.50 s. ◯ — 0.50 cyl. 180′ = 16/40 +. Extensive old choroidal changes in fundus. R. Hph 1°. Ex., 2°. Ab., 10°. Add., 18°. s. s. to 1/8 for two months. Then V. E. L. E. Ab., 9°. Add., 30°. Pain absent.

Case XXII. J. S. K., 34. Lawyer. Had iritis (probably of nervous origin) 5 years ago. Since then has never used eyes with perfect comfort. o. u. + 0.25 cyl. 90° = 16/15 +. V. E. L. E. Ab., 6°. Add., 7°. s. s. to 1/10 for two months. Now V. E. L. E. Ab., 6°. Add., 24°. V. = 16/10. Uses eyes with comfort.

Case XXIII. Miss A. O., 22. Art student. Had to quit work on account of pain in the eyes and fading vision. Is excessively nervous and belongs to a neurotic family. *Under Atrop.* O. D. + 3.50 s. ◯ + 1.50 cyl. 90°
O. S. + 4.00 s. ◯ + 0.50 cyl. 90° = 16/30. Has rebelled against wearing glasses always, until she could no longer

work. Even with glasses she cannot continue at her work long. No hyph. Ex., 4°. Ab., 11°. Add., 9°. s. s. two months to 1/8. No hph. Eso., 4°. Ab., 7°. Add., 29°. She can work for two or three hours now, but is still dissatisfied.

CASE XXIV. A. R., 29. Editor. Eyes tire at work. Atrop. $\begin{matrix} +\ 2.50\ \text{s.} \bigcirc + 1.25\ \text{cyl.}\ 115° \\ \text{O. S.} +\ 1.25\ \text{s.} \bigcirc + 0.50\ \text{cyl.}\ 90° \end{matrix} = 16/15 +$. Wore these with comfort for two years, then returns with the old complaint. No hph. Ex., 1°. Ab., 7°. Add., 21°. s. s. to 1/20 for two weeks. Then V. E. L. E. Ab., 7°. Add., 36°. Feels well and works comfortably. V. = 16/10.

CASE XXV. Miss H. R., 25. Teacher. Headaches.

Homat. $\begin{matrix} \text{O. D.} +\ 1.25 \\ \text{O. S.} +\ 1.75 \end{matrix}$ s. = 16/10.

No hyph. Ex., 2°. Ab., 7°. Add., 13°. s. s., six weeks to 1/10. Then V. E. L. E. Ab., 7°. Add., 33°. Headaches absent.

CASE XXVI. Mrs. R. H. S., 36. Pain in left eye worse during periods. O. U. + 0.50 cyl. 90° = 16/10. No hph. Ex., 1°. Ab., 6°. Add., 7°. s. s. 1/40 to 1/12, about five weeks. Then V. E. L. E. Ab., 6°. Add., 22°. Pain in eye disappeared after two weeks' treatment. In this case, after a few days' very hard work at packing and preparation for going to Washington with her husband, the balances remained correct, but the abduction was 18°, the adduction 27°, and the left eye pained; but this seems to have disappeared again while resting at Washington.

CASE XXVII. Miss J. U., 25. Headaches begin about noon, and last until evening every day. *Under Atropine*,

O. D. + 2.50 cyl. 130° ◯ + 0.50 cyl. 35° = 16/20 + 2
O. S. + 1.75 s. = 16/20

Wears these for one month without discomfort. Then V. E. L. E. Ab., 6°. Add., 13°. s. s. two months, V. E. L. E. Ab., 6°. Add., 25°. Has used her eyes without headaches since. V. = 16/15.

CASE XXVIII. Mr. F. C. W., 35. Lawyer. Complains of swimming of the lines after a short time at work. He is a very nervous man, and had to leave his work for a year for these

reasons, and went one year before the mast. O. u. Em. V. 16/10. V. E. L. E. Ab., 8°. Add., 15°. s. s. for two months to 1/8 gr. V. E. L. E. Ab., 8°. Add., 37°. He resumed his professional work and uses his eyes with comfort.

You will have noticed that six of these patients were in their teens, ten in the twenties, nine in the thirties, and three in the forties. None were older than this. This puts 90 per cent. of all below 40, and 57 per cent. below thirty years of age; 71 per cent. are females, and 29 per cent. males. Over 82 per cent. has V. = 1. and above, and only 18 per cent. has sub-normal V. One myope with 16/40 (the reduction due to changes in the choroid), one hyperope with 16/30, increased to 16/20, one H. Astig. $\frac{16/20}{\&\ 16/20\ +}$, and one *eye* with mixed Astig. 16/40. The adductors increased in strength always, but in very variable degrees. The following table sums these up shortly.

		From 28 to 40	From 11 to 30
From	14 to 24	15 — 30	16 — 30
	15 — 23	24 — 35	7 — 25
	12 — 45	15 — 30	5 — 41
	17 — 30	19 — 30	15 — 30
	17 — 55	15 — 35	12 — 25
	22 — 28	14 — 37	13 — 30
	18 — 30	7 — 24	9 — 29
	21 — 36	13 — 33	7 — 22
	13 — 25	15 — 37.	

I cannot see that age made any appreciable difference in the result. The greatest increase was in Case XI, in a patient aged 19, from 5° to 41°, and the next greatest was in a patient aged 36, who gained from 12° to 45°, and one aged 34, from 7° to 24°. The abductors, at the end of treatment, show that there was no change in them in eleven cases, or 40 per cent. They were, during the treatment, *decreased* in strength in thirteen cases, or 46 per cent. In eight cases by 1°, three cases by 2°, one case by 3°, and one case by 5°.

The abductors were *increased* in strength in 4 cases = 14 per cent. In 3 cases by 1°. In one case by 2°. A result,

quite unlooked for and surprising, was the disappearance of low degrees of hyperphoria in 3 cases. In none of these 28 cases did hyperphoria develop or increase during this treatment. Several of the patients refused tenotomy, which I urged as indicated, and preferred the Strych. treatment, with the results of which they were satisfied. It will have been observed that I often had to be satisfied without attaining the desirable balance of the muscles. The exophoria disappeared in 13 cases; in 10 cases there was only exophoria for near vision, which disappeared entirely in some of the cases. I have made no mention of the degrees in these, because a small amount of exophoria in A. appears in so many cases that I have almost come to the conclusion that it is a normal condition.

Two cases showed the exophoria unchanged, and in three cases the balance was inclined to the opposite side into esophoria 3°, 2°, and 4°. I may say that, in many of the cases, the patients were satisfied with their condition, long before I was, and several simply ceased attendance for that reason.

Of course I hold, basing my opinion on the facts given above, that strychnia is counter-indicated in cases of esophoria. As to vertical displacements, my experience is too limited to permit my uttering a positive opinion.

Since writing the above, another case which I have not had time to embody in this report came back from a month's absence at the South. It is a myope, thirty-eight years old, wearing — 3.50 s. ◯ — 1. .cyl., 180° = 16/20 +
— 3.50 s. ◯ — 1.25 cyl., 15° = 16/20 +
Hph., 2°, V. E. Ab., 8°. Add., 20°. Ex. in A. He has been taking s. s. 1/16, during his entire absence, and before that since Dec. 9, '94. He reports his eyes as well, pain absent. V. E. L. E. Ab., 10°. Add., 43°. Therefore Ab. increased 2°, Add. from 20 to 43°.

DISCUSSION.

DR. S. D. RISLEY of Philadelphia.— I have been deeply interested in Dr. Oppenheimer's paper and recognize the great value of strychnia in the treatment of many cases of muscular asthenopia. I am loath, however, to ascribe to this drug a specific effect over the internal recti muscles. I have employed

ascending doses of nux vomica for a long time in this connection and often with great benefit, but have not witnessed any increase of the dynamic force of the interni that was not shared by the other ocular muscles, and probably by the general muscular system. It is probable that its good effect is through an improved general innervation.

The demonstration, by prisms, of the increased power of convergence as a result of the administration of strychnia must be accepted *cum grano salis.* Many so-called cases of insufficiency of the interni are simply examples of a *relative insufficiency* caused by the prescribed convex glasses which have added a new factor to the dioptric system of the eyes. This relative insufficiency is not an actual weakness of the interni. All the patient needs is to be taught to use the interni under the new relation introduced by his convex glasses. It is often quite surprising how rapidly young patients especially learn to do this under the use of adducting prisms. It is therefore possible that the apparently improved tone of the muscles under strychnia in the interesting group of cases reported were due to the practice with prisms, which were employed from time to time to determine the strength of the adducting muscles.

Dr. David Harrower of Worcester, Mass. — I have used strychnia for insufficiency of the recti muscles for two and a half years. I begin on one-thirtieth of a grain and increase the dose until toxic effects are felt, and have found it to work well in a number of cases. The first of two cases, to which I may refer, is Mrs. B., 46 years of age. For a week or ten days she feels as if she was looking cross-eyed, and can't see anything clear. Had a shock a year ago.

R. 9/10 x 50 D. C. ax. 90 10/10.
L. 8/10 x 50 D. C. ax. 180 10/10.
Has exophoria, 10°.
I gave her small doses of strychnia and iron.
Nov. 4th. Is just about the same.
Nov. 21st. Has 16° of exophoria.
Dec. 14th. Has 15° of exophoria.
Dec. 28th. I began giving her strychnia 1/30 of a grain, increasing it daily, 1/180 of a grain a dose to toxic doses.
1893. Jan. 16th. Has only 7° of exophoria. Is now taking 1/7 of a grain of strychnia.
Jan. 25th. Has only 5° of exophoria.
Feb. 7th. Has 2° of exophoria.
Feb. 21st. Has 1° of exophoria.
March 1st. Has 1° of exophoria.
To gradually diminish strych. This patient has had no recurrence of her troubles up to the present time.

Case Second was a farmer, with twenty-three degrees of exophoria. I started him on the same doses, one-thirtieth of a grain, and steadily increased it. Two months later he had only a few degrees of exophoria, and shortly after, none. I have used it in cases of small degrees of insufficiency, and have had good results, but I think it is the result of toning up the whole system, rather than any specific power of the drug, for since I have used exercising prisms with equally good results in small degrees.

DR. H. S. OPPENHEIMER.—I have very little to add in reply, only that in the studies I made I found that strychnia increased the actual dynamic force of the internal muscles, and decreased the strength of the externi; and I think this fact alone would go far to show that strychnia does have a specific effect upon the interni muscles. A patient learns to use the muscles, it is true, from much testing, but my tests were not carried on long enough to be considered an exercise. While I know that exercise will tone up the muscles, this treatment is so much more simple a way of getting the desired result, that I have found it more satisfactory. The externi were tested each time with their opponents, and should have been proportionately strengthened by it. By this mode of treatment the patient needs to come but once a week, while the "gymnastic" treatment is a great expense of time to both oculist and patient.

SMALL CAVERNOUS ANGIOMA OF OCULAR CONJUNCTIVA.

BY J. A. LIPPINCOTT, M.D.,

PITTSBURGH, PA.

Cavernous angiomata involving the conjunctiva of the globe are so rare that I feel justified in reporting the following case: Mrs. J. D. S., aged about 25, consulted me on the 8th of last March in reference to a swelling on the eyeball which she had first noticed six years ago, when it was about the size of a pinhead, and which, so far as she was aware, had no traumatic cause. The swelling slowly increased in size at first, but of late its development had been more rapid. A few days before her visit to my office, the eye, without being subjected to any direct injury that she knew of, and in the absence of any violent strain as from sneezing or coughing, suddenly became suffused with blood.

On examination, the extravasation was found to be pretty well absorbed. There was a tumor of the size and shape of a large grain of wheat situated below and to the inner side of the cornea about 2^{mm} from the corneal margin, and with its long axis parallel to the latter. It was freely movable, of a greyish-pink color, and its surface was slightly lobulated, but the epithelium covering it was smooth and healthy-looking. To the touch it was soft, and its size could be considerably reduced by pressure. The surrounding ocular conjunctiva, the region of the caruncle and the eyelids, were perfectly normal.

The growth was removed by including it in an elliptical incision in the conjunctiva, and the wound, which was closed by two sutures, very soon healed up. The tumor, which was at once placed in formol solution, was examined by Prof. Whitney of Harvard, from whose report I present the following extract: "The specimen shows a small tumor in the conjunctiva, which, on microscopic examination, is found to be made up of a series of cavities separated by narrow bands of connective tissue lined with endothelial cells. These spaces contain blood and serous fluid. The growth lies just beneath the epithelium, which is perfectly normal. The condition is one of cavernous angioma."

The majority of systematic writers do not mention the subject of angioma of the eye. Those who do usually comment on the extreme infrequency of primary angioma of the conjunctiva. The cases* related by Virchow, Roosbroeck, Van Ammon, and Blessig seem to furnish the chief basis for the remarks made by Saemisch,† De Wecker,‡ Panas,§ and other writers on the subject. Saemisch states that angioma of the conjunctiva is either an extension of a palpebral swelling or it may develop primarily in the mucous membrane. "The latter," he adds, "is rare." The other form is not so rare. According to Fuchs,¶ primary angiomata are, as a rule, congenital, and increase in size after birth. In regard to treatment, Panas, after relating Blessig's case, which was cured by repeated injections of perchloride of iron, criticizes this method as dangerous and recommends extirpation, electrolysis, or igneous cauterization.

* Quoted by Saemisch (Handbuch, IV, 156).
† Ibid., IV, 156, 157.
‡ Traité Complet., I, 423.
§ Maladies des yeux, II, 272, 273.
¶ Text-book of Ophthalmology, N. Y. Ed., page 119.

SARCOMA OF CHOROID.

BY F. BULLER, M.D.,

OF MONTREAL.

The pigmented sarcomatous growths which so often develop within the eyeball unfortunately seldom come under observation until they have attained a considerable size and become concealed, more or less completely, by a large detachment of the retina. For this reason their diagnosis becomes a matter of inference, rather than of positive observation, of the growth itself. It is obvious that they are not likely to cause much disturbance of vision prior to the advent of retinal detachment, unless situated very close to the region of the macula lutea, and since in the early stages they are not likely to cause pain or other inconvenience, we have an explanation of the tardy development of symptoms sufficiently urgent to call for advice.

The case I now present was an exception to this rule, for the simple reason that the tumor happened to originate very near the macula lutea; consequently, impairment of vision brought the patient to my notice at an unusually early stage in the development of the growth, and I was able to make a positive diagnosis before actual detachment of the retina had occurred, and persuade the patient to submit to extirpation of the eyeball while peripheral vision was still intact; and the sarcoma is perhaps one of the smallest on record for which enucleation of the eyeball has been performed.

The patient, a large, robust man, aged 35, of dark complexion, perfectly healthy, parents both living (aged 81 and 75, respectively), has several brothers and sisters, all of whom are in good health.

I first saw him on the 15th of September, 1893. He came on account of partial loss of vision of the right eye. About a year previously, he had been struck, one evening, in the eye by a soft pillow, but only suffered a transient inconvenience. Some two or three nights later, he happened to close the left

eye and then noticed that the lights across the street were blurred, and had a reddish appearance. From that time on, he has been conscious of a "heavy blur" before the right eye, which, he thinks, has somewhat increased. Central vision is reduced to fingers at 10′. The blur is central, peripheral vision being unaffected. Can see a candle flame, as such, a few feet in front of him, but it looks reddish and blurred.

The ophthalmoscope showed a perfectly normal fundus, with the exception that, immediately to the outer side of the papilla, but about 1-4 disc width from its margin, there was a conical projection of the retina, of a bluish-gray color, quite steep at the side of the nerve, but gently sloping towards the macula, and at a short distance beyond this the elevation ceased; there were no hæmorrhages or infiltrations of any sort; the retina over the projection was, however, more opaque than in its normal condition. The difference in level between the face of the papilla and the apex of the projection was exactly six diopters; the peripheral outline of the projection was apparently circular. Unfortunately, I did not make a measurement of the partial scotoma.

The circular outline, bluish color, steep elevation, and absence of all signs of an inflammatory process, at once suggested the probability of a sub-retinal neoplasm. This was explained to the patient, with the request that he return in three months' time for re-examination.

On the 14th of January, 1894, he again presented himself, and I made the following notes:

There has been a considerable increase in the size of the projecting mass beside the optic papilla, as it now extends quite up to the margin of the nerve, and is here even steeper than before, as some of the retinal vessels climbing to its summit are directed apparently straight forwards, others having the appearance of winding snugly around its base. The same steepness of side exists above, but below and temporalwards a gradual slope leads to the normal retinal level; here, however, the retina is thrown into fine, radiating folds, not noticed at the first examination. Moreover, at the apex of the cone, on its vertical walls, and on outer half of the papilla, there are

quite a number of minute blood extravasations in the retina, besides several small patches of a yellowish color in or beneath the retina, as well as a few minute, glistening particles in the same. *There is no trace of a separate, sub-retinal, vascular system.*

The same bluish-gray tint characterizes the swelling as before, but is rather darker than at the first examination.

A careful ophthalmoscopic measurement shows now just 9° difference between the level of the apex of the cone and the surface of the optic papilla, showing an increase in altitude equivalent to 3 D, or about one millimetre, in the four months between first and second examination.

Vision was now reduced to counting fingers at 6′, somewhat excentrical, with a positive scotoma corresponding to the position of the lesion; peripheral vision was nowhere defective, showing, of course, that the nerve fibre layer of the retina was intact. It is possible the plicated portion of the retina to lower and outer side of the projection may have been slightly detached, but of this there was no positive evidence.

I no longer hesitated as to the diagnosis, and advised enucleation of the eye without further delay. The operation, performed under cocaine anæsthesia, was almost painless. After enucleation, the external appearance of the eye was entirely normal, with no trace of sclerotic discoloration over the site of the tumor. The eye was cut in two by an equatorial section, and presented nothing abnormal except the small, rounded mass projecting forwards at the side of the optic papilla. There was no detachment of the retina. In order to show the relative size of the growth, after careful removal of the vitreous, I inverted the posterior half of the globe and had a photograph taken. The specimen was then placed in Muller's fluid and in due time examined microscopically by Dr. Adami, pathologist to the Royal Victoria Hospital. His report, accompanied by several drawings, is as follows:

(Dr. Adami's Report.)

"Upon cutting open the eyeball, after hardening in Muller's fluid, a minute tumor was noticeable projecting into the vitre-

ous cavity and lying immediately to one side of the porus opticus. This was seven millimetres in its greatest diameter, and upon section through its center was found to project not quite three millimetres from the sclerotic, which formed its outer limit. The thinned and very delicate retina was continued without interruption over its inner surface. Through this, in the apical portion of the minute tumor, the darker color of the neoplastic formation was noticeable.

"In order to gain delicate sections, one-half of the posterior half of the organ was prepared by the paraffin rather than the celloidin method, with the result that, while the structure of the tumor was brought out in admirable detail, the delicate retina, notwithstanding great care in fixation to the slide, did not altogether remain intact in the completed preparation.

"A section through the middle of the optic nerve, multiplied three diameters,—exhibits very satisfactorily the relationships of the new growth. It is almost wholly confined to the choroid; the retina is not in any way implicated; there is a very slight amount of (commencing) atrophy of the sclerotic at the region opposite to the center of the growth, and, under the microscope, a few pigmented cells can be seen to have penetrated between the innermost layers of this latter coat. Under the low power, a certain amount of concentric disposition of the outer layers of the tumor can be recognized, as though through central growth the tissue outside had become compressed, before it, in its turn, became invaded by the sarcoma cells. It can also be seen that the tumor has originated in the deeper layers of the choroid (near to the sclerotic), inasmuch as the outer layers can be followed over the surface of the growth.

"The growth itself is a small spindle, or almost oat-shaped sarcoma, with abundant presence of interpolated pigment cells of the usual type found in melanotic sarcomata. In parts the pigment cells predominate; this is especially noticeable towards the center. At the periphery in the area of extension some small arterioles are noticeable, along whose sheaths the spindle cell formation is present to the almost entire exclusion of pigment cells.

"Fine pigment granules are visible, free, or apparently free,

in the lymph spaces of the neoplasm. This is frequent — not to say, usual — in melanotic sarcomata. Similar pigment granules were also present along sundry occasional lymph spaces, together with long, spindle-shaped collections of pigment, indistinguishable from the pigment cells of the tumor. Not having been able to recognize the nucleus of any of these masses, it is not possible for me to state, with absolute certainty, that these are cells. It is, however, eminently probable that they are, and that here we have the very earliest indication of invasion of surrounding tissues.

"Finally, it remains to be added that there was no sign of alveolar arrangement. The neoplasm is a simple, spindle or oat-shaped celled, melanotic sarcoma, arising from the choroid, and, with the exception just noted, entirely confined to that layer."

The growth itself was therefore an ordinary melanotic sarcoma, originating in the choroid, the predominating character of the cellular elements being the ordinary, pigmented spindle cells, so commonly found in this variety of sarcoma. The early stage of its development makes this specimen a particularly favorable one for studying the origin and mode of growth of such tumors.

It was easy to get thin sections including the entire extent of the tumor. These show that the center of the tumor is uniformly and intensely pigmented; the periphery, on the other hand, presents a zone of unpigmented and sparsely pigmented spindle cells, with gradual transition into the normal choroid, in one direction, and in the other a more abrupt transition into the more rounded, heavily pigmented elements of the interior. The matrix of the latter is so delicate that the entire central portion is prone to drop out of the thin sections.

After careful inspection of these complete sections, it is obvious, to my mind, that the growth springs from the stroma of the choroid, that the newly-developed cells of the periphery are, for the most part, free of pigment, but that they undergo pigmentation as they become older, and that, with this change, the delicate, almost invisible protoplasm of the young cells commonly

increases in volume, forming at last a rounded or ovoid, dark, granular mass. It is of such elements alone the inner parts of the growth seem to consist. At the periphery, the young cells are in colonies, so placed that they have the appearance of distinct layers, concentrically arranged, and separated by narrow interspaces, until finally a point is reached where they cease to exist, and we find nothing but normal, though thickened choroid.

When I say "normal choroid," I mean as to histological structure. As a matter of fact, however, there is a zone of choroid immediately adjacent to the growth, which is distinctly thickened with loosely arranged tissue, and large, thin-walled vessels, probably the result of hyperæmia, and perhaps œdema of the choroidal stroma immediately around the tumor, although not yet infiltrated with the characteristic sarcoma cells.

"Besides the peripheral invasion, there must, however, be a constant interstitial development of the growth; otherwise it would increase much more in breadth than in thickness, which is by no means the case. How this takes place is a point I have been unable to determine. It is not improbable that a continous development of small, new, non-pigmented cells, such as those seen at the periphery, takes place in the interior ("central growth"), where they would necessarily be concealed in the general pigmentary mass. I can imagine no other way in which a progressive and uniform development of the growth could occur in accordance with the simple method of extension we see taking place at the periphery ("peripheral growth"), which here evidently consists in a simple cell multiplication.

It would seem, then, that a spindle-celled, melanotic sarcoma of the choroid is morphologically nothing else than a hyperplasia of embryonic tissue, which takes on the pigmentary type of the surrounding tissue (choroidal stroma), and that its thin-walled vascular system and high degree of vascularity facilitates the transfer of its vital elements to the general circulation; that these may, and actually do, proliferate again, so soon as they happen to lodge in a soil suitable for their development. The excessive frequency of recurrence in the liver points to that

organ as the part best adapted for the nourishment of such wandering elements.

Although there was a slight semblance of invasion of the underlying sclerotic in this case, it is doubtful whether this is of the least prognostic significance.

The patient is still living and, so far — over one and a half years from the date of operation — does not show the slightest indication of systemic infection.

DISCUSSION.

DR. H. D. NOYES of New York. — In reference to Dr. Buller's paper, which is very interesting, he may not be aware of the fact that Dr. Becker also had the opportunity of removing an eyeball for a growth situated in this region. He gave me one of the section slides, and it was a little growth, perhaps one and a half millimetres wide by four or five long. I would like also to make a remark, which is of some importance, that is in relation to recurrence. I know what the general prognosis is, but I simply want to state that it is now twelve years since I removed an eyeball of a lady, which was occupied by a growth of this character, and she is still living without any return of the growth.

DR. W. F. NORRIS of Philadelphia, Pa.— In reference to the question of continuance of life after enucleation of the eye for sarcoma, I had the opportunity of seeing a patient, not long since, from whom I had removed an eye fifteen years before, on account of a closely-felted, small spindle-celled sarcoma. The man is still able to work as a farmer, and claimed to be in good health.

DR. R. A. REEVE of Toronto, Canada.— Several years ago I reported a case of a man sixty years of age, whose right eye I had enucleated for a melanotic tumor. Fifteen years later he had a sarcomatous growth of the orbit, which I removed, and two years later he died of some brain trouble.

DR. O. F. WADSWORTH of Boston. — One patient from whom I removed an eye for a melanotic sarcoma of the choroid of some size I heard from ten years later through Dr. Fryer. She had then a recurrent tumor in the orbit. A year or two later a Chicago oculist wrote me about the same case, and the tumor in the orbit then was not a very large one, while the patient's general health was good. I remember quite early in my experience seeing a patient with a melanotic tumor entirely fill-

ing the vitreous chamber, and it was only six years later that the man's liver, studded with melanotic nodules, was shown at a medical society.

DR. B. E. FRYER, Kansas City, Mo.— I have seen the case mentioned by Dr. Wadsworth within the last two years, and there has been no recurrence. It must have been eighteen years since the eye was removed. There has been twice a slight recurrence in the orbit, but since the last removal there has been no return. It did not reach the nerve. I can mention another case which I have watched for nine years where I removed the eye for a man of forty and have had no new growth.

DR. R. L. RANDOLPH of Baltimore. — It is interesting to note the fact that these tumors can remain for a long time without giving rise to any irritative symptoms. I know of one case where two-thirds of the vitreous chamber was filled with a melano-sarcoma. The patient was fifty years old, and refused to undergo an operation. Two years after his first visit he came back suffering with violent pain in the eye due to the onset of glaucomatous symptoms. Evidently the tumor had remained quiescent for two years, and the invasion of the ciliary region, I think, was followed at once by the inflammatory symptoms. I would like to say here, with regard to hardening the eyes for section, that I have found Formalin much better than Muller's fluid. It preserves the tissues in better shape.

DR. JOHN GREEN of St. Louis. — As regards the length of time a patient may live after the enucleation of an eye for spindle-cell sarcoma of the choroid, I may mention a case in which I observed the patient for fifteen years, and in which there was no sign of recurrence.

DR. S. B. ST. JOHN of Hartford, Conn.— Ten years ago I enucleated an eye for sarcomatous growth situated in the same region, and of about the same size as that of the case related by Dr. Buller. Within two years the patient died of sarcoma of the liver. I do not know whether it had started in this organ before the removal of the eyeball or not.

DR. J. A. LIPPINCOTT of Pittsburgh.— In regard to slowness of the growth of these tumors, I may report one I now have under observation in its incipient stage. The tumor is no larger now than when first seen six months ago. Its elevation is shown by the ophthalmoscope to be about $1\frac{1}{2}^{mm}$, and has not varied more than a millimetre in six months. There has also been a minute hæmorrhage on the growth, which has been ab-

sorbed, probably as a result of a mercurial course of treatment. The slowness of growth is very well illustrated in this case.

DR. WILLIAM CHEATHAM of Louisville, Ky.— I would like to add a case of angioma of the conjunctiva of the cavernous variety. The growth extended up to the superior rectus and was so prominent you could see the bulging through the lid. I supposed it was cystic and tapped it, but received only a small amount of bloody fluid. I decided then to try the injections of methyl-violet, giving the injections about three weeks apart and injecting one or two cavities each time. It has decreased very much in size, and I hope to get entire removal of it by this method; I think this or the galvanacautery the better method in such locations where much tissue cannot be spared.

DR. C. S. BULL of New York. — There is another side to these questions. It brings to my mind a case I had, not quite two years ago, of choroidal sarcoma encroaching upon the optic nerve, and without any other symptom at that time elsewhere. The eyeball was removed, and I found that the growth had invaded the optic disk. I had divided the nerve posterior to the apparent growth. There is no return in that eye, but in three months there appeared a rapidly growing tumor of the parotid gland. It was removed and proved to be sarcomatous, which is rather an uncommon growth for that gland. The patient is now the subject of very extensive disease in the liver, spleen, and bladder. There is no return of the growth in the eye. I think in many of these cases, if it were possible to follow them and see them constantly, some evidence of malignant disease existing elsewhere in the body would be not infrequently discovered.

DR. F. BULLER. — I think the most interesting point in the case I have presented was the observation and accurate measurement of the process of growth of the little tumor, which could be readily observed on account of the retina not yet being detached. As for the delay in systemic infection, I reported a case of recurrence to this society some years ago. After removal of the eye the woman remained well for thirteen years, except for a small, slow-growing recurrence of pigmented growth in the orbit; but she did not eventually escape the general fate, for two years later she died of cancer of the liver. With regard to Dr. Bull's point, if I have understood his remarks aright, he would place some of the numerous intra-ocular sarcomas in the category of metastases. So far as I am aware, there are no published data to justify such an assumption.

AN ADENOMA OF THE MEIBOMIAN GLANDS.

BY O. F. WADSWORTH, M.D.,

BOSTON.

Few cases of adenomata of the lids have been described. Salzmann (Archives of Ophthalmology, XX, 3) reports three cases and refers to four others.

Fig. 1.

Fig. 2.

F. M., aged 18, presented himself at the Massachusetts Charitable Eye and Ear Infirmary in October, 1894, with a growth of the left upper eyelid. The history to be obtained was meagre: he stated that there had been an operation for removal four years before, and since that time growth had been gradual.

The tumor was situated at the middle of the lid, involved considerably more than half its width, the whole height of the tarsus, and overhung the lower lid. About half of the tumor

lay below the level of the cilia. It measured about 25mm vertically, 20mm horizontally, and 15mm in thickness.

The conjunctiva on its posterior surface was somewhat thickened and congested. The anterior surface above the lashes was nodular, the skin of fairly normal appearance, but not movable. The part which corresponded to the lid edge was greatly increased in size, irregularly nodulated, the nodules of slightly yellowish color and faintly umbilicated. The cilia were not much changed except in position. To the touch the growth was firm and without sense of fluctuation. The globe was normal. No definite diagnosis was made.

The tumor was removed by division of the whole thickness of the lid with scissors on either side, and completing the sec-

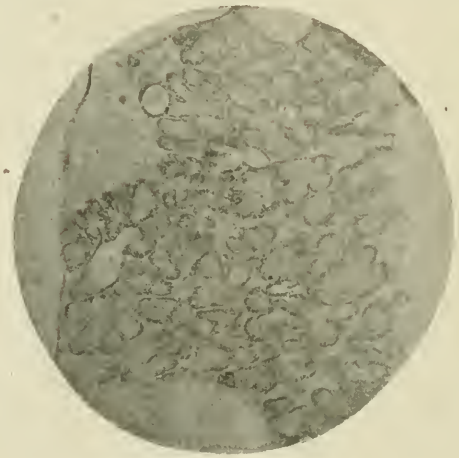

Fig. 3.

tion above with the knife. The gap left was a large one. Fortunately, the lid was naturally loose, so that, by incising the skin directly outward from the outer canthus about one and a half c.m., and freely dividing the fascia extending from the tarsus to the outer edge of the orbit, it was possible to bring the edges of the wound together and cover the space denuded without much strain. Sutures on the conjunctival as well as on the outer surface completed the operation. Under powdered iodoform and bandage the wound healed by first intention.

I am indebted to Dr. W. D. Hall for sections and photo-

graphs, and to Dr. F. B. Mallory for the following description of the tumor:

On one side is seen normal epidermis containing sebaceous glands and a few small hairs; on the other is an epidermis with marked papillæ (conjunctiva), beneath it is considerable round cell infiltration.

The tumor (in the section) measures about 1.5 c.m. long, and 1 c.m. wide. It contains a number of cysts, of which the largest measure from 2 to 3 m.m. in diameter.

Microscopically, the growth consists essentially of a great number of glands which resemble more or less perfectly in their structure normal sebaceous glands. The cells, especially towards the centers of the glands, are large, with coarsely reticulated protoplasm, and a small, lightly staining nucleus. In many of the glands the cells in the center have been transformed, so that their outlines are shadowy and the nuclei do not stain. Many of the glands are dilated into larger or smaller cysts containing the remains of desquamated cells.

At the base of the growth, the glands have invaded to a slight extent the striated muscle fibres, and at one point have almost surrounded a nerve bundle.

Towards the margin of the lid there is a marked papillary growth of fibromyxomatous tissue, covered with epidermis and containing numerous branching glands and even small cysts, into a large irregular cavity which would seem to be the dilated duct of the sebaceous gland from which the growth started.

Diagnosis: An adeno-cystoma originating in a Meibomian gland, showing in its outer portion a marked intracanalicular papillary structure, and at its base a slight tendency to invade the deeper tissues.

TRAUMATIC ENOPHTHALMOS, WITH A CASE.

BY G. E. DE SCHWEINITZ, M.D.,
OF PHILADELPHIA.

Charles Rodgers, aged 23, a laborer, born in Pennsylvania, was admitted to the ophthalmic wards of the Philadelphia Hospital, January 4, 1895, with the following history: On December 21, 1894, while on an extended debauch, he was struck by a trolley car and removed to the Chester Hospital, where he remained in a semi-unconscious condition for four days, both eyelids being swollen shut. When he recovered consciousness and was able to open his eyes, he noticed diplopia, and that the left eyeball was apparently smaller than the right and had receded into the orbital cavity. The surgeons who first saw him were unable to find evidence of fracture, the only lesions being several lacerated wounds of the left side of the face and scalp, and severe contusion of the left wrist, ankle, and the left half of the thorax. Recovery from these wounds was uninterrupted, and he applied for admission to the Philadelphia Hospital on account of the ocular disturbances, fifteen days after the accident.

When I examined him (January 5, 1895) the following conditions were present: Five scars, each about 2.5 cm. long, as follows: one 3 cm. above the left eyebrow, one down and out on the left temple 6 cm. from the external commissure, one at the angle of the lower jaw upon the left side, one at the edge of the scalp on the left side, and one at the vertex. There was a peculiar depression over the right side of the skull posteriorly, at the junction of the parietal with the occipital bone — a depression, however, apparently not connected with his accident. The left eyeball was sunken 4 mm. deeper into the orbit than the right, and presented the appearances which Nieden so aptly has compared to those produced by an artificial eye (Figure I). The width of the right palpebral fissure was 13 mm.; of the left palpebral fissure 9 mm. The inter-pupillary distance was 58 mm.

Fig. 1.

The difference in the level of the corneæ, measured at their lower borders, when the patient looked directly forwards on a horizontal level, was 3.5 mm., the right being higher.

The difference in the level of the upper corneal borders, when the patient looked directly downward, was 5 mm., the left being lower (Figure II).

The difference in level, when the patient looked directly upward, was 4 mm., the right being higher.

The difference in level, when the patient looked to the left and upward, was scant 5 mm., the right being higher.

The difference in level, when the patient looked to the right and upward, was 4 mm., the right being higher.

Limitation of the movement of the affected eye is indicated by the measurements* just recorded; *i. e.*, the left eyeball could not be moved directly upward, nor upward and to the left and upward and to the right as far as the corresponding globe on the right side, while the downward movement is somewhat exaggerated. There was crossed diplopia in all portions of the field of fixation, the vertical separation of the images being neutralized by a prism of 4°, and the lateral separation by one of 2°, when the patient regarded the test-object at 5 metres, his eyes being in the primary position. It was almost impossible to determine the relation of the double images to each other, owing to the patient's exceedingly contradictory answers, but evidently, at the time of the original examination, there was paresis of the left superior rectus, associated with insufficiency (perhaps paresis) of the interni. About one month later Dr. Oliver examined the muscle balance, with the following result:

O^2 without correction ⌒ vertical diplopia of ten degrees, shows heteronymous diplopia of two degrees at five metres distance.

O^2 without correction ⌒ horizontal diplopia of ten degrees, shows vertical orthophoria at five metres distance.

O^2 without correction ⌒ vertical diplopia of ten degrees, shows heteronymous diplopia of nineteen degrees at thirty-five centimetres.

* My colleague, Dr. Charles A. Oliver, kindly repeated these measurements, with the same result.

O^2 without correction ⌒ horizontal diplopia of ten degrees ⌒ nineteen degrees of corrected heteronymous diplopia, shows orthophoria in vertical meridian at thirty-five centimetres.

(The diplopia producing prisms always placed before O. S.)

Within the last five years the literature of traumatic enophthalmos has been reviewed in some detail by a number of observers. Thus, Hansell[1] observed retraction of the eyeball immediately following injury, and refers to four cases of similar nature. Theodore Beer[2] analyzed thirteen cases and describes two others studied by himself. Schapringer[3] contributes a collection of illustrative cases, together with remarks on the pathology of the affection, and adds two new examples of permanent traumatic enophthalmos, which he has observed, and Alex. Ogilvy[4] reports an example of this affection from the Clinic of Professor Fuchs, in Vienna, and gives a number of abstracts of previously recorded cases, exactly the same ones which Beer[5] has collected. Not the least interesting feature, from the literary standpoint of this subject, is the earliest account of this ocular anomaly by Henricus Smetius, in 1575.[6] Altogether, including the one which I report to-day, about twenty-six cases are upon record, exclusive of non-traumatic examples, those which are caused by cicatricial bands and adhesive inflammation[7] after operative interference in the orbit, those which followed extirpation of a tumor involving the cervical sympathetic[8], and, finally, those in which there is a monolateral, non-traumatic enophthalmos changing into exophthalmos when the head is bent forward — such cases, for example, as have been reported by Robert Sattler,[9] Gessner,[10] and others.

[1] Transactions of the Philadelphia County Medical Society, February, 1890.
[2] Archives of Ophthalmology, Vol. XXII, p. 98.
[3] Klin. Monatsbl. f. Augenheilk., September, 1893.
[4] Ophthalmic Review, May, 1894.
[5] Loc. cit.
[6] See Shapringer, loc. cit., and Centralbl. f. prakt. Augenheilk., Vol. XIII, p. 191.
[7] Del Monte: Osservazione e note Cliniche, 1871, p. 71; and Litteneuer: Gaz. des Hôpitaux, 1873, I, p. 243.
[8] Matlakowski: Centralbl. f. prakt. Augenheilk., 1881, XV, p. 387.
[9] Amer. Journ. Med. Sc., 1885, n. s., 89, p. 486.
[10] Centralbl. f. prakt. Augenheilk., 1889, XIII, p. 161.

Fig. 2.

The various theories which have been advanced to explain this condition may be summarized as follows:

1. Cicatricial contraction of the retrobulbar connective tissue following periostitis and inflammation (Gessner); or cicatricial adhesions of the eyeball itself (Löw).

2. Atrophy of the orbital cellular tissue on account of a disturbance of nutrition due to a lesion of a nerve center or tract, and particularly of the sympathetic, or of the trigeminus. (Beer's theory.)

3. Paralysis of Müller's orbital muscle from lesion of the sympathetic (Schapringer).

4. Fracture of the orbital walls (inner or under) causing enlargement of the orbital space and allowing retraction or sinking of the eyeball (Langenbeck, Tweedy, Von Becker, Lang, etc.).

Schapringer contends, and, no doubt, with good reason, that the name "enophthalmos" should be retained for those cases in which the retraction of the eyeball occurs indirectly from a nerve-lesion; for those which result from a direct mechanical influence, *e. g.*, extensive fracture or perforation of the orbital walls, he prefers the term "dislocation" or "luxation."

My own case presents no evidence of fracture (other than the diplopia); certainly there was no infraction of the orbital walls sufficiently great to allow sinking or misplacement of the eye. It is best explained by that hypothesis which assumes that retraction of the eye may be caused by lesion of the sympathetic; indeed, this is not only a hypothesis, but demonstrable by experiments in animals.

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16. Schwarzschild: New York Medical Record, May 14, 1892. (One case; also exophthalmos when bending forward.)

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18 Schapringer: Klin. Monatsbl. f. Augenheilk., 1893, XXXI, p. 309. (Two cases.)

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EYE LESIONS IN MYXŒDEMA.

BY PETER A. CALLAN, M.D.,
OF NEW YORK CITY.

The number of cases of myxœdema, which have been carefully reported during the past few years, has grown to a considerable number; while the literature on the subject has developed apace, and is not confined to any one country.

The clinical features of this disease are so striking and characteristic that one cannot fail to recognize this peculiar ailment, when a case presents itself for treatment and advice. The patient's face looks not unlike a mask; the features enlarged, lines obliterated, eyelids enlarged, nose thickened and swollen, lips increased in size and bluish in color, while the whole expression is dull and listless. The skin is dry and cold, with waxy or bronze color. The mental perception is impaired, responses to questions are slow in forthcoming, as if mental concentration were difficult, and the voice is guttural.

The eye symptoms of myxœdema are not many, the most prominent being lachrymation, due to the swollen eyelids. In the four cases which I have seen, I found that there was an appreciable amount of corneal anesthesia besides the lachrymation of the eyes; but no other characteristic eye symptoms.

Cases of amblyopia and atrophy of the optic nerves have been reported in patients suffering with myxœdema, but the question naturally arises, were they not accidental accompaniments, and in no way due to the constitutional ailment, and dependent on other causes? In an article in Wood's Reference Handbook of the Medical Sciences, Vol. 2, page 98, Dr. Allan McLane Hamilton states that "the fundus oculi presents a peculiar tumefied appearance, and choked disc is occasionally found." Four cases are certainly too few to generalize from in writing on any disease; however, in these patients under my observation, whom I repeatedly examined, there were no such lesions to be found.

Three of these patients were women, and the fourth a man. Two of the women had, beside the lachrymation and anesthesia,

ocular disease. One, aged 50, had incipient cataract, whose vision the patient considered improved under the treatment of thyroid extract, but I could not detect that the lens striæ were any less numerous, nor was the sight better by objective tests. The betterment was subjective and undoubtedly to be attributed to the increased physical tone of the patient. The second case, a woman 48 years old, I had, off and on, treated for slight eye-troubles for ten years, she being unwilling to wear correcting lenses for a hyperopic astigmatism, which caused asthenopic symptoms. A little more than two years ago she put herself under treatment for myxœdema at my suggestion. In a very short time there was marked improvement, the face lost its masklike appearance, weight reduced from 190 to 155 lbs., and became mentally and physically like her former self. I lost track of the patient shortly after this improvement, owing to my insistance that she wear glasses. In March, 1895, she returned again, complaining that her sight had become very poor, so that reading was impossible. She told me that for two years she had daily taken the thyroid extract, and that her health had been good, and nothing to complain of until recently, when her sight became poor. An ophthalmic examination of the eyes showed well-marked typical retinitis albuminurica, with vision amounting to ability to count fingers at twenty feet. Urine showed casts and 9 per cent. of albumen per volume.

It may be an unfounded suspicion on my part that the continuous use of thyroid extract in this case caused the Bright's disease, after two years of that treatment. In this connection it may be of interest to quote an experiment of Driver of Harrowgate, England. He injected into dogs an alcoholic extract of supra renal capsule, and then measured the blood pressure. Before the injection the pressure would support a column of mercury four inches, and after the use of supra renal capsule extract it was capable of sustaining a column twelve inches.

In the majority of the myxœdema cases there is present high arterial pressure, and if to this is added the thyroid extract treatment, which increases still more the action of the heart, it is but natural to infer that kidney lesion may result. Prior to the use of the thyroid treatment, cases of cirrhosis of the liver

and kidney diseases were reported as secondary to myxœdema. No doubt that the thyroid extract, when employed judiciously, relieves the distressing mental and physical symptoms of this disease, so that the afflicted patients take renewed interest in life; but, as the thyroid gland is atrophied, the treatment must be kept up indefinitely.

DISCUSSION.

DR. O. F. WADSWORTH of Boston, Mass.— As the author has referred to me, I will say that I have seen more than a dozen cases of myxœdema, but only in the one which I reported has there been any special eye lesion. With regard to that case, I may say that some years after it was reported, a gentleman writing on acromegaly referred to it as probably a case of that disease. I looked up the history of the case again, and think the writer may have been right, although several physicians who saw the case had no doubt it was one of myxœdema; but at the time I saw the case acromegaly had hardly been described. It is possible that in that case it was not myxœdema but acromegaly that caused the optic atrophy.

TWO CASES OF TUMOR OF THE IRIS.

BY HOWARD F. HANSELL, M.D.,

PHILADELPHIA.

CASE I. — *Cyst.* Referred to me by Dr. George Hartmann of Port Kennedy, Pa.

J. W., aged 20, while harvesting, was struck forcibly in the eye with a cornstalk. The cornea was perforated, the anterior chamber emptied, the capsule torn, and probably the lens injured. I saw the patient a few days after the accident. The cornea showed an irregular cicatrix near the center, the iris was attached in several places to the capsule, the lens was opaque, striæ running backward from the point of densest adhesion, and there was moderate ciliary injection. In six months the eye was free from injection, the synechiæ persistent, and the

lens was entirely opaque. Extraction of the traumatic cataract was advised and refused. Two years later W. returned on account of the development, six months earlier, of a growth in the anterior chamber. The tumor was the size of a large pea, round, perfectly white and glistening, resembling very closely a large pearl, and attached to the iris at the lower outer quadrant — the section that had been injured. Its antero-posterior diameter was longer than the depth of the anterior chamber, so that the opaque and partly absorbed lens was dislocated backward. The growth of the tumor had been slow and nearly painless, but, on account of its unsightly appearance, the patient desired to have it removed. The cut was made in the corneo-scleral border opposite the tumor. Upon the escape of the aqueous, and in consequence of the withdrawal of the support of the cornea and the pressure from behind, the tumor rotated obliquely into the pupil, forcing the lens still farther backward. A Levis wire loop was, after one or two attempts, successfully forced over and behind the tumor. It was then drawn out without difficulty, and the iris, including its attachment, cut off. The wound healed without interruption. One month later the lens and portion of the capsule were extracted, resulting in restoration of moderate acuity of vision.

The cyst contained a yellow glutinous substance; after removal, the cyst wall ruptured and the contents, in part, discharged.

This rare variety of iris tumor has been designated by Fuchs as "Pearencyst." Its anterior wall consists of single fibres of iris tissue and the inner surface is lined with epithelium from which the contents are derived. He supposes the epithelium to be conveyed into the anterior chamber at the time the perforating wound is made. Others, (De Wecker, Arlt,) think the cysts arise from traumatic subdivision of the posterior chamber, and Eversbusch from separation of the anterior lamella of the ligamentum pectinatum.

CASE II.— *Fibroma.* J. W. Ellis, male, aged 17, sent to me by Dr. K. C. McWilliams. He had had no ocular trouble until June, 1894, when, while in bathing, he had smarting in the left eye followed by violent inflammation, for which he received proper

treatment. At that time a small growth was noticed on the iris. Dr. McWilliams saw the case in December, six months after the commencement of the symptoms. There was a deposit in the anterior chamber, a few posterior synechiæ, and a small oval, non-vascular, brownish, pigmented tumor growing from the anterior surface of the iris. This was afterward removed by me by iridectomy. Vision 20/70 before and after operation. Three weeks later he received a blow on the eye which opened the wound through which the tumor had been removed and filled the anterior chamber with blood. The wound healed, but vision never cleared up on account of membranous network of inflammatory material which had formed as a result of traumatic iritis in both the old and new pupil.

The tumor was given to my friend, Dr. Loeb, of the Philadelphia Polyclinic, for microscopical examination. He reports: "The small growth submitted to us for examination proved to be a fibroma in active state of inflammation. The elementary structures of said growth are of non-malignant type, which excludes the probability of its being of the sarcomatous or carcinomatous nature. Bacteria have not been found, nor has it been of a tuberculous origin, for no tubercles could be discovered in staining."

REPORT OF A CASE OF TRAUMA OF LEFT ORBIT, IN WHICH EXOPHTHALMOS AND PROBABLY ANEURISM OF INTERNAL CAROTID ARTERY IN THE CAVERNOUS SINUS RESULTED: RECOVERY FROM THE ANEURISMAL SYMPTOMS WITHOUT OPERATIVE INTERFERENCE.

BY DR. B. E. FRYER,
OF KANSAS CITY, MO.

On September 18, 1893, I was asked by Dr. J. M. Singleton of Kansas City to see with him J. B., 8 years of age, who had, two hours previously, received a severe and peculiar injury in the left orbit. The boy, who was healthy and of perfectly healthy parents, on going out in a terrible storm, had tried to

put up an umbrella over him, was struck, with great force, by a metallic umbrella-rib, the end of which had been previously broken and was pointed. This rib was driven into the orbit quite deeply by the force of the strong wind acting upon the open umbrella. The extraction of the rib required considerable force and produced intense pain, and syncope followed.

Upon examination of the boy, I found that there was exophthalmos and swollen lids, which latter were echymosed. The eyeball was intact, as far as could be ascertained by external observation and by an incomplete and quickly made ophthalmoscopic examination. The wound of entrance, a small and ragged-edged one, was in the conjunctiva close to the inner canthus, from which there was a slight bloody oozing. The patient was semi-conscious only, and of course no subjective test of vision was possible at the time.

On the following day the lids were more swollen and the eyeball protruded farther. The boy was then quite conscious, and complained of severe headache and great pain in and around the injured orbit. He vomited once or twice and the vomited matter contained blood. Blood had also been discharged through the nose just after the injury. On the third day following the accident the child complained of an intermittent rushing sound in his head, which he located deep in the left temporal region. This sound he compared (without suggestion) to the puffing of a locomotive. On applying a stethoscope over the temporal fossa, the pulsation could be distinctly heard. It was heard also over other portions of the cranium, but less loud. This cranial sound, which was synchronous, or nearly so, with the wrist pulse, could not have been caused externally by the arteries in the temporal region, for these were controlled by pressure during observations. On pressing over the left common carotid, the sound was heard neither subjectively nor objectively. The bruit gave the impression that its site was not produced in a vessel of small calibre. The sound could be heard on both sides of the cranium, but was louder on the side of the injury. The bruit in the cranium was sought for by the family physician and by me many times and its existence noticed several months, during which time it could be readily heard, and its

presence was complained of by the patient during that time. Four months after the injury the sound gradually lessened and finally ceased; is not heard by the patient now, nor is it discoverable by the physician or by me.

At the time of the first discovery of the bruit objectively, a slight ocular pulsation was observed by touch. This lasted, however, but about two weeks.

No operative interference was had in the case, the aneurismal symptoms disappearing without surgical assistance.

For several months after the injury the lids remained much swollen and were partially everted; at the same time there was hyperplasia of the orbital connective tissue, which gave little, if any, yielding on digital pressure. At the present time (July 1, 1895) the boy has slight exophthalmos; the eye is turned inwards, markedly, and cannot be moved outwards. Vertical excursions of ball are but slightly interfered with, however.

Ophthalmoscopic examination shows the eye grounds normal, with the exception that the left disc is slightly paler than its fellow.

It is to be much regretted that a full ophthalmoscopic investigation could not have been made shortly after the injury, and several times afterwards, also; but this was impossible, the boy being peevish and always rebellious against any attempt of the kind, until lately. The vision of the eye on the injured side permits only of the counting of fingers at 12 feet.

From the reception of the injury the eyeball has been congested externally, the subconjunctival veins being quite large and tortuous, and this condition lasted several months and is somewhat apparent yet. At no time was there any abnormality of pupillary action.

DISCISSION OF THE CAPSULE AFTER CATARACT EXTRACTION, WITH THE PRESENTATION OF A NEW INSTRUMENT.

BY JOHN E. WEEKS, M.D.,

NEW YORK CITY.

It is, I think, generally admitted by ophthalmic surgeons that discission of the capsule after cataract extraction is desirable in the majority of cases. The highest possible average of vision, in a given number of cases, can only be obtained after discission has been performed, and the operation would be more frequently done if it could be made more simple and less dangerous. If operator and patient are satisfied with a fair degree of vision, discission is necessary in but few cases; however, it is a fact that the patient usually wants the best vision that can be obtained, and often is not satisfied with that. The coming operator will not be satisfied with as low an average of visual results after the extraction of cataract as is obtained to-day, any more than the present operator is satisfied with the average of visual results that were obtained one or two decades ago. The improvement in average vision after cataract extraction will come principally through discission of the remaining capsule, and, in the writer's opinion, it will not be long before an operation for cataract will not be considered complete until discission of the anterior (if it still remains) and posterior portions of the capsule is performed. The reluctance of many operators to perform discission is undoubtedly due to some bad results that have followed — results due to traumatism or to infection; the latter can be avoided, and the first can be made so small that it becomes insignificant. For the successful completion of the operation of discission, the retention of the aqueous humor is almost a necessity. This has been recognized by ophthalmic surgeons for many years. The substitution of cutting the membrane, instead of tearing it, we owe largely to Dr. H. Knapp, and the application of this principle enables us to reduce the traumatism to a minimum. The knife needle

advocated for use in the operation of discission by Dr. Knapp is a great advance over all preceding instruments for all cases where the capsule has not been thickened by dense fibrous bands due to inflammatory reaction. Admirable as the knife needle is, its use has not been perfectly satisfactory, for in attempts to divide the capsule, in not a few cases where an easy splitting was expected, the thin capsule has been partly or wholly dislocated. In studying the conditions present when the knife needle was in use (see Fig. 1), it was observed that when the capsule was punctured at the margin of the iris opposite to the point of entrance of the needle one or two millimetres of the cutting edge of the knife impinged on the surface of the capsule, thus making the resistance to the cutting edge of the knife many times more than it would have been if the thickness of the capsule only had come against it. As the handle of the knife was swept toward the normal to the center of the cornea the edge of the knife met with less resistance, provided the incision through the capsule had been made at the start (the capsule had not been dislocated), and at the finish of the horizontal incision the resistance was least, as nothing but the edge of the capsule came against the edge of the knife. It is a fact that dislocation of the capsule usually occurs, if it occur at all, when the knife needle strikes the capsule.

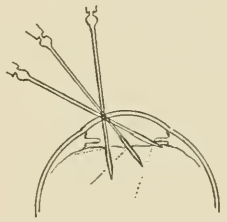


FIG. 1.

Contact with capsule when the knife needle is employed.

FIG. 2.

In order to reduce the resistance to the cutting edge of the knife to a minimum, thereby making the operation with the single needle surer and less difficult, the writer has devised a curved knife needle, shaped something like a sickle (see Fig. 2); three sizes are made. The length of the blades in the set of knife needles is 5, 4, and 3.5mm. It is found that these sizes are the most suitable for use, and are sufficient to select from.

A hooked extremity is formed by a curve which extends from the middle of the blade to the point. The curve of the blade brings the extreme point 2.5mm. away from a line projected from the axis of the shaft. The blade is about 2/3mm. in width, and the shaft is just large enough to fill the opening made by the blade when the knife is properly entered. The concave edge and the point of the blade are rendered as sharp as possible; the convex edge at the point, for one millimetre up, is also sharpened.

The passage of the knife into the anterior chamber is not so easily effected as with the Knapp knife needle. The curve of the knife must be followed (see Fig. 3), in order to avoid

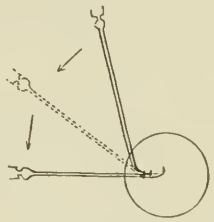


FIG. 3.
Sweep of needle to follow curve when piercing cornea.

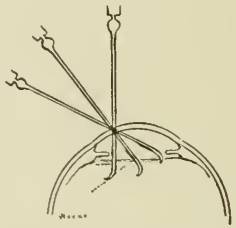


FIG. 4.
Contact with capsule when the curved needle is employed.

making an incision too large to be filled by the shaft. The knife is made to pierce the cornea at a point on its horizontal meridian, midway between the center and the periphery of the cornea to the temporal side. The operator should stand behind the patient, using the right hand to hold the knife when operating on the right eye, the left hand to hold the knife when operating on the left eye. The knife is entered on the flat, the sharp edge being turned toward the upper margin of the cornea. After entering the anterior chamber the point of the knife is passed to the opposite margin of the iris; the knife is then turned so that the cutting edge presents towards the capsule; the point is then made to pierce the capsule, and the knife is so held during the time of making the incision that only the thickness of the capsule presents against its edge — in other words, the plane of the capsule forms a normal to the impinging edge (see Fig. 4). The resistance is thus reduced to

the lowest possible degree, and the danger of dislocating the membrane and of making too much traction on the ciliary body is avoided. On account of the dull convex edge of its curved extremity, the knife can be moved about in the anterior chamber with more facility than is possible with the straight knife needle; the point does not catch on the capsule, and the different parts of the capsule can be more readily reached. With the curved knife needle the operator is not so liable to pierce the vitreous to a great depth, which, in the writer's opinion, is an advantage. By turning the dull convex border of the knife toward the iris, the point may be insinuated between the iris and the capsule, in cases where the iris does not dilate well. In withdrawing the knife it should be turned on the flat, as when entered, and the curve of the blade followed; the aqueous humor will then be retained in the anterior chamber.

The instrument presented is not designed to divide dense bands or membranes, the result of inflammatory reaction, but simply to cut through the thin capsule, which, perhaps, retains some cortical lens substance, that so often remains in the pupillary space after cataract extraction.

The discission should be done within three months after the extraction has been performed.

DISCUSSION.

DR. W. CHEATHAM, Louisville, Ky. — With reference to the needling of membranes, let me say that I had a case some years ago which makes me dread the operation, and I never do it if I can avoid. It was a case of double extraction, with vision resulting in twenty-fortieths. Some months later he returned, and I decided to needle the capsule for him. I did it, and lost both eyes by suppuration, though I had taken the same antiseptic precautions as for the previous operation. An examination of the urine afterwards showed that he had diabetes. He must have had this disease at the time of the first operation, but in the last one it produced sepsis.

DR. H. D. NOYES, New York. — I have had occasion in some difficult cases of membrane following cataract to realize that in the simple operation, where the pupil has not been interfered with, that to deal with the membrane is not a simple thing. Proceeding through the cornea will not always answer the purpose. For this reason, I have resorted to the old-

fashioned method of attacking the membrane from behind the iris, and I have devised a needle for the purpose. Introducing it from below, and cutting along as far as the angle, I get into the membrane above. It gives a large leverage, for you cut down with a slightly withdrawing motion. The case must be chosen, though, for it is not applicable to all cases. A second suggestion I would offer is that within the last year I have found that a very valuable instrument is an old Graefes' cataract knife, which has been ground so many times that it is reduced to one-half of its usual width. Such a blade will enter a cornea better than any needle I have ever used. It will cut through a membrane where a shorter needle made expressly for the purpose will not, and effects its work with less violence than many needles do.

DR. S. D. RISLEY, Philadelphia. — I have now in the hands of an instrument maker a new knife I have devised for discission operations.

The fault in most instruments devised for this delicate operation is that they are so formed that they cannot be sharpened satisfactorily. A cross-section through them presents too often an almost equilateral triangle, which can only afford a blunt-edged cutting instrument. I have sought to avoid this by having a small spear-shaped knife beaten out on the end of the shank, and sharp at both ends. The mid-rib of the spear is very thin, and tapers gradually to the point and to either edge. The amount of metal in the spear or blade of the knife will be the same as that contained in the shank, less the loss sustained in grinding and polishing; so that, after the cornea is penetrated, the wound made by the blade will be closed by the shank, and effectually prevent the loss of the aqueous humor until the instrument is withdrawn.

The advantages of the double-edged knife are obvious. Such an instrument can be readily and satisfactorily sharpened, as is apparent from the fact that a cross-section through the blade is not a triangle, but a very flat ellipse. The accompanying illustration shows very well the form and three-fourths size of the instrument as made by Mr. Meyrowitz.

DR. B. E. FRYER, Kansas City. — There is a condition that now and then confronts us in these operations that might be spoken of in this connection — that is the presence of organisms in the conjunctival sac. Before we do an operation upon the eye I think we should examine the secretion from the conjunctival sac, and if there are any pus-producing microbes

present, the operation should be postponed until they can be removed. I have had a case in preparation now for a month, and still there are staphylococci in that conjunctival sac.

DR. C. H. WILLIAMS, Boston. — I have had one or two cases where a little manœuvre was carried out which worked very well. That was division by two needles at one time. You pass one in about one-third of the way from the inner edge of the cornea towards the center, and pass the other into the outer side of the cornea in the same meridian, in the same relative position; then by bringing the needle points together in the center of the pupil and penetrating the capsule with them, and then bringing the handles together, you will tear the capsule in such a way that the whole strain falls on the capsule itself. One of the greatest difficulties in ordinary methods has been that the strain of cutting the capsule falls upon the ciliary region. This method of dividing a capsule remaining in the pupil by two needles was first proposed by Sir Wm. Bowman in a paper published in 1853 in the "Medico-Chirurgical Transactions," and, when carefully done, is a very satisfactory operation.

DR. J. E. WEEKS, New York. — I do not think that sepsis need be considered in this connection, as that is now relegated to unantiseptic methods. I wish to emphasize a remark made in the paper — that this needle is not intended to divide thick capsules, the result of inflammatory action. If we can use a single needle, I believe it is better than to attempt to use two.

A THIRD TABLE OF TEN THOUSAND CATARACT EXTRACTIONS.

F. M. WILSON, M.D.,

BRIDGEPORT, CONN.

The cases were collected by my associate, Dr. H. S. Miles. It is called a third table, because the number ten thousand was suggested by the two tables of Dr. Noyes, published in 1879. Almost all the operations were done between the years 1879 and 1893. No attempt at selection was made. The most available published reports were used until the desired number (ten thousand) was obtained. No attempt at analysis of the cases was made, except to note the published percentages of loss.

So far as I am aware, the conclusion of Dr. Noyes in 1879 that 6 per cent. loss was a fair average for the surgical methods

then in vogue has never been called seriously in question — *i. e.*, before antisepsis or asepsis was much practiced, and before cocaine, it was possible to collect ten thousand cases of cataract extraction, with an average loss of about 6 per cent.

Table.

Operator.	Year.	Cases.	Per Cent. of Failures.	References.
H. Derby,	1878	100	9.00	Trans. Am. Oph. Soc., vol. 3, p. 195.
H. Derby,	1880	100	1.00	" " " 3, p. 195.
Webster,	1883	31	17.14	" " " 3, p. 497.
Strawbridge,	1886	221	6.79	" " " 4, p. 298.
Webster,	1886	50	6.00	" " " 4, p. 320.
Bull,	1887	36	2.77	" " " 4, p. 417.
Knapp,	1882 to 1886	200	4.00	" " " 4, p 422.
Webster,	1886 to 1891	136	4.41	" " " 6, p. 75.
Pomeroy,	1892	50	0 00	" " " 6, p. 438.
Pagenstecher,	1876 to 1880	117	7.77	Knapp's Archives, vol. 10, p. 152.
Knapp,	1879 to 1881	100	5.00	" " " 10, p. 295.
Knapp,	1881 to 1882	100	2.00	" " " 12, p. 69.
v. Rothmund,	1877 to 1883	593	4.80	" " " 13, p. 311.
Cheatham,	1885	63	9.52	" " " 14, p. 1.
Chisolm and Harlan,	1887 to 1888	100	10.00	" " " 17, p. 1.
Knapp,	1886 to 1887	100	1.00	" " " 17, p. 51.
Rheindorf,	1880 to 1885	273	9.16	" " " 17, p. 437.
Knapp,	1887 to 1888	100	1.00	" " " 18, p. 1.
Knapp,	1889 to 1890	100	1.00	" " " 19, p. 280.
Haab,	Reported 1893	310	2 87	" " " 22, p. 470.
Schœler and others,	1884 to 1891	232	2.59	" " " 23, p. 152.
Schœler and others,	1884 to 1891	317	3.12	" " " 23, p. 152.
Swanzy,	1893	100	3.00	" " " 23, p. 350.
v. Arlt,	1874 to 1881	1,547	2.00	Wien Med. Wochenschr, Nos. 16-18.
De Monte,	1883	138	2.18	Movimento Med. Chir., vol. xvi, 3,4,5.
Walker,	1882	63	22.22	63d An. Report N. Y. E. and E. In.
Kazauraw,	1885	100	5.00	Wjestink Ophth., 1884, vol. 1, p. 23.
Bagajewsky,	1887	173	8.00	Wjestnik Ophth., 1887, No. 6.
Fieuzal,	Reported 1885	1718	5.00	Bull. de la Clin. Nat. Ophth., April, June, 1885.
Fieuzal,	1885	25	16.00	Bull. de la Clin. Oph., Apr., June, '85.
Higgins,	1884	200	8.00	Ophthalmic Review, vol. 3, p. 187.
Drake Brockman	Reported 1884	1564	17.28	" " " 3, p. 233.
Noyes and others,	1884 to 1889	309	7 00	N. Y. Med. Record, Mar. 30, 1889.
Thomas,	1888	120	7.50	Jour. Oph. Otol. et Laryngol, Jan., '89.
Thomas,	1891	50	0 00	" " " " '91.
Steffan,	1884	300	9.00	v. Graefe's Arch., Band xxix, 2, p. 167.
Panas,	1884 to 1888	460	5.00	Acad. de Med., Jan. 31, 1888.
.....	.....	10,296	228.12	.....

37) 228.12

7.16 Average Loss.

I have tried to reason away this deadly uniformity with the results of twenty years ago, but have been entirely unsuccessful. What Virchow calls the "brute force" of such masses of cases is too great.

From the well-known facts of general surgery, we can only infer that antisepsis or asepsis must be important in cataract extraction.

Laboratory experiments upon animals seem to show the same thing. From my own clinical experience, I have come to regard aseptic precautions in cataract extraction as of the highest importance.

But I see no escape from the fact that the average loss *was* about 6 per cent. in 1879, and *is* about 6 per cent. now.

EXPERIMENTAL SALICYLIC ACID-AMBLYOPIA.

By G. E. de SCHWEINITZ, M.D.,

of PHILADELPHIA, PENN.

It is not unnatural, owing to the physiological action of salicylic acid and the salicylates and the well-known symptoms which they produce in full doses — symptoms resembling in many particulars those which we know under the general name of cinchonism — that visual disturbances analogous to those produced by toxic doses of quinine should be the result of the ingestion of large quantities of these drugs.

Thus Reiss,* in his research on the effects of salicylate of sodium on healthy people, noted tinnitus aurium and disturbance of vision after five-gramme doses.

The first case of importance, however, is the one reported by E. Gatti†: A sixteen-year-old, robust peasant girl was given, on account of articular rheumatism, eight grammes of

* Berl. klin. Wochenschr., Nr. 50, 1875.

† Abstract in Nagel's Jahrsbericht f. Ophtalmologie, Vol. xi, p. 243, 1880.

salicylate of soda, divided into ten doses, one dose to be taken hourly. After receiving the last dose she fell asleep, and awoke entirely blind, even quantitative light perception being lacking. The sensibility of the cornea and the sclera was normal; there was well-marked mydriasis; the media were clear; there was a light gray reflex from the retina depending upon the decided choroidal pigment. The optic papilla was normal, its borders sharply marked, and the retinal veins well filled — conditions which obtained after the restoration of vision. Other symptoms were: Dullness of hearing, weak heart sounds, small pulse, and slight perspiration. The urine was free from albumen and sugar. Ten hours later the patient could count fingers, and twenty-four hours after the blindness originally began vision was restored. Mydriasis persisted for several days. The amaurosis was explained by a direct action of the salicylate of soda upon the retina and optic nerve.

Knapp,* describing quinine blindness, states that he has seen three cases presenting precisely analogous symptoms, due to large doses of salicylic acid and the salicylate of soda.

H. Brunner † refers to salicylic acid amblyopia, and declares that it has been described by several authors, but gives no particulars.

Evidently an amblyopia resembling that produced by quinine may result from the ingestion of large doses of salicylic acid, or of one of its salts. In order to test the effect of this drug on animals, I have performed a number of experiments similar to those of Brunner and myself with quinine. The following are the results:

Experiment I. — 3-21, '92. Yellow, short-haired dog; weight, twenty-two and one-half pounds; eyegrounds and vision normal. Sixty grains of salicylate of soda injected.

3-23, '92. No change in vision. Sixty grains of salicylic acid dissolved in ammonia, so that one-half grain of salicylic acid was contained in one minim of the solution, were injected.

* Bericht über die Dreizehente Versammlung der Ophtalmologischen Gesellschaft, Heidelberg, 1881, p. 103.

† Über Chininamaurose, Inaug. Diss., Zurich, 1882.

3-24, '92. Dog partially blind; hangs his head, and fails to avoid objects in moving around the room; no positive change in the eye-grounds, save a slight diminution in the size of the arteries; pupils react normally.

3-28, '92. Dog partially blind, but there is slight conjunctivitis, and it is difficult, on account of the haziness of the cornea, to obtain a good look at the eyeground. Abscess at the point of injection; opened and carefully sterilized.

4-1, '92. No new symptoms, but there is distinct return of vision, as the dog no longer fails to avoid objects.

4-4, '92. Optic nerves decidedly pale, with arteries smaller than before, although the dog sees very well — at least, so far as central vision is concerned. There is contraction of the field of vision.

EXPERIMENT II. — Long-haired black dog; weight, thirteen pounds. Sixty grains of salicylate of soda injected at 4 P. M., 3-28, '92.

3-29, '92. Dog very weak; drags the hind legs, and apparently blind; there is haziness of the cornea, and some conjunctivitis; abscess at the point of injection.

4-1, '92. Pyaemic symptoms; there is a large hypopyon-keratitis. Dog killed; eyes, optic nerves, and chiasms removed.

EXPERIMENT III. — Original salicylic acid dog was given sixty more grains of salicylate of soda, 4-4, '92.

4-8, '92. Corneæ have become hazy, and a small spot of suppuration has developed in the upper and outer part of each one; cornea not anæsthetic.

In several similar experiments similar results were obtained. We reach, therefore, the following interesting conclusion: Somewhat more slowly, but none the less certainly, it is possible to produce amblyopia with large doses of salicylic acid, or the salicylate of soda, the ophthalmoscopic appearances — blanching of the optic disc and contraction of the vessels — resembling, although in minor degree, those seen in quinine amaurosis.

Conjunctivitis, corneal haze, and even hypopyon-keratitis may follow injections of this drug. In the severe cases, however, this phenomenon is associated with abscess at the point of injection, and may be the result of pyaemia. Conjunctivitis of a mild type, without constitutional derangements, was also noted, and may be analogous to similar conditions which have

been observed in human beings after the ingestion of this drug.* In all probability, the mechanism of salicylic acid blindness is the same as that of quinine amaurosis, although in the eyes which I examined I could not find evidences of endovasculitis, thrombosis, or degeneration of the optic nerve fibres, such as I have demonstrated in animals as the result of toxic doses of quinine. The salicylic acid dogs, however, were not allowed to remain alive for any great length of time after the first symptoms of amblyopia appeared, and further experimentation is necessary to show what the ultimate effect of this drug is upon the visual tract. Personally, I have little doubt that it is possible with it to produce extensive atrophy in the same manner as with quinine.

SALICYLATE OF SODA IN GLAUCOMA.

By Dr. T. Y. SUTPHEN,

NEWARK, N. J.

In looking over the literature bearing upon the treatment of glaucoma, I can find but very little mention made of the usefulness of the salicylates, even where there was a possibility of a rheumatic diathesis existing, except as the recommendation was made that any general indication met with should be taken into consideration and treated accordingly. Several years ago, when in charge of a case where the patient was suffering great pain in an attack of glaucoma, all other means of relief having failed, I was led to prescribe the salicylate of soda. Much to my surprise and joy, the remedy acted with the greatest promptness, the patient being quickly relieved, and the acute symptoms subsiding rapidly. The eye, though blind, was saved from enucleation. From that time on I have used this remedy with the utmost satisfaction, believing it to be almost a specific for the relief of the severe pain so constant in secondary

* Consult Rosenberg Deutsch Med. Wochenschr., No. 33, 1889.

glaucoma, with or without an apparent rheumatic diathesis, and also in cases where there is more or less supra-orbital neuralgia when the condition of the glaucomatous eye does not demand surgical interference.

I wish, by a brief report of a few typical cases, to call the attention of the members of this society to the salicylates as an important adjunct to our list of means for the relief of pain in glaucoma.

M. M., æ. 50, a strong, healthy, policeman, came to consult me May 2, 1894, for a painful inflammation of his eye. The history of his case was this: a blow upon his left eye, several years previously, followed by complete loss of vision, but no further trouble until ten days before, when it had become suddenly inflamed and very painful. There was deep pericorneal injection, deep anterior chamber, moderately dilated pupil, the lens opaque, completely dislocated, and freely floating about in the vitreous. There was no perception of light, and the fundus could not be illuminated. The tension was greatly increased, and the pain had been so severe that he had taken large doses of opium, often repeated, with no benefit whatever. The patient gave no history of rheumatic troubles. Under the administration internally of salicylate of soda, in gr. xv. doses, and warm, wet cloths applied to the eye locally, the severe pain was decidedly relieved in two or three days, and in a week's time he was able to resume his duties. The eye has given the patient no trouble since that time, and when seen a few days ago was perfectly quiet and free from pain and irritation.

W. H. D., æ. 47, a country merchant, first consulted me in May, 1890. His left eye had become suddenly blind. A complete detachment of the retina was found, for which he was treated, with no benefit. The eye gave him no other trouble until February 2, 1894, when he had a severe attack of secondary glaucoma. There was deep pericorneal injection, shallow anterior chamber, and partially dilated pupil; the details of the fundus could not be made out, except the presence of the detached retina, and the globe was of stony hardness. There was no history of rheumatism; eserine when used only seemed to

increase his pain, and large and oft-repeated doses of morphine did not relieve him. After a few days of unsuccessful treatment, everything was abandoned, except the sodium-salicylate, which was administered in gr. xv. doses every four hours, and fomentation locally applied to the eye. The next day the patient was greatly relieved from pain, which entirely ceased within four days, the tension becoming much less. Internal medication was kept up for ten days, the doses being given at longer intervals each day. Since then he has had one or two occasions when another attack seemed imminent, but a few doses of the salicylate appeared to allay the symptoms immediately. At present the eye gives him no trouble whatsoever, except that it is blind; the other eye is healthy.

September 14, 1894, J. L., a strong, healthy man, aged 79, sought treatment on account of severe pain in his left eye, which was blind from glaucoma. The history was as follows:

Eight or ten months previously he had noticed gradual loss of vision in that eye. Six weeks before he came to me it had become painful, the pain increasing in severity, until it was almost unbearable. The eye was found hard, anterior chamber shallow, pupil dilated and fixed, fundus dark. The patient said he had received no injury, and had never suffered from any rheumatic trouble. The fellow eye was healthy. Salicylate of soda was prescribed internally in gr. xv. doses, and warm, wet cloths ordered to be applied locally to the eye. One month later, when again seen, he stated that the pain quickly left the eye under treatment, but that his medicine lasting only a week, his pain had returned, and he had come back for more of the medicine. The subsequent history of the case was speedy and permanent relief from the pain after beginning treatment the second time. When the patient was seen July 9th, one week ago, the left eye was completely glaucomatous, but free from all irritation, and the right eye normal.

February 18, 1895, G. H., æ. 57, presented himself for treatment for a very painful attack of secondary glaucoma in the right eye. Several years ago he had been struck upon the eye violently by the bung from a beer keg, since which time his vision in that eye had been poor, but he had had no pain until

two weeks before he came to me; since then his pain had been very severe, and he was unable to obtain any rest. The eye was found intensely congested and hard. There was a roughened condition of the cornea; anterior chamber deep; the lens was partially dislocated upwards and opaque, the free border projecting through the pupil, and the fundus could not be illuminated. The salicylate of soda was ordered. The patient returned February 21st, with no pain; the pericorneal injection was greatly lessened. From that time on there was a steady and rapid recovery from the more acute glaucomatous condition. At the present time the eye is quiet, and gives him no trouble. In this case also there was no history of rheumatism.

October 11, 1894, Edward S., æ. 61, sought relief for a painful inflammation of his right eye, which was found glaucomatous. The patient regarded his trouble as secondary to an intra-ocular hemorrhage occurring several months previously, the presence of which was announced to him by a physician who had made an ophthalmoscopic examination. The positive signs of glaucoma were all present — greatly-increased tension, shallow anterior chamber, dilated pupil, dark fundus, no perception of light, and the pain intense. In the left eye there was a glaucomatous excavation of the disk, shallow anterior chamber, tension 1+, but no pain. There had been a marked loss of vision in this eye during the last year. A weak solution of eserine was prescribed locally for the left eye, and the salicylate of soda internally. The patient returned November 21st, the pain in the right eye gone, and the condition of the left unchanged. He declined an operation upon the latter one, the advisability of which had been urged.

These cases are a portion of those seen by me during the last two or three years, and are notable as being free from any apparent symptoms of rheumatism; but they seem to teach a lesson that we may well heed, and that is that in some cases where there is severe glaucomatous pain this symptom is quickly relieved by the use of sodium salicylate — the remedy "par excellence" in rheumatic arthritis — and sets us to wondering what it all means. May there not be a greater similarity in the conditions surrounding rheumatism affecting the

joints and the hardening of the eyeball in glaucoma than we have formerly appreciated?

The following case is reported because of its peculiar clinical history, and suggests the possibility of a wider field of usefulness for the salicylate of soda in glaucoma than merely the relief of pain. This case was watched with the greatest interest from the beginning to the end, and becomes more valuable as it was seen by other observers, who confirmed the diagnosis and noted the remarkable recovery.

Sister I, aged 37, who was in fair health, came to me first April 15, 1894, for pain in and about the left eye. She said that in 1889 she had had trouble quite similar to this while in a neighboring city, and it had quickly passed away under the influence of eye drops which dilated the pupil. I found a slight pericorneal injection, some discoloration of the iris, and pupil about normal in size; photophobia and lachrymation moderate, tension 1+, supra-orbital neuralgia quite severe and occurring at intervals, and vision reduced to 20/30 with a corrective glass + 1 D. cyl. — ax. 15°. She had never had any rheumatic troubles. The case was considered as serous iritis, and treated accordingly by a solution of the sulphate of atropia (½ per cent.) locally and the sodium salicylate internally. The pain was quickly relieved, and the irritation subsided, but the trouble showed a tendency to return the next month. The treatment was again resumed, with the same good results as at first. I did not see her again until November 18, 1894, seven months after her first visit. She then stated that July 16th, while I was absent from town, she had a third attack, which she managed herself by resuming the former treatment. In three or four days she was all right again, and her vision had been good since that time until two weeks previous to her visit at my office in November, when she awoke one morning with severe pain above her brow and almost complete loss of vision in her left eye, and she again resorted to the old treatment. When I saw her there was slight pericorneal injection, anterior chamber normal in depth, pupil partially dilated, a well-marked excavation at the disc, glaucomatous in character, tension decidedly increased, and vision 20/100, with correction. The

case, at that time, appeared to be glaucoma, following the use of the mydriatic. As her vision had been so poor for two weeks, it was deemed best not to make an iridectomy, but to watch the case carefully under the use of eserine locally and the sodium salicylate internally. During the next few days the glaucomatous conditions were all materially lessened, but her vision fell to 20/200. On November 26th she was seen by my friend, Dr. Mathewson of Brooklyn, who confirmed my diagnosis, and advised the patient to submit to an operation when urged by me. On December 1st she returned to me, with all her symptoms better, and her vision increased to 20/50, with correction (1 D. cy. ax. 15°). As she was so much better, the treatment was continued. On February 14, 1895, her vision had raised to 20/20. About this time she was again seen by Dr. Mathewson, who expressed, in a letter to me, his astonishment at this remarkable improvement. Following her visit to me in November the eserine was continued two months, being used once daily; the salicylate of soda, for the same length of time every six hours for three weeks, and then less frequently. At my request, the sister came to my office July 9th, one week ago, when I found her eye normal in every way, except that the excavation was still well marked; vision 20/15, with corrective glass. She stated that during the last three months she had, on two or three occasions, slight evidences of a return of her supra-orbital pain, but this had quickly been dispelled by a dose or two of the sodium salicylate.

In this latter case, the fact that the patient used both eserine and the salicylate leaves a doubt as to which was the beneficial agent. I am inclined to think that, had it been the eserine, there would have been a more prompt improvement, provided the mydriatic was the source of the glaucomatous attack, and that the cure was really brought about by the long-continued internal treatment. In two or three cases of glaucoma developing slowly, without inflammatory trouble, I have seen a decided decrease in tension follow the administration of this drug, and the disease be apparently held in check. In acute glaucoma also I have used it, and there has been a decided lessening of the pain; but I have known the value of an iridec-

tomy too long, and the salicylate too short a time to allow myself to experiment at any length in this class of cases. I have found it necessary during the past two years to remove but one eyeball for the relief of glaucomatous pain, and that was a badly disorganized one, where the patient had suffered a number of repeated attacks, two of which were shortened in duration by the sodium salicylate.

The internal use of this remedy, in my experience, has shown no unpleasant effects, even when long continued, provided the drug was that made by Merck or Squibb. In the discussion which I hope will follow the report of these cases, I trust there will be corroborative evidence of the value of sodium salicylate in relief of glaucomatous pain, and possibly sustain me in my conviction that there is in many glaucomatous cases a rheumatic diathesis at the bottom of it all, even if not apparent in any other manner.

DISCUSSION.

DR. W. F. MITTENDORF, New York. — I have had occasion to use this drug in a case of glaucoma in both eyes in an old lady, and I cannot praise it too highly. She had lost both eyes by glaucomatous attacks several years before, and I was consulted to decide whether it was best to remove the blind eyes, as the pain was now terrible. She was rheumatic and quite crippled. I gave her five-grain doses of salicylate of soda every two hours. The first day the pain began to diminish, and on the third or fourth day had disappeared, so enucleation did not become necessary. I have tried it in several cases of absolute glaucoma lately, and it has not always given the same satisfactory result. It seems that in those cases where we have a rheumatic diathesis it acts most promptly.

DR. S. D. RISLEY, Philadelphia. — I have been very much interested in these clinical notes, for I believe that the important relation which obtains between the general lithic-acid diathesis and diseases of the uveal tract are too often overlooked. I recall in this connection the paper on "Gout and Glaucoma" presented before the society a few years ago by Dr. Ritchie. Salicylate of soda is not, however, the only drug which has great therapeutic value in the general treatment of glaucoma. I have seen biborate of soda have the same beneficial effect as has been reported in this interesting clinical paper. It is prob-

able that it is the soda and not the salicylic acid which is the valuable agent in these cases. Persons who are the subjects of chronic malarial poisoning are especially liable, I think, to lithæmia, which sooner or later leads to the characteristic affections of the general vascular system, in which the ocular blood vessels participate. The nutrition of the ocular membranes is disturbed, proliferation occurs because of the constant irritation produced by the morbific products in the blood stream, the filtration channels are partially closed, and increased tension follows. In at least one of the cases reported by Dr. Sutphen there were intra-ocular hemorrhages — a fact which suggests the almost certain existence of already diseased blood vessels.

SUDDEN BLINDNESS IN A PREVIOUSLY IMPAIRED EYE COMING ON AFTER REMOVAL OF THE OTHER FOR ABSOLUTE GLAUCOMA.

BY J. A. LIPPINCOTT, M.D.,

PITTSBURG, PA.

In April, 1891, Mr. S. B., a gentleman 65 years of age, came for advice with regard to his sight which had been failing pretty steadily during the previous year. Vn=R. E. 20/c, L. E. do. A + 1 D. improved each eye to 20/LXXX. No astigmatism. External appearances, including depth of the anterior chambers, size and reaction of the pupils, etc., perfectly normal. No increase in ocular tension.

Ophthalmoscopic examination. R. E. Media clear. Optic nerve atrophic and somewhat excavated, the excavation involving nearly, but not quite, the whole surface of the disc. The latter was bluish white and decidedly mottled. The retinal vessels were much reduced in size. L. E. Appearances similar but the depth and the area of the excavation were somewhat less marked. The visual fields were moderately contracted, the limitation being concentric and approximately regular. Color perception good. Rainbow phenomena had never been observed. The patient was not a drinking man. He had chewed tobacco occasionally, but had never smoked. His health was fair. The case was diagnosticated as probable

simple glaucoma; and iridectomy was suggested, but not urged, as, up to that time, my experience had not led me to take rose-colored views of the value of operative interference in such cases. The patient declined to run the risk of an operation, and strychnia was prescribed.

I heard nothing further in regard to the case until May 21, 1895, when Mr. B. again presented himself, stating that the sight in both eyes had continued to fail so that by the beginning of the present year it was almost abolished in the right eye, and greatly reduced in the left. At that time he began to have the sensation of a foreign body in the right eye, which became reddened and painful. The pain, at first intermittent, soon became continuous, and gradually increased in intensity. The halo phenomenon had never been observed.

Status praesens. The pain is grinding and excessive, and extends from the eye over the whole right side of the head, which is so tender that the patient cannot lie on that side, or even bear the lightest touch upon it. He keeps his eyes constantly closed because any movement of the right eye increases the agonizing pain. Lids catarrhal. Deep conjunctival vessels engorged and tortuous. Cornea surrounded by a livid zone. Anterior portion of globe appears slightly staphylomatous. Anterior chamber abolished, the lens being thrust forwards against the cornea. The latter is steamy. Pupil excessively dilated, especially downwards, in which region the rim of the iris is altogether invisible. Eyeball of stony hardness. No light perception. Lens cloudy in the center and decided haziness of the vitreous, preventing a view of the fundus. L. Eye externally normal except that the pupil is moderately dilated (about 4 mm.) and rather sluggish. A slight cloudiness of the center of the lens interferes somewhat with the ophthalmoscopic examination, but the disc is seen to be deeply excavated, the excavation extending to the margin on all sides. Tn + 1, V greatly reduced, fingers being counted with difficulty, and that only on the temporal side. Nevertheless patient states that he could see to get about at home. He is quite feeble, owing to the severe and long-continued suffering.

The condition of the right eye being such as to render the prospect of a successful iridectomy extremely doubtful, enucleation was performed under general anæsthesia that evening. On awaking the following morning, Mr. B. found himself comparatively free from pain; but his remaining eye was entirely blind. To all appearances the eye was in precisely the same condition as it was the previous day. There was no injection of the globe. The anterior chamber was practically normal in depth. The pupil was no more dilated, although there was little if any response to light. Tension not perceptibly higher nor did the ophthalmoscope reveal any cause for the loss of sight. In the afternoon I performed sclerotomy and reduced the tension, but with no visual result. Iridectomy was at the time proposed, but rejected.

A week later the patient complained that the sandy feeling, which had ushered in the pain in the right eye, had now begun in the left. A weak solution of eserine increased the irritation, and a free iridectomy was made, as a result of which the irritative phenomena disappeared, but no sight was regained.

In the complete absence of objective changes I am unable to account satisfactorily to myself for the sudden loss of vision. The enucleation presented no difficulties and no unusual phenomena. There was a tendency to atheromatous changes in the vessels and it is perhaps conceivable that, as a result of the anæsthetic (ether was used) there may have been a rupture of a cerebral vessel. If so, no other symptom of such an accident declared itself. I am inclined to think that the loss of sight is to be referred to the class of obscure nervous reflexes of which glaucoma furnishes other examples, such as the sudden development of the disease in one eye after iridectomy upon the other.

Apart from the effect of the enucleation, the case just related has some interest as tending, so far as it goes, to establish the modern view of the intimacy of the relationship subsisting between simple and inflammatory glaucoma.

TWO CASES OF CONGENITAL ENTROPION OF BOTH UPPER LIDS, WITH DEFICIENCY OF TARSAL CARTILAGES; TRANSPLANTATION OF A FLAP OF SKIN INTO THE LID MARGIN.

BY GEORGE C. HARLAN, M.D.,

PHILADELPHIA, PENN.

The subject of the first case was a negro girl five years of age, well-developed and in good health. A weakness of the eyes was noticed when she was a few days old, and their present condition was attributed by the mother to the use of a powder by the attending physician. The child's sight was very imperfect, but she saw enough to go about alone and to engage in play.

In the right eye there was well-marked complete entropion of the upper lid. The lashes, which were well-developed and rather long and thick, were inverted so that all of them rested against the ball. To the touch, the tarsal cartilage seemed to consist of a narrow band, about four millimetres wide, along the edge of the lid. This band was rather thicker than normal tarsus, and formed a rounded, raised rim, which rose above the level of the lashes and seemed to press them backwards. The lid was easily everted and its inner surface presented an appearance which was very singular. Two millimetres from the lid margin, there were two horizontal grooves, each five millimetres long, separated by a bridge of conjunctiva beneath which a probe could be passed. Towards the nasal side there was a smaller opening in the conjunctiva in a line with these grooves, and the probe could be passed into it from the latter. The point of the probe could also be swept beneath the conjunctiva to the upper edge of the narrow strip of cartilage, showing that the conjunctiva and tarsus were merely in apposition, but not united. There was

no indication of cicatrization or inflammatory contraction; there was sound mucous membrane at the bottom of the grooves, and the bridge between them was formed of normal conjunctiva. The contour of the lids was otherwise normal, the commissure was not contracted, the conjunctival sac was of full extent and the orifices of the Meibomian glands could be seen.

In the left eye there was entropion of the nasal third of the lid margin, where the lashes were completely turned against the ball while the rest were in nearly normal position. Here, also, the cartilage was incomplete. There was a rim of cartilage similar to that on the right side, except that it nearly disappeared at the inner third of the lid, where the entropion existed, narrowing down to a scarcely perceptible thickening of the lid margin. When the lid was everted, there appeared to be a horizontal rent in the conjunctiva, extending from the outer angle to the inner third, through which the upper edge of the narrow cartilage, covered with mucous membrane, thicker and softer than the conjunctiva, protruded. The rest of the inner surface of the lid was lined with normal conjunctiva, and the Meibomian orifices were present along the whole extent of the margin. The nasal third of the lid was narrower than the rest and suggested in appearance a partial coloboma; but the cleft which forms a coloboma includes all the tissues of the lid, merely a bridge of thin skin usually uniting the edges of the coloboma at its summit, while in this case there were well-grown cilia. The arrest of development seems to have been confined to the mesoderm, as the parts supplied by the ectoderm (mucous membrane, cilia and Meibomian glands) were fully developed, the mucous membrane being really in excess and suggesting a partial reduplication.

The cornea in each eye was partially opaque from keratitis induced by the friction of the lashes, and the left eye was convergent, but there was no other anatomical defect in the eyes or elsewhere.

Through the kindness of Dr. de Schweinitz, I have recently had the opportunity to examine another case of congenital entropion strikingly similar to that just described. The

subject was an infant, six weeks old, who had been under treatment for ophthalmia neonatorum in the Philadelphia Hospital. There were the same complete inversion of the lashes of the upper lids, the same narrow thickened rim of cartilage along the lid margins, with absence of tarsus above it, and the curious apparent reduplication of the conjunctiva. The similarity of the anatomical conditions in the left eye to those in the right in my case was very remarkable. There were but two openings in the palpebral conjunctiva, instead of three, but they were situated exactly along the same line, *i. e.*, just within the lid margin, and a probe could be passed from one to the other beneath the conjunctiva. One on the nasal side of the lid was just large enough to admit freely a No. 5 Bowman probe, and the other, near the temporal extremity, was a horizontal slit about three millimetres long. In the right eye there was a wide, valve-like opening in the palpebral conjunctiva near the temporal angle of the lid, through which the probe entered freely. The conjunctiva seemed redundant and slightly baggy when raised on the point of the probe.

Congenital entropion, at least of the upper lid, seems to be very rare. According to Himly,[1] "the edges of the eyelids are, in the late period of fœtal life, strongly turned inwards, and if this condition lasts beyond the normal, a slight trace of congenital entropion may result, but real entropion never occurs congenitally." Wecker[2] refers to a case reported by Von Ammon[3] as unique — "*tout-a-fait exceptionnel.*" In this case it is merely stated that there was in the right eye entropion of the upper lid and ectropion of the lower, and in the left eye entropion of both, and also dyscoria in the right. Wilde[4] reports a case in which "the margin of the outer half of the right superior lid was completely inverted." He is inclined to consider the entropion as a result of inflammation of the palpebral conjunctiva during fœtal life. No detailed description of

[1] Die Krankheiten und Missbildungen des menschlichen Auges. Bd. I, S. 121.

[2] Wecker and Landolt.

[3] Klinische Darstellungen der Angeborenen Krankheiten des Auges und der Augenlider, S. 6, Tab. II, Fig. 15.

[4] Malformations and Congenital Diseases of the Organs of Sight; and Dublin Medical Journal, 1844.

the anatomical conditions is given in either of these cases, but it seems probable that there was malformation of the tarsus in both. At the last meeting of this Society, Dr. Lippincott reported a case of congenital entropion of both upper lids, which he considered due to malformation. The close resemblance in the character of the deformity of the four lids in the cases described above can scarcely be considered merely a coincidence, and they probably convey an embryological lesson that I have been unable to read satisfactorily.

If we include simply inversion of the lashes of the lower lid from redundancy of the skin, this congenital defect is by no means so rare. In the last volume — XIV — of the Transactions of the Ophthalmological Society of the United Kingdom, there is a paper by Sydney Stephenson on "A Form of Congenital Trichiasis," which he says is not very uncommon. He has seen it in fourteen cases, in nine of which it was bilateral. From the descriptions, and from several plates that are given, it appears that these cases would be more properly classified as entropion. It is stated that the cilia were normal in all respects except their direction, and it is not easy to understand how they could be so completely inverted, even to the extent of being buried out of sight in the conjunctival sac, while the lid margin retained its proper position. I have met with two such cases, both unilateral, and the inversion appeared to me to be due to a redundancy of the skin of the lid, — a condition somewhat analogous to epicanthus. In one, the lashes were so pressed into the cul-de-sac that the cornea escaped irritation. Both were promptly and permanently cured by the removal of a fold of skin.

In the present case the lid margin of the right eye was easily everted by Green's operation, but the left offered a more difficult problem on account of the deficiency of tissue in the portion of the lid affected by entropion. The operation proposed by Gayet[5] seemed best adapted to the case, and was performed as follows: The edge of the lid, for the extent of the inverted lashes, was split, as in the Arlt operation, by an incision made just behind the bulbs of the cilia, and the wound

[5] Annales d'oculistique, Jan. '82, p. 27.

was made to gap so that the anterior lip, containing the inverted lashes, was drawn up and everted, and a space on the lid margin about four millimetres wide was laid bare. A tongue of skin rather larger than the bared space was then dissected from the lid, parallel to and a little above the edge and with its attached base at the inner canthus, and transplanted into the lid margin where it was retained by delicate stitches. The wound left in the skin of the lid by removal of the flap was united and a dressing of iodoform gauze and cotton was applied. The flap united firmly in its new position, excepting a small slough at its extreme point, which did not seriously affect the result. When the patient was last seen, a few weeks after the operation, the cilia were satisfactorily everted and the corneæ were clearing rapidly.

ADDENDUM TO DR. G. C. HARLAN'S COMMUNICATION ON TWO CASES OF CONGENITAL ENTROPION OF BOTH UPPER LIDS, WITH DEFICIENCY OF THE TARSAL CARTILAGES.

By G. E. de SCHWEINITZ, M.D.,

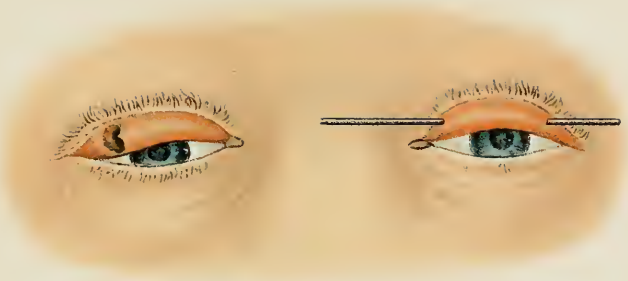
PHILADELPHIA, PENN.

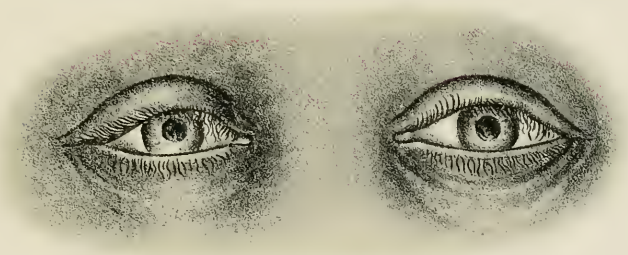
It may be interesting to add a few words to the description already given by Dr. Harlan of the case of congenital ectropion occurring in my wards in the Philadelphia Hospital:

The mother of the boy is a healthy woman, with negative family and personal history. She has had one other child, born at seven months, after a labor of twenty-four hours.

In the present labor the position of the child was L. O. A., the vertex presenting. The first stage of labor occupied thirty-two hours, the second forty-five minutes. Three-quarters of an hour elapsed before the placenta was delivered by Credè's method. There was some difficulty in resuscitating the child after birth.

The eyes were immediately washed with soap and water, followed by boric acid lotion and two drops of silver nitrate





Margaretta Washington.

CONGENITAL ENTROPION, WITH DEFICIENCY OF THE TARSAL CARTILAGES. FROM A PATIENT UNDER THE CARE OF DR. DE SCHWEINITZ IN THE PHILADELPHIA HOSPITAL. COMPARE WITH DR. HARLAN'S ILLUSTRATION AND DESCRIPTION.

(gr. v. f3i.) were instilled into each conjunctival sac. On the morning of the third day after birth, a mucous discharge began in each eye, but gonococci were absent. On the ninth day an orange-colored patch of exudation formed in the lower cul-de-sac of each eye and extended half-way up the corneæ Bacteriological examination of this material was negative. The conjunctivitis subsided in four weeks, leaving a small area of corneal haze at the position formerly occupied by the exudate, and a few fine adhesions between the tarsal conjunctiva and the inferior margin of the corneæ.

The lids presented the appearances already described by Dr. Harlan and figured in the accompanying illustration, by Miss Margaretta Washington. The length of each palpebral fissure was 2.5 centimetres; the width of the bridge of cartilage which caused the swelling of the superior lid margins was 5 mm; the probe passed through the canaliculus in the mucous membrane of the left lid for 14 mm. The somewhat ear-shaped opening in the mucous membrane of the right lid permitted the entrance of a probe, but there was no similar orifice on the opposite side.

The cilia of the right upper lid were in correct position along the outer half, but inverted along the inner half; on the left side the inverted lashes occupied the outer two-thirds of the superior ciliary margin, but assumed their normal relation along the inner third of the lid.

A CASE OF RECURRENT HEMORRHAGE IN THE VITREOUS BODY IN A YOUTH.

By CHARLES J. KIPP, M.D,

NEWARK, N. J.

R. McD., a well developed boy ten years of age, came to me for the first time on June 6, 1886. His father stated that about three months ago he noticed that the boy's *right* eye was inflamed and on questioning him learned that he could not see with this eye. On examining the boy's eyes I found that the

left eye was perfectly normal and vision 15/10. With the *right* eye he could only count fingers at four feet. He saw movements of the hand in all parts of the visual field of this eye. This eye diverged slightly. There was a faint ciliary injection, the cornea was clear, the anterior chamber of normal dimension, the aqueous was clear, the pupil was largely dilated from atropine which had been prescribed by his family physician, the lens was transparent, the vitreous body was so opaque that the fundus oculi could not be seen. The tension of the eye was about normal. The boy was sure that the eye had not been hurt in any way. I examined his urine and found it to be free from albumen and sugar. His heart was free from disease, and so far as I could ascertain, the boy was in excellent health. I put him to bed, applied four leeches to his right temple, applied warm fomentations to the lids, instilled a one per cent. solution of the sulphate of atropine in the eye every three hours, and prescribed the iodide of potassium in three grain doses, three times daily. Under this treatment all inflammatory symptoms disappeared in a few weeks, but the opacity of the vitreous body increased steadily, and after several months a whitish membrane made its appearance immediately behind the lens. About six months after his first visit to me, I noticed the development of vessels in the membrane behind the lens, and in a few weeks these covered the entire membrane, giving it a pinkish appearance. I could not make out the origin of these vessels, although the lens was perfectly clear. The iris has now almost disappeared from view, only a narrow rim remaining at the temporal side. The use of the atropine drops was stopped several months ago. Some months later cataract developed, and the globe seemed somewhat enlarged; since then this eye has remained in about the same condition. The tension remains about normal. Slight photophobia is about the only symptom of which he complains. The eye is totally blind.

On September 23, 1887, about fifteen months after his first visit to me, after a long ride in the hot sun he noticed that the vision of his *left* eye was considerably impaired. On the following day the impairment increased and by night he was totally blind in this eye. The eye was not inflamed and seemed

entirely normal in appearance to the boy's parents. I saw him a few days later and found that he could see only the movement of my hand close to his eyes. I may state here that I had examined this eye very carefully every three or four weeks during the year preceding this attack and had found it entirely normal and his vision *perfect*, at every examination.

The eye was entirely normal in its outer part, there was no injection of the conjunctiva, and the cornea, aqueous, and lens were perfectly clear. The iris was normal in appearance and the pupil was of normal size and active. *The vitreous body was so opaque that the fundus oculi could not be seen.* I put the boy to bed and prescribed pilocarpine and other remedies to produce free diaphoresis. The urine, which had been examined several times during the past year and always found to be normal, was free from sugar and albumen. The boy's general health was very good.

A few days after my last visit I discovered a few reddish clots in the anterior part of the vitreous chamber, otherwise the eye remained unchanged for several weeks. About three weeks after the onset of this attack he began to see movements of the hand at a foot from the eye, and from this time on there was a gradual improvement in his vision; six weeks later he was able to find his way about the house, but was still unable to count fingers held within a foot of his face. Three months after the attack he could count fingers at five feet. At this time I could see numerous membranous opacities, reflecting a bluish white light, in the posterior part of the vitreous body. The optic disk could be seen only very indistinctly. Six months after the attack his vision was 15/70. The opacities in the vitreous body were in part absorbed. Ten months after the attack vision was 15/30. The vitreous was now pretty clear with the exception of a large bluish white streaked membrane which appeared to be fixed in the anterior inner part. The disk was distinctly visible and was normal in appearance. No changes in retina or choroid could be made out. A year after the attack vision was 15/15. The vitreous was now nearly clear, only a few brilliant, bluish white stripes remaining in the anterior inner part. The disk was normal. At this time a few small atrophic spots were found in the choroid outside of the macula.

After this the boy was seen about once every three months, and no change was observed during the following four years. He attended school, avoiding, however, the use of his eye at night and in poor light.

On June 2, 1893 (nearly six years after the first attack in this eye) after working in a hay-field in the very hot sun, he again noticed failure of sight of his left eye. I saw him on the following day and found that he had perception of light only. He was unable to recognize even the movement of the hand close to his eye. Projection was good in all directions. The eye was free from changes in its anterior parts. Conjunctiva, cornea, aqueous, iris, and lens were normal. *The vitreous body was again so opaque that the fundus oculi could not be seen.* He had no pain but complained of photophobia. Tension was normal. The urine was again tested and found to be free from sugar and albumen. His general condition was as good as ever. He was put to bed and treated with the salicylate of sodium in ten-grain doses every two hours, for several days. After that I gave him the iodide of potassium in ten-grain doses three times daily. Nothing else was done. Five days later I again noticed bright red clots in the vitreous, just behind the lens. Sixteen days after the attack he was allowed to walk about the house, and his vision was at this time so much improved that he could find his way about the room. Two months later he could count fingers at five feet. The condition of the eye was not much changed. Three months after the attack he visited my office. Vision 15/100. Large, black, lumpy masses were seen in the posterior part of the vitreous, and thin membranous opacities with brilliant bluish white lines in them, in the anterior part especially in the nasal half. The disk could not be seen. From this time on there was a gradual, though very slow improvement of vision, and the opacities in the vitreous were slowly absorbed. Six months after the attack vision was 15/15 with + 0.75c 90°. The visual field is intact for white and colors. The vitreous was now clear, all floating opacities had disappeared, but there remained in the anterior part, especially at the periphery, numerous faint, bluish white lines. The disk is normal in appearance, and with the exception of a few

atrophic spots in the choroid outside of the macula, no changes can be seen.

During the last year I have examined the eye every few weeks and no change has occurred during this period. The boy attends school, has no trouble with his eye, and is apparently in robust health.

I have reported his case, as it is the only one in which such complete restoration of vision followed after two attacks of profuse hemorrhage in the vitreous body, that I have seen during the twenty-five years that I have been in practice. Cases of hemorrhage in the vitreous in young people are not very common, and recurrence of the hemorrhage has also been noted by several authors, but so far as I know no detailed histories of such cases are on record.

A CONGENITAL PTOSIS CASE AND OPERATION.

BY J. OSCROFT TANSLEY, M.D.,

NEW YORK.

Cases of congenital double ptosis are somewhat rare. I have had four upon which I have operated, and I have seen several operated upon by other surgeons. The only operation which I have seen performed, and which I have myself performed previous to the case which occasions this paper, has been the so-called Von Graefe's, that is, the removal of a parallellogram, or semi-lunar shaped piece of the lid, and orbicularis muscle. These operations, so far as my observation goes, have always been unsatisfactory, either not benefiting the patient much, or else not leaving sufficient lid tissue to cover the cornea during sleep.

The case which I take great pleasure in showing you to-day consulted me on Jan. 26, 1895. It was a very marked ptosis, the palpebral opening was quite short, and reduced to a mere slit, the patient had but very small power over the upper lid, and was obliged to throw the head back considerably in order to see anything in front of him.

The palpebral opening being so short, an operation for its elongation was necessary before attempting to operate upon the ptosis, so upon Feb. 14th I performed the usual canthoplasty upon both eyes, under cocaine.

Upon March 4th I operated for the ptosis, doing an operation which is practically a combination of the Panas and Von Graefe operation, as follows:

I made two perpendicular and parallel cuts,— A, B, C, D,— one-quarter of an inch apart, and extending from the upper orbital margin to within two lines of the edge of the upper lid. These cuts were united at the upper extremity by a horizontal incision,— A, C,— and then the ribbon of tissue was dissected up and permitted to drop down upon a wad of cotton lying upon the cheek, which was kept moistened with warm Panas solution.

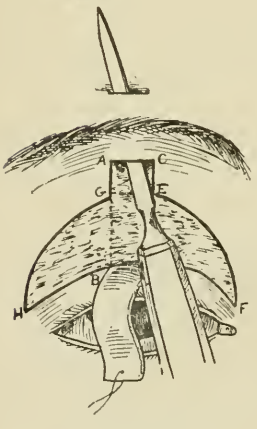


FIG. 1.

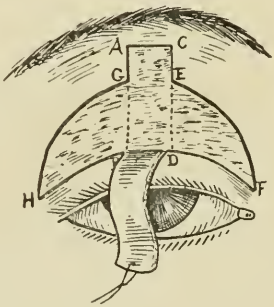


FIG. 2.

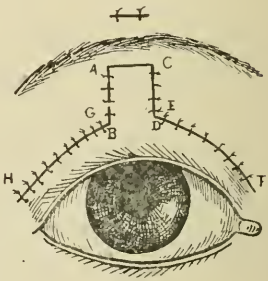


FIG. 3.

Then a curved cut was made from H to G, and E to F, following the crease which shows the upper limit of the *tarsal* cartilage, and a straight cut was made from H to B, and from D to F *parallel* to and about two lines distant from the lower border of the upper lid. The derma and the orbicularis embraced within these cuts was then carefully dissected off, leaving the whole *tarsal* cartilage clean and denuded of tissue.

This denuded surface was carried a trifle beyond both the internal and external canthi.

The cut edges, H, G, and E, F, were united to the cut edges H, B, and D, F, respectively, by interrupted sutures.

Then a Graefe's knife was entered at A C and passed beneath, and brought out upon the forehead just above, the eyebrows, and slight lateral cuttings were made so as to give room for the passage of the ribbon of derma which had been dissected up at the first stage of the operation. Then passing a strong suture into the upper edge of this ribbon of derma, it was used to draw this ribbon up into the cut made beneath the eyebrows and brought out upon the forehead, and when drawn up sufficiently tight, so as to leave no folds of tissue or puckerings, it was cut off smooth with the forehead and fastened there by two small sutures. Then several sutures were placed from A to G, and C to E, uniting the edges of the ribbon — which had been slid up as described — to the bordering derma, and the operation was finished.

The whole operation was done under cocaine, using it first hypodermically, and then having it dropped upon the cut surfaces at short intervals by an assistant.

The dressings were pieces of linen moistened in a cold solution of boric acid and biborate of soda, and changed often night and day until the parts had healed completely.

The sutures were removed from day to day as seemed advisable. There was no swelling or formation of pus. The ribbon of tissue under the eyebrows caused some little pain for two days, but this passed away, and there was no annoyance thereafter.

The results to me were very satisfactory, much more so than any of my previous operations, and as one of my friends, who has had great experience and opportunities for observing such cases, said, "He had never seen so perfect a lifting of the upper lid with so perfect a covering of the cornea when the eye is closed." The only point upon which I am anxious is what will become of that ribbon of derma which is buried under the eyebrows.

DISCUSSION.

DR. H. D. NOYES of New York. — I can answer the question regarding the fate of that piece of skin. You will never

hear from it again, and never have any thickening. I have buried pieces of skin in the same way and had no trouble. This method is an ingenious one, and an improvement on many others. The suggestion to take a narrow strip is better than cutting a broad one. In accordance with an article which appeared in the Journals within the last year, I have adopted the opinion of the writer, whose name I have forgotton, that it is not necessary to use cocaine in these operations. He claims that by the use of physiological salt solutions if the injections ends in the derma, if your needle be not allowed to go beyond the skin proper, you will get all the anæsthesia that you can from cocaine. You avoid the risk of constitutional poisonous effects of cocaine. I cannot yet verify all the claims of the writer. In operating on cases of congenital ptosis I have sometimes attempted the wrinkling up of the levator palpebræ muscle. I have only recently had one success in my endeavor. I had never been able to find the tendon of the levator so as to isolate it from the surrounding parts. The last time I made my incision down through the skin and orbicularis muscle at the same stroke, and with the parts stretched and blood vessels emptied by pressure of the fingers I ran a probe under the muscle and put a suture in deeply, going to the margin of the orbit, and succeeded in my endeavor.

DR. S. B. ST. JOHN of Hartford, Conn.— In this operation of Dr. Tansley, he has done in an elegant way what I tried to do to rectify the deformity remaining after completing an operation upon the lines laid down by Panas. I found a bad wrinkle in the lid after drawing the lid up by traction upon the narrow tongue of skin, and to remedy it I removed a small triangle of skin on either side of the base of the flap, but not as accurately as Dr. Tansley has done. His method demonstrates the advantage of removing some of this skin before elevating the lid as described by Panas.

DR. LUCIEN HOWE of Buffalo. — As reference has been made to the use of cocaine in these operations, and the discussion seems to turn in that direction, I would add that the rule for the use of cocaine injections by the method referred to is to put in the point of the syringe and inject a drop or two of the fluid, and then feeling the way along the line of the incision continue the injections as the tissue fills up.

DR. G. C. HARLAN of Philadelphia. — A satisfactory operation for ptosis consists in subcutaneously taking out a piece of the cartilage. The lid is grasped in Snellen's clamp, and the amount of elevation needed having been measured while the

patient is looking forward, a semi-lunar piece of cartilage is removed, the edges brought together and the skin closed over it. The width of the piece removed corresponds, at the highest point of its convexity, to the amount of elevation required. It is recommended to have the plate of the clamp made of horn that the knife may cut down upon it without injury to its edge. I have performed the operation several times, and have been pleased with the result. It was described by de Grandmont in a French journal, whose title I cannot now recall.

DR. SAMUEL THEOBALD of Baltimore. — As to the anæsthesia in these cases I have obtained very excellent results from cocaine without the necessity of injections at all. If the incision necessary is only skin deep it is possible to obtain absolute anæsthesia. I might mention a case operated upon the other day. I wished to transplant some skin flaps by Thiersch's method from the arm to the eyelid in a little colored boy. After having had the skin of the arm washed and sterilized, I put on a pledget of absorbent cotton, soaked wth 10% solution of cocaine and covered this with a bit of protective rubber tissue. The tissue was put on to prevent evaporation of the cocaine solution. After about twenty minutes the anæsthesia was absolute, and the grafts were shaved off without any indication of pain. The grafts took perfectly, the cocaine, seemingly, having had no bad effect upon their vitality. There was one little spot about the center of the lid wound which I failed to cover at the first operation, and exuberant granulations sprang up at this point. I shaved them off, and taking a new graft from the arm simply laid it on the spot, and it united very promptly. The soil seemed very unpromising, but the graft took perfectly.

DR. W. B. JOHNSON of Paterson.— Dr. Schleich is the name of the surgeon who invented the method of local anæsthesia that Dr. Noyes referred to. Dr. Wurdemann illustrated the theory at the meeting of the American Medical Association held at Baltimore in May last. The process is the production of œdema in the tissues, and the claim that it can be done with salt solution as well as with cocaine can be made good. After the operation there is apt to be pain in the tissues if salt solution alone is used, and it has been suggested that a solution containing small quantities of salt, cocaine, and carbolic acid in sterilized water be used. It is then to be made ice-cold before using and injected into the skin into the epidermal tissue, and not in the areolar tissue beneath. The point of the needle is inserted but a short way into the epidermis, and injecting a few drops raises a slight wheal. After this first puncture is made no pain should be felt. The introduction of the syringe

further is to be made just within the edge of the wheals as they are successively formed. The condition of œdema of the deeper tissues can be produced, and if the idea is the removal of a tumor the needle may be gradually passed beneath the tumor and the injection carried on all around it. I saw Dr. Wurdemann demonstrate the procedure, using a very weak solution of cocaine, and must say its effect was almost marvelous. There is one objection, however, to this method, and that is that in the œdematous tissue it is difficult to follow the line of operation.

DR. GEO. C. HARLAN of Philadelphia. — It is a question whether any of the subcutaneous injections are better than applications of cold. I recently suffered with a felon which required lancing, and simply held a lump of ice upon the part for a few minutes. There was no pain when the incision was made, and no complication of any kind afterwards.

DR. O. F. WADSWORTH of Boston.— I have found that, when the operation is a short one, and only a small piece of skin is to be removed, gradually increasing pressure by pinching the skin between the fingers will generally give sufficient anæsthesia to allow operating without much discomfort.

NOTE CONCERNING THE LENS IN THE EYES OF RODENTS.

BY DR. LUCIEN HOWE,

BUFFALO, N. Y.

Several years ago, when making sections of the eyes of rabbits, my attention was called to the fact that the antero-posterior diameter of the lens was decidedly greater in proportion than that of the human eye. Since then I have noticed the same peculiarity in other nearly related animals, and it occurs to such a marked degree in some of the rodents that it appears worthy of mention. It is well known that the lens in the eye of the fishes is globular, for, as the rays pass from a medium of one density into another but slightly different, a lens of such a form is necessary to bring the rays to a focus on the retina. It is not surprising, either, that the lens in the amphibians should

also be very thick, as the globe of the eye has usually a relatively shorter antero-posterior diameter than those of the higher classes of the vertebrates. In some of the birds, also, the diameter of the lens is proportionately large. These variations in size and form in the eyes of different animals have long been carefully studied by Cuvier, and his work still continues to be classical. I am not aware, however, that any one has noticed that in the rodents there is any unusual size of the lens in proportion to the length of the eye. This, however, is admirably shown in the preparations here exhibited. For example, in the eye of a rabbit which measures twenty-one millimeters from above backwards, the lens has a thickness of seven millimeters. The eye of a squirrel, which is six and eight-tenths millimeters from before backwards, has a lens of three and five-tenths millimeters. The eye of a chipmunk (tamias) measures six and nine-tenths millimeters and has a lens of three and eight-tenths millimeters; and a rat, with a total diameter of the eye of five and five-tenths millimeters, has a lens of three and four-tenths. Several other examples of this kind could be mentioned. It would seem, therefore, that in the rodents the size of the lens is larger than in other vertebrates of the same class.

It might appear also that the index of refraction of these lenses is different from that of other air-breathing animals, although it is not difficult to account for the dioptric arrangement even if the index be the same.

Finally, the point to which I wish to call attention is the use of Perenyi's fluid for the preserving of these eyes.

This is composed of

400 C.C. of 10 per cent. Nitric Acid,
300 C.C. of ½ (.5) per cent. Chromic Acid,
300 C.C. of 95 per cent. Alcohol.

1,000 C.C.

The method of preparation is exceedingly simple. The eye, when first enucleated, should be placed in the fluid, three or four ounces being amply sufficient for the human eye, and less, of course, if the eye is smaller. In twenty-four hours it should be transferred to alcohol of seventy per cent., again, in twenty-four hours, to eighty per cent.; with a few further transfers the

eye is in excellent condition to be cut into sections. This solution is admirably adapted for preserving delicate portions, — the rods and cones of the retina, for example. I am indebted to Mr. J. R. Slonaker, of Clark University, not only for most of the best specimens from which the measurements of the lens are made, but also for the suggestion made some time ago in regard to the use of Perenyi's fluid for the preservation of the eye. He has of late been making an exhaustive and special study of the fovea centralis in the vertebrates, and has found this fluid better than any other in which to harden the eye for microscopical examination.

DISCUSSION.

DR. JOHN GREEN of St. Louis. — It does not seem necessary to assume a high index of refraction for the lens in rodents, as compared with the human lens, inasmuch as all the lenses shown in these sections are of a more nearly spherical form than in the human eye. It must be remembered, also, that the crystalline lens receives from distant objects only such pencils as have been rendered strongly convergent by passing through the very convex cornea. It is possible, therefore, that the focus for parallel pencils may lie very near to the posterior surface of the lens, so that distant vision may be very good, notwithstanding the fact that the vitreous body is very shallow. Moreover, we know very little regarding the actual range of accommodation in rodents, and are, therefore, not in a position to assume that they enjoy any very high degree of acuteness of vision for small near objects.

DR. S. D. RISLEY of Philadelphia. — I have a little terrier at home who delights in wearing glasses, and we give him a three dioptre convex lens. He makes many manifestations of pleasure when allowed to wear them, and it would seem from his actions that he does not see well without them.

DR. W. S. DENNETT of New York. — I would like to say in connection with the last remark that I have a patient two-years-and-four-months-old who wears a plus ten in the same way, and likes the glasses, for she cries for them. I would call attention, also, to the proceedings of the Royal Society of a number of years ago, which contained many well-drawn pictures of the lenses of the eyes of lions, tigers, fishes, and other animals. I cannot remember the year, but they are by Sir David Brewster, and so interesting as to be well worth looking up.

DR. C. H. WILLIAMS of Boston. — In this connection I would like to show a specimen made by Dr. Wilder of Chicago, hardened in formalin, and mounted after the Priestly Smith method. It brings out beautifully the short distance between the lens and retina, and the natural hypermetropia of the sheep's eye. Some years ago I did some work upon fishes; their lens is more spherical in shape, and the distance between lens and retina is quite short. In the land animals the lens has more of the ordinary form of the human lens.

REPORT OF EIGHT CASES OF REMOVAL OF METAL FROM THE VITREOUS BY THE ELECTRO MAGNET, WITH A REVIEW OF NINE CASES PREVIOUSLY REPORTED.

BY E. E. HOLT, M.D.,

PORTLAND, ME.

One of the most serious conditions of the eye the ophthalmic surgeon is called upon to treat is an injury which has lodged a foreign body in the vitreous. Whether the sight has been immediately obscured or slightly affected, its presence still involves the integrity of the organ and may lead to sympathetic inflammation of the fellow eye. So long as there is a difference of opinion as to the best method of treating these injuries, it is the duty of everyone to accurately record his cases and report his experience to the end that there may be ultimately more uniformity in their treatment. With this object in view, the records of eight more cases are presented to the Society with a review of nine cases published in the TRANSACTIONS of the Society of 1891 and 1893.

Case I. D. A. P. (10,261), aged 36, consulted me November 29, 1893, stating that six days previous to this time, while driving up a hoop on a flour barrel, using a broad file and a hammer, he felt something strike his right eye. He consulted physicians who could see nothing in the eye, and therefore were of the opinion that nothing serious had happened to it. With good sight and with the absence of external inflammation

he went till the fifth day, when on testing the sight he found that he was nearly blind. Examination of the eye showed an indistinct scar in the cornea, just below the center of the pupil. There was circumcorneal injection with irritability of the eye. When he realized his condition his chagrin was unbounded, as he was a physician himself, and had been lulled into this condition against his better judgment. My advice was to remove the eye at once, if he wished to get well in the easiest, quickest, and safest way, but there was a possibility of removing the steel by the electro-magnet and of saving the form of the eye with perhaps sight, if he chose this course with its long tedious convalescence. He decided to have the steel removed by the electro-magnet if possible; if not successful in this attempt the eye was to be removed before he recovered from the ether. Under ether the operation was performed similar to those described in the previous cases reported. The long, straight point of Bradford's magnet was introduced several times, but nothing came out except something that might have been a drop of pus. Finally, after nearly an hour's search a whitish membrane presented in which was a dark spot. With the aid of the scissors and magnet this proved to be a bit of steel. It had evidently been drawn to the incision in the eye by the magnet. The conjunctival wound was closed by catgut, the eye dressed, and the patient put to bed. He made a good recovery, the lens became absorbed so that he had vision equal to about 0.1. One day expressing how pleased he was with the result and how well he felt, another patient jokingly said he had no strength. This challenge was accepted, and in the scuffle he received a severe blow on the eye. It became inflamed and painful; phthisis bulbi developed and, finally, it was removed.

Case II. F. B. (10,410), aged 23, was sent to me by Dr. E. M. Fuller of Bath. He stated that while chiseling out a set-screw a piece flew and struck his right eye. Examination of the eye showed a wound in the inferior temporal quadrant of the cornea, a notch in the iris, and the lens fractured so that no view of the fundus could be obtained. After the usual statement in such cases he desired to have the attempt made

to remove the steel by the electro-magnet. Under ether the incision was made as usual between the external and inferior recti muscles, and upon introducing the magnet the second time I was gratified to find the steel upon its point, when it was withdrawn. There was marked reaction due largely to swelling of the lens. The pupil cleared, leaving a membrane, vision being equal to 0.2 when he went home. Discission would markedly improve the vision.

Case III. G. C. C. (11,091), aged 28, consulted me Sept. 7, 1894, stating that while he was holding a cold-chisel, and another man was striking it to cut a car-rail, he felt something strike his right eye. The wound was large, and in the nasal side of the sclerotic, extending into the cornea. Under ether the wound was enlarged a little, and the long point of the electro-magnet introduced, but no steel was found. After searching half an hour with the magnet and probe, it was evident that the steel was concealed by tissue or had gone through the eye. The eye was removed, and the steel was found imbedded in the wall of the eye opposite the wound, so that it was not felt by the magnet or probe.

Case IV. E. W. B. (11,306), aged 54, was referred to me by Dr. Smith of Bangor, Me., Nov. 19, 1894. He stated that while chiseling out a set-screw he felt something strike his right eye. Examination showed a large wound in the temporal side of the eye, about ten millimeters long, one-third of which extended into the cornea. Under ether the wound was enlarged backward, and the steel was felt in doing it. The magnet would draw the steel toward the wound, but it was so entangled with the tissue that I was obliged to use forceps to assist in extracting it. There was no marked reaction or pain, but with such an extensive lesion, the whole eye being involved, phthisis bulbi developed, and the eye was removed.

Case V. C. B. (11,368), aged 38, was brought to me December 10, 1894, by Dr. H. T. Clough, who found him being treated for a cold. He stated that twelve days before this time, while driving out a bolt with a steel punch, he felt something strike his right eye, but neither his friends nor his family physician could see any wound of the eye, and it was thought that

he was suffering from the external injury accompanied with a cold. Vision had been reduced to discerning the outline of objects. The wound was a peculiar one. The man was looking up, and the steel entered the eye four or five millimeters below the cornea, on a line of its vertical diameter without wounding the lens, so that when he looked off on a horizontal or downward, it was completely covered by the lid, hence the inference that the eye was suffering from an external injury and cold. By looking into the eye with the ophthalmoscope from the extreme temporal side of the pupil the steel could be seen on the nasal side, lodged on the ciliary body. Under ether the wound in the sclerotic was enlarged backward, and the long point of the Bradford's magnet was introduced. After introducing the point of the magnet many times, I could, with the opthalmoscope, still see the steel, but little removed from its former place. Renewing my efforts, I succeeded in removing it after several more attempts. There was only moderate reaction, and he made a fair recovery, though of course the eye was seriously affected before the operation, vision being reduced to quantitative.

Case VI. J. C. G. (11,759), aged 20, consulted me April 30, 1895, stating that while holding a drill for another man to strike with a twelve-pound hammer he felt something strike his left eye. Examination showed a wound in the inferior temporal quadrant, four millimeters long, crossing the sclero-corneal margin obliquely. The lens was fractured, and no view of the fundus could be obtained. The eye was in a state of active suppuration, so much so that I questioned him closely about having gonorrhœa, but he denied ever having the disease. I, however, applied a 2 per cent. solution of nitrate of silver after cleansing the eye thoroughly with a saturated solution of boric acid. Under ether I dissected down the conjunctiva on the inferior nasal quadrant, and made an opening in the sclerotic, striking the steel as my knife passed into the vitreous. The magnet point was introduced several times, but the steel could not be brought out. As the suppurative conjunctivitis was very active I desisted from further attempts to remove the steel by the magnet or forceps, for I felt that the eye would be rap-

idly destroyed by the active inflammation present, if the steel were removed, and it would be better to remove the eye, which was done. The steel was found so entangled in tissue that it could not have been removed by the magnet.

Case VII. C. M. C. (11,806), aged 28, consulted me May 16, 1895, stating that he felt something strike his eye yesterday while he was using a planer. Sight was obliterated at once. There was a wound in the upper temporal quadrant of the eye, extending into the cornea sufficiently to divide the iris throughout its width and crossing the sclero-corneal margin to an extent of two or three millimeters. The lens was broken up so that there was no red reflex. Under ether I opened the eye between the external and inferior recti muscles and made a careful search for the steel. I felt quite sure I came in contact with it once. I finally decided to remove the eye and did so, during which operation there was some loss of its contents. I speak of this because upon a pretty careful examination of the eye afterwards I failed to find the steel.

Case VIII. G. C. O. (11,884), aged 26, consulted me June 14, 1895, at the instance of Dr. Griffin of Pittsfield, stating that six days previous to this time he felt something strike his left eye while he was hammering an iron pin. Sight was immediately obscured. Examination of the eye showed a dilated pupil (from atropine, which had been applied) several dark spots just behind the lens in the vitreous, one of which had rather an indistinct reflex, like metal, so that it was decided that this one was the piece of steel. In searching for the wound of the eye, through which this penetrated, I found after some time an indistinct scar at the lowest portion of the cornea, close to the sclero-corneal margin. The pupil being dilated, the wound in the iris was obscured. It would seem that the steel had been projected into the vitreous to a point above the center of the pupil, taking in some blood with it which had become absorbed, leaving dark spots and streaks, and that it had gradually sunk down and back as could be readily demonstrated by a parallax of the spots, which moved about, indicating that the vitreous had become liquefied at this point. Under ether I opened the eye between the external and inferior recti muscles. I introduced

the long, straight point of Bradford's magnet, and as I knew the exact location of the steel, and could readily see the point of the magnet through the pupil as I manipulated it, I did not expect to be long in removing the steel, but I was doomed to disappointment. I introduced the magnet many times, but practically in the same direction, and at last saw the steel at the edge of the wound on the magnet. There was but little hæmorrhage and no loss of vitreous. The conjunctival wound was closed by two catgut sutures, and the eyes covered with cotton, held in place by silk isinglass plaster. The operation lasted about an hour. The patient's pulse became feeble, and the breathing bad, so that the feet were elevated and he was given a hypodermic of strychnia. The patient was put to bed. He has made an excellent recovery, vision being equal to 0.5.

In reviewing these cases and those previously reported, we have a series of seventeen which, although small, is nevertheless interesting and instructive. The one case in the first series, in which primary enucleation was performed, there was no expectation of saving the eye; it was introduced into that series to show how accurately the estimation of the location of the steel was made, and how the eye might have been saved had not the folly of waiting two weeks been adopted. It should not be considered in the results. In case one of this series the eye might have been saved had not an accident occurred during convalescence, although a week had elapsed before the operation was performed, during which time the lens became opaque, and no view of the fundus could be obtained. In cases three and four the nature of the injury was such as not to expect any better results than were obtained. In case six the eye was infected and active suppuration existed, so that if I had persisted, and had been successful in removing the steel, the eye would have been destroyed by suppuration. In case seven I was disappointed in not obtaining the steel. I felt sure it was in the eye, but could not find it even after enucleation. It probably escaped during the process of enucleation, as some of the contents of the eye was lost. We, therefore, have three primary and two secondary enucleations in this series. Case eight was an ideal one for the removal of steel by the electro-

magnet, though a week had elapsed before the operation. The results thus far have been all that could be expected, namely, the preservation of the eye with good vision.

As long as medicine is not an exact science, the true physician or surgeon must constantly be on the alert lest his remedies do more harm than good. With these facts in view, we must in every case of injury of the eye, in which a foreign body has been lodged in the vitreous, advise the patient either to have the foreign body removed or the eye, or else let them alone, and treat the eye expectantly. We must do one of these three things, and which it shall be must be determined in each individual case after the accident has occurred. There are some ophthalmic surgeons, however, who question the propriety of removing steel from the vitreous, claiming that if successfully done the eye sooner or later is doomed to destruction. This has not been my experience. The results of these three series of cases are as follows: One had vision of 0.7; three had vision of 0.5; two had vision of 0.2; four had vision of 0.1; one had quantitative vision.

I have heard from those operated upon any length of time, and they are all doing as well or better than when they left me. I feel sure I should hear from them if they had any trouble with their eyes. Discission in five or six of these cases would improve vision, but they were satisfied with the results obtained, and discission was not urged upon them, for I think it best to keep the eye as quiet as possible after an accident and operation of this kind.

I have now practiced the removal of steel from the vitreous by the electro-magnet for ten years, and the results are very much better than those obtained in the ten years previous to that time when I did not use the magnet.

I feel sure from my former experience and from the observation of neglected cases of those treated on the let-alone plan, that the sight in nearly all of the eyes here recorded would have been destroyed had not the steel in the vitreous been removed. With the certainty that in a large number of cases the eye will be destroyed if the steel is left in the eye, is it not our duty to make an attempt to remove it and thus give the patient

the benefit of a chance to save the eye with useful vision? There is no excuse for not attempting to remove the steel because the lens has been injured, and we cannot see it with the ophthalmoscope. There were only five of these cases where the steel could be seen and located. In the other twelve cases its position had to be estimated from the position and nature of the external wound of the eye and the probable position of the person and the eye at the time of the accident. This estimation was so accurate that in nine of the twelve cases the Graefe knife came in contact with the metal when the incision was made through the sclerotic. There is no reason why we should not attempt the removal of a foreign body from the vitreous when it cannot be seen or definitely located, provided the injury is such as to necessitate its removal or the eye itself. If successfully done, under aseptic methods, there is a chance of saving the form of the eye with useful vision, which is one of the greatest triumphs of the ophthalmic surgeon.

A CASE OF VASO-MOTOR ATAXIA, WITH EYE SYMPTOMS SIMULATING MONOCULAR EXOPHTHALMIC-GOITRE.

By S. D. RISLEY, M.D.,

OF PHILADELPHIA.

The clinical picture presented by exophthalmic goitre is, unfortunately, a very familiar one to the ophthalmic surgeon. Notwithstanding the frequent opportunities for its study, the ultimate cause, or exact nature of the characteristic phenomena are still very far from a satisfactory solution.

Although as a rule both eyes are involved, cases of monocular exophthalmos are not rare in literature; no case has, however, come under my own observation, unless indeed, the case here reported is to be so regarded.

On June 12th last, Mrs. B., aged 42, came to the Wills Eye Hospital, complaining that for the past three months she had been annoyed by a peculiar "staring" appearance in the right

eye. She had diminished sharpness of vision in both eyes due to a high grade of mixed astigmatism, but otherwise the eyes were healthy, barring the changes due to eye strain.

The movements of the balls were normal in all directions, and there was no defect in the accommodation. On the left side the appearance of the eye was normal, but on the right the eye presented at first sight the appearance of palsy of the orbicularis. The upper lid was drawn strongly backward into the orbit. On careful study, however, it was found that the lids could be closed, but the effort to do so caused a slightly exaggerated contraction of the lids on the other side. In moving the eyes downward, Graefe's symptom was well marked.

The patient was excessively nervous, there was slight exophthalmos, some enlargement of the thyroid and marked tachycardia, the pulse rate being very high and the cardiac rhythm irregular. The case was recorded as "Monocular Exophthalmic Goitre," although the exophthalmos was slight.

Subsequent study led me to call in question the correctness of the diagnosis. On the second or third visit, the exophthalmos was so slight, and the enlargement of the thyroid having disappeared entirely, I made a more extended study of general conditions. About this time a paper on "Vaso-motor Ataxia" by Dr. S. Solis Cohen of Philadelphia was placed in my hands by its author, and several of the interesting group of cases there presented reminded me at once of my patient. The tachycardia, red and moist hands, dermo-graphism and factitious urticaria were all present and seemed to place the case in the category of vaso-motor disturbance. The case was therefore sent to Dr. Cohen for consultation, at the Philadelphia Polyclinic. He sent the following note as the result of his study.

DEAR DOCTOR:— Mrs. B. has enlargement of the thyroid gland, soft, not pulsating, no thrill and no bruit. There is moderately rapid heart's action with soft apex systolic murmurs, and sharp second sound, somewhat foetal first sound. Dermographism and factitious urticaria can be produced. Pilomotor and superficial reflexes generally are well marked. Nails are not typical. There is a tremor of the hands and profuse sweating. The redness of the hands is an evidence of unbal-

anced circulation. I think the case is one of vaso-motor ataxia, at least, it is not typical Graves' Disease. The eye condition is peculiar and unlike anything I have ever seen. The supposition of facial paralysis is negatived by the wrinkling of the brow and by closure of the eye on bilateral movement of the lids. Sincerely yours,

S. SOLIS COHEN.

The patient was overworked in a large boarding-house, but had had no severe illness and had not been the victim of sudden fright or any serious trouble. The menstrual function was performed regularly but was becoming scanty, and she thinks her menopause is approaching. At the present time the case has, so far as the eye symptoms are concerned, proved quite rebellious to treatment, but under ascending doses of nux vomica the tachycardia has almost disappeared, her nervousness is much less, and the urticaria can no longer be produced. The persistent red line, however, still follows a line of firm pressure upon the skin. She says that the eye does not stare so constantly, and after a rest this symptom is at times almost absent.*

DISCUSSION.

DR. G. E. DE SCHWEINITZ of Philadelphia.— I have been much interested in listening to Dr. Risley's communication, as it describes an etiology of exophthalmos which should receive wider study. In my paper on enophthalmos I have referred to some of these examples of vascular protrusion of the eyeball, one variety, for example, being under the control of the patient. In another the exophthalmos depends upon position, being present when the head is bent forward, and absent in the ordinary erect position. Finally, there is a type in which the protrusion is evident when the patient stoops forward, but when he is lying down upon his back the eye recedes to the normal position, or even sinks into the cavity of the orbit, the exophthalmos becoming enophthalmos. A paper relating to this subject will be found in a recent number of the *Archives d'Ophthalmologie.*

* Since the above statement was made the high grade of astigmatism present in each eye has been corrected, and the nux vomica continued with occasional intermissions up to the present time. The exophthalmos, thyroid enlargement, dermo-graphism and factitious urticaria have all disappeared. When in repose the dragging backward of the lids is absent, but can be excited by fatigue or "any thing which makes her nervous." The tachycardia and excessive nervousness have also disappeared.

Referring to his classification of these cases, we may have exophthalmos due to vascular anomalies in the orbit itself; for example, aneurism, aneurism by anastamosis, aneurismal dilatation of the ophthalmic artery in its whole course; or the same phenomena may be due to extraorbital aneurism of the ophthalmic artery, to aneurism of the internal carotid, and, as we know, most frequently to aneurismal varix involving the internal carotid and cavernous sinus. These cases, together with others of somewhat similar appearance caused by vascular growths and analogous anomalies in the orbit, form one great type of exophthalmos, commonly described as "pulsating," although the phenomenon of pulsation may be absent. Another class of cases of exophthalmos to which reference has been made in the earlier portion of these remarks, are those which may or may not be associated with enophthalmos; and finally, we have the cases of exophthalmos which are under the control of disturbances of the vaso-motor system, either centric or peripheric in origin, exemplified by the ordinary exophthalmos associated with tachycardia, and sometimes with goitre, or by the variety which Dr. Risley has described this afternoon. In many respects it seems to me that his case has features entirely distinct from any of the groups mentioned, although it necessarily belongs, in general terms, to those which occur under the influence of vaso-motor disturbance.

THE LAW FOR THE PREVENTION OF BLINDNESS IN THE STATE OF NEW JERSEY.

BY WALTER B. JOHNSON, M.D.

PATERSON, N. J.

The copy of the law for the prevention of blindness from communicable eye disease in the state of New Jersey is presented to the Society for publication in its TRANSACTIONS in the hope that it may be of service to any of the members of the Society who may conclude to introduce laws of a similar character to the legislatures of their own states.

The original laws which were adopted in New York state, and have been, in the main, followed by other states enacting laws similar to them, have been somewhat altered in the New Jersey state law, which is so framed that some of the new fea-

tures have eradicated inadequate or objectionable portions of the existing laws.

The most important consideration now is, shall the disease ophthalmia *neonatorum* not be placed upon the list of contagious and infectious diseases of our boards of health, and a compulsory report of every case required under all circumstances without regard to the question of what practitioner may be in charge of the case.

The special features of the New Jersey state law are

1. It provides for the report of cases only to the local board of health.

2. It provides for the care of the infant in placing it immediately in charge of a physician.

3. It provides for the preparation and distribution of the law to every physician, midwife, and nurse in the state.

4. It provides for the prosecution of all cases of violation of the law by local boards of health who have the money and counsel for use in such cases.

STATE OF NEW JERSEY.
DEPARTMENT OF STATE,
TRENTON, March 11, 1895.

Following is copy of an act approved this day. HENRY C. KELSEY, *Secretary of State.*

CHAPTER 118, LAWS OF 1895.

AN ACT for the prevention of blindness in the state of New Jersey.

1. BE IT ENACTED *by the Senate and General Assembly of New Jersey*, That should one or both eyes of an infant become inflamed, swollen, or reddened, or show any unnatural discharge at any time within two weeks after its birth, and no legally-qualified practitioner of medicine be in attendance upon the infant at the time, it shall be the duty of the midwife, nurse, attendant, or relative having charge of such infant to report the fact in writing within six hours, to the local board of health of the city, township, or other municipality in which the parents of the infant reside.

2. *And be it enacted*, That the said local board of health shall direct the parents or person having charge of such infant suffering from such inflammation, swelling, redness, or unnatural discharge of the eyes to immediately place it in charge of

a legally-qualified practitioner of medicine or in charge of the physician of the city, township, or other municipality if unable to pay for medical services.

3. *And be it enacted,* That every local board of health in the state of New Jersey shall furnish a copy of this act to every legally-qualified practitioner of medicine, and to each person who is known to act as a midwife or nurse, in the city, township, or other municipality for which such board of health is appointed; and the secretary of state shall cause a sufficient number of copies of this act to be printed, and to supply the same to such officers for distribution.

4. *And be it enacted,* That any failure to comply with the provisions of this act shall be punished by a fine not to exceed two hundred dollars, or imprisonment not to exceed six months, or both, upon conviction under prosecution proceedings to be brought by any local board of health.

5. *And be it enacted,* That this act shall take effect and be in force on the first day of May, one thousand eight hundred and ninety-five.

DISCUSSION.

DR. LUCIEN HOWE of Buffalo.—I desire to add just a word on this important subject in respect to the different states in which the law already exists. I think there is still something to do to-day. A practitioner in New York has made the statement that the law there is practically inoperative. That is simply due to the carelessness of the physicians. The only way to have the law enforced is for our local societies to appoint a committee to call the attention of the public to the law and to constitute itself a prosecuting committee. Taking one typical case for the first prosecution, and obtaining the extreme limit of punishment will have a great effect. I am glad that the law now exists in so many states. There are a number of members present from states that have not the law, and as attention has been called to it, it seems to me that in addition to our other duties we should consider ourselves in this respect the guardians of the public health.

DR. JOHN GREEN of St. Louis.—I am happy to say that the state of Missouri also has recently fallen into line, and that her action was secured through the judicious and persistent efforts of a member of this society, Dr. H. M. Post of St. Louis.

DR. S. B. ST. JOHN, Hartford, Conn.—Connecticut has fallen into line within the last year mainly through the efforts of a gentleman whom we received into membership last night, Dr. H. W. Ring of New Haven.

SEVERE HEMORRHAGE FOLLOWING EXTRACTION OF CATARACT.

BY HENRY D. NOYES, M.D.,

NEW YORK CITY.

The kind of hemorrhage referred to, takes place from the ciliary processes or from the choroid, may appear immediately after the operation, or within twenty-four hours, or within several days. Of cases of this type I can contribute five eyes in four patients. One patient lost both eyes, and three patients each lost one eye. Of three patients two had very high degrees of myopia, and they were aware of the risks incurred; another of them lost one eye which was also enucleated, and finally gained sight in the remaining eye after it had been several times operated upon. Regarding one case I can give only such account as my memory permits, and that was my first experience, as long ago as about 1864. The patient was a German woman, about 55 years old, so far as known in good health, presumed not to have been myopic, although no inquiry was made. She had mature cataract in each eye, and both lenses were extracted at the same sitting by the flap method upwards, with a Baer's knife. No accident happened; both eyes were closed by isinglass plasters, as was then the custom, and no untoward incident appeared for several hours after the patient was put to bed. The operation took place in the afternoon, and during the night the patient was wakened by severe pain in both eyes. Examined by myself at the end of twenty-four hours, a large coagulum was found pushing out between the lids of both eyes,—and my horror may be imagined. Panophthalmitis was followed by phthisis; and for nearly twenty years I refused to perform the double operation for cataract lest the same disaster should ensue.

My next case was in the person of Mrs G., aged 52, in July, 1889. She was very tall, much emaciated, querulous and unhappy, health very poor, anæmic; has cystitis,—O. D. corneal

diameter normal, pupil active and dilatable, lens sclerosed, opaque for thirteen years — iris of a steely blue, functional examination normal. The possibility of atrophy of the iris was not thought of, nor was any note taken of the radial arteries, relative to sclerosis. Cocaine, section peripheral, iris fell over the knife and was bruised, not cut. Capsulotomy attempted so as to make a quadrilateral opening. The effect was dislocation of the lens; and for its removal, a hook, a spoon, and finally a serrated loop were employed, the last proving successful. Pain, unusually severe, was felt immediately after delivery of the lens, a small clot of blood and vitreous appeared in the wound, the eye was closed, and both eyes were covered by a bandage and cotton. In twenty-four hours bandage removed, iris prolapsed, a bead of vitreous and a clot seen in the wound. Eye carefully cleansed with Sol. Corros. Subl., 1–3000, and the dressings constantly kept moist with the same.

August 1st. The same method has been pursued, and reaction has not been severe, blood nearly absorbed, and wound closing. On the forty-fifth day patient discharged, wound healed, V. = 8/200 with + 5 D. This indicates that the eye was myopic.

During the following autumn irido-cyclitis continued and the eye shrank, lost perception of light, and was considered a menace to the other, and was enucleated. The cataract in the other eye was subsequently operated on, and while some hemorrhage ensued and required a long period for disappearance, the globe retained a fairly normal condition, although the pupil was occluded by a dense membrane. She was readmitted to the Infirmary April 9, 1890. The membrane divided by a needle, fearing to try a more severe proceeding — rather free bleeding into anterior chamber, and the clot was not fully absorbed until May 8th, when patient was discharged. During her treatment the bladder gave much trouble, as happened during the former proceedings, and she suffered also from severe dyspepsia. Details of treatment omitted.

1895, *Apr.* 26. Readmitted to Infirmary, dense membrane in pupil to which iris adheres — a coloboma upward, caused by the mode of extraction. Did iridectomy downwards under cocaine.

No important bleeding, reaction moderate. Discharged May 17th, V. $\frac{20}{200}$ with + 5 D, but + 10 D gives about same vision. No astigmatism by ophthalmometer. Was seen during summer, and pupil remains clear, floating bodies in vitreous; can walk street alone easily, and is much happier.

Case III. Dr. H. S. F., æt. 44, Jan. 15, 1880, with extreme myopia. O. D. with — 27 D, or — $1\frac{1}{2}^{s}$. focus, V. = $\frac{20}{50}$. O. S. with — 27 D., or — $1\frac{1}{2}^{s}$. focus, V. = $\frac{20}{200}$. Wears —16 D., using only the right eye. Both lenses show striae. Floating bodies in vitreous. O. D. Both discs completely surrounded by choroidal atrophy, which extends along the vessels towards the macula. Impossible to use upright image.

In January, 1895, just able to go about his native city alone; been unable to read for three or four years. Both lenses have broad, mossy striations, and are much sclerosed. The patches of choroidal atrophy dimly seen by inverted image. Decided to extract cataract from left eye — after stating candidly the great risk of failure, which the patient understood and accepted. Perception and projection moderately good.

1895, *Feb.* 8. Simple extraction under cocaine, and with strict antisepsis. Section peripheral without accident, wound gaped immediately, but lens extracted in the usual manner without loss of vitreous. After its expulsion patient showed an uncontrollable impulse to squeeze the lids, and made all manipulation excessively difficult. While gentle pressure was being made with pads of dry cotton, he forced out a large quantity of fluid vitreous, which flowed down the cheek. At the same moment he complained of intense pain. He was measurably quieted, the protruding iris gently stroked into place by a spatula, and a 2 per cent. aseptic solution of boric acid injected into the globe by a bulb. A bandage and dressing applied to both eyes. Pain continued severe, and morphia sulph., gr. $\frac{1}{4}$, given hypodermically. No appearance of blood in the wound. Returning to the patient an hour later the dressings were found saturated with blood. Dressings not disturbed — hypodermics of morphia ordered as frequently as pain indicated. Subsequent treatment was hot fomentation with solution corros. subl. Panophthalmitis ensued, and patient remained in

hospital five weeks. The globe atrophied V. nil. After reaching home continued to have dull pain and irritation. On March 24th his physician (an oculist) reported that in the other eye he was having phosphenes and photophobia, without tenderness of either eye to touch. On my advice, the operated eye was enucleated about seven weeks after the cataract extraction. Soon afterwards the irritating symptoms disappeared from the remaining eye.

Case IV. Mr. S., æt. 63, Kingston, Island of Jamaica. General health good. Always been very myopic, the exact amount not known, but probable above 15 D. Has floating vitreous opacities, vision never made very good by glasses. Can see the hand at ten inches; projection and perception good. Prognosis of operation stated to be not good. Yet inasmuch as both eyes are blind to all useful purposes, agreed to make the attempt. June 3, 1895. O. S., at New York Eye and Ear Infirmary, cocaine at early stage, followed by chloroform. Incision at limbus, including 2/5 of cornea and free capsulotomy. In trying to expel lens the fluid vitreous escaped and the lens disappeared. Eye covered by a wad of cotton, and patient complained of severe pain. Morphia Sulph. gr. $\frac{1}{4}$ given hypodermically, and chloroform administered. Iridectomy then done upward; after which patient squeezed severely, causing expulsion of lens with large amount of fluid vitreous and profuse hemorrhage. Iris engaged in wound, and all of the protruding mass excised. Lips of wound united by fine suture, but not brought into very good coaptation. Eyes bandaged. A few hours afterwards blood had soaked through the dressings.

June 5. Dressing left in situ until to-day. Eye opened showing wound occupied by a clot; considerable chemosis and steady pain; iced compresses. This treatment followed for a week, when enucleation was done under ether. At the same sitting iridectomy upward was done in the fellow eye to render extraction more simple in case patient should be inclined to have it done.

Reaction after enucleation pretty severe; duration of treatment seventeen days in all. The eye having iridectomy showed no

tendency to hemorrhage, and healed within a week. Patient withdrew from my observation, and put himself under the care of another oculist. By letter from him I learn that the operation was without accident and recovery took place, giving vision of about 0.3. This result was very gratifying and I think it fair to assume that the iridectomy which I did may have been helpful to success by rendering the expulsion of the lens easier, and simplifying the proceeding.

These cases show clearly what, perhaps, did not need clinical proof, the very great peril of operating for cataract upon highly myopic eyes of old people. Indeed, in my judgment, cases such as the last two should not have been attempted; and although this may now be clear enough in view of what took place, nevertheless, the urgency of a patient, the difficulty of telling the state of the fundus and the condition of the blood-vessels, may sometimes betray the operator into an attempt, in spite of his knowledge of its attendant perils. We know that certain cases of chronic irido-choroiditis with fluid vitreous and opaque lens, and perhaps with occluded pupil, will tolerate an operation in a remarkable way. The globe may sink like a collapsed balloon, yet filled by aseptic 2% solution of boric acid, or even if this be not done, it may recover plumpness, and a gain in vision may or may not be secured. But violent hemorrhage does not complicate the situation. This is the truly tragic element. Such cases are likely to be comparatively young in years, and their disease has had a long duration. Of course prognosis is most uncertain; but if perception of light exists I would in many instances give an operative chance. Not so, however, in old people with high myopia; their vessels are too frail, both by local lesions and from constitutional degenerations. The case of Mrs. G., Case III, was, in my opinion, more to be reckoned to the atheromatous state of the capillaries and other vessels than to the degree of myopia, which was not great. He remaciation and malnutrition argue for this view. Moreover, I am persuaded that we often operate in the midst of such perils without being aware of their existence. For example, a recent case is an Irishman, æt. 73, with double cataract, the irides exhibiting a mottled, steely color, and in one eye

a perforation near the pupillary edge attests the atrophy of the vascular structure. Such vessels do not contract well when the pressure which supports them is removed by the loss of aqueous. They rupture, and a more or less copious hemorrhage into the anterior chamber ensues. How greatly this embarrasses the operator sometimes, is a trite observation. But I do not think the correct interpretation is always fully appreciated, in the vascular degeneration which this bleeding implies. In not a few cases imperfect results or even failures are not to be credited to the lack of skill or judgment of the operator, but to the intrinsically unhealthly condition of the eye. It suffers from arterio sclerosis, and this is to a greater or less degree the occasion for cataract through implication of the ciliary body. We do well, then, to study the iris carefully before we operate, and may gain useful knowledge as to the risks we run in doing an operation. We may not deny the patient his chance, but copious hemorrhage makes the opening of the capsule troublesome, demanding free irrigation; the operation is prolonged, the patient loses his docility, he squeezes the lids and holds the eye muscles tense; the lens may suddenly jump out, and not rarely we are annoyed by seeing a small prolapse of vitreous, as the performance is about to be finished, and we try to secure as perfect clearness of the pupil as possible. Such an episode happens constantly, and is the fruitful parent of imperfect results. Under these conditions I cannot help remarking that an iridectomy makes bleeding more likely and more copious than does the simple extraction. A preliminary iridectomy may be a wise proceeding as the fortunate result in the second eye of Mr. S. case IV. would suggest. Nevertheless the issue of a single case does not warrant decisive conclusions.

A last word may be ventured in favor of the use of atropia before extraction, as has been my habit for three years, for the reason that it gives at least temporary aid by the larger pupil, and that it also contracts the vessels of the iris. Whether it can be credited with those effects I will not confidently aver, but I can say that if the pupil refuses to dilate we have an indication to do iridectomy in spite of the fact that we thus become aware of a probable atrophy of the iris, or also of a

defect in the innervation by the sympathetic nerve. A copious hemorrhage, with or without iridectomy, and before capsulotomy, was one of the baleful features of the original Graefe mode of extraction, and is always to be deplored. It hinders subsequent steps, and may be the means of rendering the patient difficult to manage, and give rise to disagreeable accidents. Hence I withhold contemporaneous iridectomy as often as I can.

TRAUMATIC KERATITIS CAUSED BY FORCEPS DELIVERY OF AN INFANT.

By HENRY D. NOYES, M.D.,

NEW YORK CITY.

The above title tells the essential features of the case now reported, which is nevertheless not frequently observed if one may judge from the meagreness of reported instances. Probably cases moderate in degree are seen from time to time by the obstetrician, and, as their significance is obvious and their duration brief, the oculist fails to get the observation.

On May 15, 1890, I was asked by my friend, Dr. Chas. A. Leale, to look at the infant son of Mr. S., then four days old, in consultation respecting his eyes. The child weighed 10 lbs., and was 21 inches long. The mother had contracted pelvis; the delivery was effected by forceps and was difficult. The scalp was greatly contused, and chiefly on the left side. The left cheek was swollen and contused. Immediately after birth the left cornea was noted to be extremely cloudy, then slight conjunctival irritation, which in four days disappeared. At that time I saw the child and found the skin of the usual yellow hue, and both conjunctivae of the same color. In the left eye there was chemosis without hyperaemia, the lids moderately swollen. The dense white color of the cornea extending over the whole surface, floculent in quality and involving all its layers, was a very striking feature. The iris and pupil could not be discerned, and there was a suspicion of exudation in the anterior chamber; but this could not be substantiated. The

right eye was normal, the cornea clear, pupil between one and two mm. in diameter.

The child was fully nourished, had no eruption at the anus, or about the soles of the feet. There was no history of syphilis, and while the appearances might be simulated by hereditary syphilis, the severe traumatism during birth and the fact that the bite of one blade of the forceps had evidently implicated the left eye, left little doubt that the lesion was strictly traumatic.

A solution of atrop. sulph. gr. ss. adʒj was ordered for both eyes 3 times daily, and hot lotions to the left eye. At the end of 24 hours the right pupil was enlarged and the haziness of the left cornea had so far begun to recede as to permit a similar dilation of the left pupil to be discovered. I had no further opportunity to see the case, but had the following communication from Dr. Leale, under date of June 18, 1890, rather more than six weeks later:

"MY DEAR DR. NOYES, — There have been many complications and new developments in both mother and child since you saw the latter. The eye has been kept from exposure to too much light as there has remained a marked photophobia and opacity of inner upper quadrant of the cornea, but no inflammation."

Since five years have now passed it is probable that no opacity visible to the naked eye now remains. Whether the curvature of the cornea has been disturbed it would be interesting to know.

A PERSISTENT CASE OF IRITIS.

BY J. OSCROFT TANSLEY, M.D.,

NEW YORK CITY.

August 13, 1890. S. B. R., large, portly and of florid complexion and magnificent physical development, came to my office about three o'clock in the afternoon of to-day and gave the following history:

Three days ago, after using the eyes closely for some time, he had pain in the left eye, which soon became somewhat inflamed, and it has so continued ever since, neither better nor worse.

Yesterday at the advice of his family physician he applied a solution of sugar of lead, which cooled it somewhat, but had no other effect.

Examination shows considerable circumcorneal injection, but not serious, looking like a mild iritis. After using atropine solution gr. iv. ad ℥j. and a 5 per cent. solution of cocaine, coup sur coup, much to my surprise I found there was a total synechia posterior.

I continued to use the solution of atropine and cocaine separately every ten minutes for three hours, and during the same time had him bathe the eye continuously with water as hot as he could bear.

At the end of this time there was a slight giving away of the adhesion, at the nasal side of the pupil, but he was so strongly under the action of atropine that I had to stop its farther use. At six o'clock P.M. I sent him to a bath establishment to take a hot steam bath, directing him to cool off gradually and not to use the cold douche.

At ten o'clock P.M. he was brought to my office in a carriage, as he was unable to walk. He said he thought the eye drops had all gone into his knees, as he could not keep them stiff under him, they would double up. Of course his throat was very dry and his face very red, but he was all right otherwise.

The pupil of the unaffected eye was widely dilated, and the attachment of the iris in the left eye was all broken excepting three thin hair-like attachments. The pupillary edge was very ragged, and there was a ring of pigment upon the anterior capsule.

I sent him to a friend's house, telling him to keep well covered up in bed, and sweating all night, and to use atropine several times during the night if possible.

August 14. Pupil widely dilated and every attachment broken. As our time had been so fully occupied yesterday in treatment I had not inquired closely into his history.

To-day upon questioning him he denied ever having had syphilis, and he gave no evidence that would lead me to doubt his word. He had had rheumatism somewhat, and had had some laryngeal difficulty two or three years ago, which had been treated by my friend, Dr. Lefferts, who told him that his difficulty was of a gouty nature. I found also that he was a generous liver, and a rather more than generous drinker and smoker.

I restricted his diet, told him to use atropine four times a day, and gave him saturated solution potassic iodide in increasing doses.

August 27. Patient has seen me regularly every day, and has continued to improve daily.

There is not the slightest injection in the eye to-day, the vitreous is clear, and there is no pigment upon anterior capsule. He is now taking gtt. xxv. of the sat. sol. potassic iodide t. i. d. Told to continue the iodide but discontinue atropine.

August 31. He returns with renewed inflammation to-day, saying that the eye continued well until yesterday, when it began to be inflamed and to pain; he used atropine immediately.

Examination shows pupil attached to lens capsule in about three-fourths of its circumference, the other fourth toward the nose is dilated, but there is a line of pigment corresponding to its previous pupillary margin, showing that the synechia had been total until the use of the atropine yesterday.

Hot water, atropine, and cocaine were again used for about two and a half hours, in the same way as upon first visit, with the result of breaking all but two small attachments, one supero nasally and one infero temporally. Told to continue atropine and hot water every hour at home, and to take the potassic iodide gtt. xxv., as he has been taking it.

Sept. 1. Still two filiform attachments; using atropine, cocaine, and hot water at intervals all the afternoon, the pupil was caused to dilate more, but the attachments still continue. Told to take hot steam bath, continue atropine as often as possible; use hot water when at home.

Sept. 2. Attachments still continue, though very delicate and filiform.

Sept. 3. Attachments remain the same; told to use inunctions of Hydrarg. twice daily. Continue with atropine and hot water as often as convenient.

Sept. 5. Attachments all broken; pupil widely dilated, Continue inunctions once daily, increase potassic iodide gradually. Atropine four times a day.

Sept. 16. Eye in perfect condition. No injection and vitreous clear; pupil widely dilated. Has not used inunctions for a week. Told to continue atropine and potassic iodide.

Sept. 24. Eye in excellent condition. Pupil widely dilated. Media clear. He is still taking potassic iodide. Told him he may now decrease the amount of atropine used, and discontinue altogether in a week.

Oct. 2. Patient has seen me several times since last note, and has been in excellent condition, and says that for several days his pupil has been small; he was able to read as well as ever, but this morning the eye was slightly inflamed and he began using atropine again, several times to-day. This evening I find the nasal half of the iris attached to the anterior capsule; the temporal half of iris is widely dilated. It is very evident that had he not used the atropine, he would certainly have had another total synechia. I have devoted the evening to the use of atropine and cocaine coup sur coup, and had him bathe the eye with hot water, and at time of writing (eleven o'clock P.M.) all attachments but one, infero-nasally, are broken. I have instructed him to use the atropine and hot water as previously, and begin inunctions of ung. hydrarg. at once.

Oct. 3. The infero-nasal attachment remains the same; the patient is becoming discouraged at the repeated relapses, so I sent him to Dr. Knapp, who kindly returned him with the following note:

"Mr. Redmond has not a bad case of iritis, but considering the tendency to relapse, I would treat it as if it were a bad case. The pupil must be kept dilated with atropine. I would recommend him to stay at home for two weeks, go to bed at five o'clock, sleep long in the morning, beware of colds in sitting up, be strict in diet, and take salicylate of soda, gr. x. four or five times a day."

Oct. 8. Eye perfectly recovered; iris free and widely dilated; pigment spots on cornea all gone. He has been using inunctions for past week, but there is no evidences of mercurialization.

Told to stop inunctions and take sod. salicylate gr. xx. four times a day.

Oct. 27. The patient has seen me several times since last note and he has been in excellent condition. He stopped using atropine five days ago, and this morning had another inflammation. He at once used the atropine and came to see me.

Happily, I find no adhesions, but considerable circumcorneal injection. He has been taking sod. salicylate continuously since I advised it on the 8th inst. I have sent him to consult my friend, Dr. Webster.

Oct. 28. The patient is better, and brings the following letter from Dr. Webster:

"I have examined the eye of your patient, and it seems to me there is nothing about his case very extraordinary except the persistency of recurrence of the inflammation. I do not see what can be done other than what you have done and are doing. I would put in atropine just often enough to keep the pupil dilated for several months, and would keep up internal medication for the same length of time, and would alternate between salicylate soda and iodide of potassium; give him one for a couple of weeks and then the other for the next two weeks, both in full doses. I would let him have a Turkish bath once or twice a week.

Nov. 10. Patient was doing nicely and had no inflammation, but four days ago he became weary of using atropine and stopped its use and to-day he has another iritis, and notwithstanding the immediate use of atropine several times this morning, I now find considerable injection and some five or six adhesions, two of them quite large. Put at once upon inunctions of hydrargyrum and told to use atropine, cocaine, and hot water, as previously.

Nov. 13. All adhesions broken excepting one, but there is quite a number of spots of pigment upon anterior capsule. Told to continue inunctions, etc., as before.

Nov. 17. Synechiæ all broken and eye quiet. Told to stop inunction and take potassic iodide and continue atropine.

Jan. 8, '91. Patient stopped the use of atropine Dec. 31st, about a week ago, and was doing well until to-day, when eye became quite inflamed and somewhat painful. There is now considerable circumcorneal injection, more than I have ever seen before in this case.

The pupil is elliptical with attachment supero-nasally and infero-temporally. The patient used atropine several times this morning, immediately upon finding the eye inflamed; had he not done so there certainly would have been another total synechia posterior, as there are now only two small portions of the iris not attached. There are several striæ in the capsule inferiorly, caused by the pulling of the synechiæ. I sent the patient again to see Dr. Webster, who wrote as follows:

"It is certainly a most extraordinary case. So many attacks of iritis in six months. I would suggest that you break up the adhesions by such means as you know so well how to use; get the eye well again and then do a nice narrow iridectomy upwards with the hope of preventing further recurrence of the disease."

I have ordered inunctions once daily, atropine and hot water bathing as previously used.

Jan. 13. Pupil widely dilated and no circumcorneal injection whatever. Told to continue inunctions and begin again the potassic iodide, as the salicylate has been of no use whatever.

Jan 28. Eye still under the action of atropine. Changed internal medication to vinum colchici rad. gtt. xv. tid.

Feb. 18. Has been taking colchicum regularly and says it makes him sweat easily and feel a little weak, but has not affected his bowels. Told him to increase the dose one drop per day.

Feb. 22. Had slight inflammation of eye yesterday. Has now some circumcorneal injection, but very slight. Pupil is free. Told to continue atropine and increase colchicum to gtt. xxv. tid.

March 23, '91. Eye is perfectly normal in every particular

excepting that the pupil is dilated, as he is still using atropine and taking colchicum. I told him that he must certainly keep up the medication for a couple of months longer.

Oct. 4, 1892. Patient has seen me occasionally since last note. He has not used atropine for several months, but he has been taking colchicum more or less all the time, and has restricted himself considerably in the use of tobacco and alcoholics.

The occasion of his visit to-day is a slight conjunctivitis caused by a long ride yesterday in a storm, and in an open wagon.

Oct. 16. Patient returns to-day with another attack of iritis. It began yesterday and he at once used atropine. There is very slight circumcorneal injection and no pain, but there are a number of posterior synechiæ, several of which are quite large. He says that the eye has not been perfectly well since the exposure from driving in a storm.

I have used atropine and cocaine, coup sur coup, and hot water bathing to the eye for several hours, until his locomotion was affected by the belladonna, and have succeeded in breaking all adhesions except three.

Told to begin inunctions at once and use atropine, hot bathing to eye, as previously.

Oct. 25. I have seen patient daily since last note, and again the attachments are all broken and pupil is once more widely dilated and circular. The question of iridectomy has come up several times in the past months and has recurred again to-day. I have sent the patient and his brother a second time to consult Dr. Knapp, who was inclined to advise iridectomy, but after considerable discussion of the pros and cons, we have decided not to operate. We reasoned as follows: The eye is now perfect in sight and condition, it may not be so after the operation. It certainly will be a lame one, as every eye with a coloboma is. The iridectomy will have no effect upon the constitutional disease, but by watching the dietary and attending to daily and regular exercise and the occasional use of colchicum, I am sure we can overcome the gouty tendency.

July 1, 1895. I have seen the patient occasionally in the past three years. His eyes have continued well in every particular, and we have not had occasion to regret the non-performance of iridectomy.

A MODIFIED PHOTOMETER FOR TESTING RED SIGNAL LENSES AND LANTERNS.

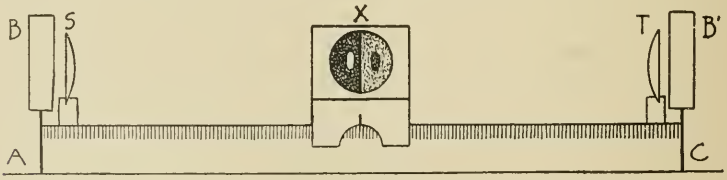
By CHARLES H. WILLIAMS, M.D.,

BOSTON, MASS.

My attention was recently called to the great variation in the shade of red lenses which are used as signals in railroad semaphores, switch stands, etc., and to the crude methods by which such lenses are inspected.

For purposes of comparison I selected three lenses from the accepted stock of one of our large railroads, one a light red, a second of medium color, and a third dark red, and in testing an engineer not long afterward I found that he called the lighter and medium lenses red, but the dark red he repeatedly called green, and never red. Another man called the light red a white light, and the other two he named correctly. These tests were used as confirmatory tests, the lenses being placed in front of a lamp, and in each case the Holmgren and other tests had already shown the presence of defective color sense.

To get a quick and accurate method of testing these red lenses and of eliminating those which are too light or too dark, a photometer was arranged as shown in the following diagram. At each end of a graduated bar A C one hundred



inches long was placed an argand burner B, B′, supplied from the same gas pipe, round each burner was a metal shield to cut

off the light except at a point facing the other burner, where each shield had a vertical slit one quarter of an inch wide by one inch high (nearly the dimensions of the slit in the Methven screen) and so arranged that the bottom of the slit was one inch above the top of the burner. A box X was mounted so that it could be moved along the bar, and placed vertically in this box, and at right angles to the line of the bar was a Bunsen disc (a piece of white ledger paper with the center made translucent by melted paraffine). Each end of the box was open so that the light could pass unimpeded from the burners to the disc, and on the side of the box facing the observer another hole was cut so that each side of the disc could be seen reflected in mirrors at the back of the box, as in the ordinary Bunsen photometer.

To test the instrument it is placed in a dark room, and each burner lighted so as to burn with a flame which covers well the slit in the shield, the box X is moved back and forth on the bar and a point is quickly found where the spot in the center of the disc seems to disappear, and becomes of the same shade as the rest of the paper disc; at this point the light falling on each side of the disc is equal and the light reflected from the white border of the disc is the same as the light transmitted through the translucent center, whereas if the light is stronger on one side of the disc than on the other the center will look lighter or darker than the border according to which side of the disc is looked at, the dark center being on the side toward the stronger light. If the two lights are equal the neutral point will be found in the middle of the bar.

We now place a standard red lens S one inch and a half in front of the burner B and the lens to be tested T at the same distance from the other burner, the axis of each lens being placed so as to coincide with the center of the beam of light from the slits. The box X is now moved on the bar until the center of the Bunsen disc appears of the same shade as the rest of the disc and practically disappears; this marks the point at which the light transmitted by each lens is equal, and, unless the lens should happen to be of just the same shade and power as the standard lens, it will be found that the box has been moved decidedly to one side or the other of the middle of the bar, and

its position can be read off by the graduations in inches or the bar. If the lens to be tested is lighter than the standard lens the box and disc will be moved much nearer to the standard lens, and *vice versa.*

The standard lens is selected as transmitting a dominant wave length of about $\frac{6200}{10000000}$ m.m., and of a medium density of color, not too light or too dark. The rule of squares of the distances will not apply with the photometer arranged in this way, for the lenses being set at about half their focal length from the source of light, act on the rays of light and make them less divergent than they would be if they came from the slit without passing through the lens, but the conditions being equal for each lens do not affect the result, and we thus get a quick and accurate method of comparing any lens with a standard, and one which any person of ordinary intelligence can be quickly taught to use. The results are sufficiently accurate to accomplish the purpose of eliminating those lenses which are dangerous on account of being too light or too dark, and of fixing a practicable standard of safety for such lenses.

It has been found in practice that an arbitrary limit of from eighteen to twenty-two inches measured either way from the middle of the bar can be allowed with safety.

The same method can also be applied to the globes of red lanterns, the globe being slipped over the argand burner and shield and compared with a standard globe at the other end of the bar.

In the diagram, the lens to be tested, T, is lighter than the standard lens S, for with the Bunsen disc in the middle of the bar the periphery of the disc on the side facing the standard lens is darker than the other, and the spot in its center is lighter than the other, so it would be necessary to move the box X to the left toward the standard lens until the point was found where the spot in the center disappeared, and each side of the disc was equally illuminated.

TRANSACTIONS

OF THE

AMERICAN

OPHTHALMOLOGICAL SOCIETY.

Thirty-Second Annual Meeting.

NEW LONDON, CONN., 1896.

HARTFORD:
PUBLISHED BY THE SOCIETY.
1897.

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MEMBERS

OF THE

AMERICAN OPHTHALMOLOGICAL SOCIETY.

1896-97.

ACTIVE MEMBERS.

The (*) indicates *Associate* Members.

NAME.	RESIDENCE.	PLACE.
Dr. F. W. ABBOT,	523 Franklin Street,	Buffalo, N. Y.
*Dr. A. E. ADAMS,	44 Grand Street,	Newburg, N. Y.
Dr. WM. F. AIKEN,	74 Broad Street,	Savannah, Ga.
Dr. L. A. W. ALLEMAN,	64 Montague Street,	Brooklyn, N. Y.
Dr. HARLAN P. ALLEN,	73 East State Street,	Columbus, Ohio.
*Dr. G. W. ALLYN,	515 Penn Avenue,	Pittsburg, Pa.
Dr. A. ALT,	3036 Locust Street,	St. Louis, Mo.
Dr. J. A. ANDREWS,	9 W. 22d Street,	New York, N. Y.
Dr. S. C. AYRES,	64 West 7th Street,	Cincinnati, Ohio.
Dr. WILLIAM T. BACON,	1 Pratt Street,	Hartford, Conn.
Dr. B. J. BALDWIN,	13 South Perry Street,	Montgomery, Ala.
Dr. EDWIN W. BARTLETT,	420 Jefferson Street,	Milwaukee, Wis.
Dr. DAVID DEBECK,	cor. 9th and Race Streets,	Cincinnati, Ohio.
Dr. H. W. BRADFORD,	6 Beacon Street,	Boston, Mass.
Dr. CHARLES S. BULL,	47 West 36th Street,	New York, N. Y.
Dr. F. BULLER,	838 Dorchester Street,	Montreal, Canada.
Dr. SWAN M. BURNETT,	916 Farragut Sq. (17th St.),	Washington, D. C.
Dr. PETER A. CALLAN,	35 West 38th Street,	New York, N. Y.
Dr. F. P. CAPRON,	203 Washington Street,	Providence, R. I.
Dr. W. H. CARMALT,	87 Elm Street,	New Haven, Conn.
Dr. H. B. CHANDLER,	34½ Beacon Street,	Boston, Mass.
Dr. WM. CHEATHAM,	303 West Chestnut Street,	Louisville, Ky.
Dr. F. E. CHENEY,	Hotel Bristol,	Boston, Mass.
Dr. C. F. CLARK,	188 East State Street,	Columbus, Ohio.
Dr. DAVID COGGIN,	7 Chestnut Street,	Salem, Mass.
*Dr. WM. E. COWEN,	35 E. 60th Street,	New York, N. Y.
Dr. C. M. CULVER,	36 Eagle Street,	Albany, N. Y.
Dr. W. S. DENNETT,	8 East 49th Street,	New York, N. Y.
Dr. HASKET DERBY,	182 Marlboro Street,	Boston, Mass.
Dr. RICHARD H. DERBY,	9 West 35th Street,	New York, N. Y.
Dr. LEWIS S. DIXON,	232 Clarendon Street,	Boston, Mass.
Dr. J. B. EMERSON,	20 East 30th Street,	New York, N. Y.
Dr. ARTHUR E. EWING,	2670 Washington Avenue,	St. Louis, Mo.
*Dr. T. H. FENTON,	1319 Spruce Street,	Philadelphia, Pa.
Dr. GEORGE F. FISKE,	100 State Street,	Chicago, Ill.
Dr. EDW. FRIDENBERG,	242 Lenox Avenue,	New York, N. Y.
Dr. H. FRIEDENWALD,	1029 Madison Avenue,	Baltimore, Md.
Dr. B. F. FRYER,	cor. 9th and Cherry Streets,	Kansas City, Mo.
*Dr. J. B. GIBSON,	215 E. Pike's Peak Ave.,	Colorado Springs, Col.
*Dr. G. M. GOULD,	119 South 17th Street,	Philadelphia, Pa.
*Dr. H. Y. GRANT,	414 Delaware Avenue,	Buffalo, N. Y.

Name.	Residence.	Place.
Dr. John Green,	2670 Washington Avenue,	St. Louis, Mo.
Dr. Emil Gruening,	109 East 23d Street,	New York, N. Y.
Dr. G. W. Hale,	Wilcox Building,	Nashville, Tenn.
Dr. A. D. Hall,	1623 Spruce Street,	Philadelphia, Pa.
*Dr. William D. Hall,	387 Boylston Street,	Boston, Mass.
Dr. H. F. Hansell,	254 South 16th Street,	Philadelphia, Pa.
Dr. George C. Harlan,	1515 Walnut Street,	Philadelphia, Pa.
Dr. David Harrower,	9 Elm Street,	Worcester, Mass.
*Dr. N. D. Harvey,	260 Benefit Street,	Providence, R. I.
Dr. Gustavus Hay,	383 Marlborough Street,	Boston, Mass.
Dr. Neil J. Hepburn,	369 West 23d Street,	New York, N. Y.
*Dr. Ward Holden,	45 West 39th Street,	New York, N. Y.
Dr. Edward L. Holmes,	31 Washington Street,	Chicago, Ill.
Dr. E. E. Holt,	723 Congress Street,	Portland, Me.
Dr. Lucien Howe,	87 West Huron Street,	Buffalo, N. Y.
*Dr. A. A. Hubbell,	212 Franklin Street,	Buffalo, N. Y.
Dr. D. W. Hunter,	233 Madison Avenue,	New York, N. Y.
*Dr. E. E. Jack,	215 Beacon Street,	Boston, Mass.
Dr. Edward Jackson,	1633 Locust Street,	Philadelphia, Pa.
Dr. B. Joy Jeffries,	15 Chestnut St., Beacon Hill,	Boston, Mass.
Dr. W. B. Johnson,	170 Broadway,	Paterson, N. J.
Dr. Samuel J. Jones,	115 Monroe Street,	Chicago, Ill.
Dr. Charles J. Kipp,	534 Broad Street,	Newark, N. J.
Dr. H. Knapp,	26 West 40th Street,	New York, N. Y.
Dr. Carl Koller,	715 Madison Avenue,	New York, N. Y.
Dr. Chas. W. Kollock,	cor. Wentw'th & Com'g Sts.,	Charleston, S. C.
Dr. W. E. Lambert,	8 West 35th Street,	New York, N. Y.
Dr. J. A. Lippincott,	435 Penn Avenue,	Pittsburg, Pa.
Dr. F. B. Loring,	1420 K Street,	Washington, D. C.
Dr. F. W. Marlow,	401 Montgomery Street,	Syracuse, N. Y.
Dr. W. V. Marmion,	1108 F Street,	Washington, D. C.
*Dr. W. B. Marple,	20 W. 31st Street,	New York, N. Y.
Dr. Arthur Mathewson,	139 Montague Street,	Brooklyn, N. Y.
Dr. S. F. McFarland,	76 Front Street,	Binghamton, N. Y.
Dr. Chas. H. McIlwaine,	107 South Warren Street,	Trenton, N. J.
Dr. J. McKay,	cor. 9th and Market Streets,	Wilmington, Del.
Dr. C. S. Merrill,	22 Washington Avenue,	Albany, N. Y.
Dr. B. L. Millikin,	278 Prospect Street,	Cleveland, Ohio.
Dr. H. G. Miller,	262 Benefit Street,	Providence, R. I.
Dr. J. Lancelot Minor,	cor. Main and Beale Sts.,	Memphis, Tenn.
Dr. W. F. Mittendorf,	140 Madison Avenue,	New York, N. Y.
Dr. William O. Moore,	42 East 29th Street,	New York, N. Y.
Dr. Russell Murdoch,	418 Cathedral Street,	Baltimore, Md.
Dr. William F. Norris,	1530 Locust Street,	Philadelphia, Pa.
Dr. Henry D. Noyes,	233 Madison Avenue,	New York, N. Y.
Dr. Charles A. Oliver,	1507 Locust Street,	Philadelphia, Pa.
Dr. H. S. Oppenheimer,	49 East 23d Street,	New York, N. Y.
*Dr. R. J. Phillips,	4011 Chestnut Street,	Philadelphia, Pa.
Dr. O. D. Pomeroy,	316 Lexington Avenue,	New York, N. Y.
Dr. Thomas R. Pooley,	107 Madison Avenue,	New York, N. Y.
Dr. M. H. Post,	Beaum't St., cor. Wash. Av.,	St. Louis, Mo.

NAME.	RESIDENCE.	PLACE.
*Dr. H. R. PRICE,	485 Franklin Avenue,	Brooklyn, N. Y.
Dr. J. S. PROUT,	26 Schermerhorn Street,	Brooklyn, N. Y.
Dr. B. ALEX'R RANDALL,	1806 Chestnut Street,	Philadelphia, Pa.
Dr. R. L. RANDOLPH,	211 W. Madison Street,	Baltimore, Md.
Dr. WILLIAM RANKIN,	23 Cedar Street,	Newark, N. J.
Dr. J. M. RAY,	423 West Chestnut Street,	Louisville, Ky.
Dr. R. A. REEVE,	22 Shuter Street,	Toronto, Canada.
Dr. STEPHEN O. RICHEY,	732 17th Street,	Washington, D. C.
Dr. CHARLES E. RIDER,	53 South Fitzhugh Street,	Rochester, N. Y.
Dr. WHEELOCK RIDER,	53 South Fitzhugh Street,	Rochester, N. Y.
*Dr. H. W. RING,	46 Elm Street,	New Haven, Conn.
Dr. SAMUEL D. RISLEY,	1722 Walnut Street,	Philadelphia, Pa.
Dr. EDMUND C. RIVERS,	16th and Stout Streets,	Denver City, Col.
Dr. D. B. ST. JOHN ROOSA,	28 East 30th Street,	New York, N. Y.
Dr. JOHN D. RUSHMORE,	129 Montague Street,	Brooklyn, N. Y.
Dr. ROBERT SATTLER,	14 East 7th Street,	Cincinnati, Ohio.
Dr. G. E. DESCHWEINITZ,	1401 Locust Street,	Philadelphia, Pa.
*Dr. P. N. K. SCHWENK,	827 North 7th Street,	Philadelphia, Pa.
Dr. W. W. SEELEY,	S. E. cor. 4th St. & B'dway,	Cincinnati, Ohio.
Dr. HENRY L. SHAW,	19 Commonwealth Avenue,	Boston, Mass.
*Dr. F. D. SKEEL,	41 E. 23d Street,	New York, N. Y.
Dr. J. A. SPALDING,	627 Congress Street,	Portland, Me.
Dr. FRANCIS P. SPRAGUE,	229 Commonwealth Avenue,	Boston, Mass.
Dr. MYLES STANDISH,	6 St. James Avenue,	Boston, Mass.
Dr. GEORGE T. STEVENS,	33 West 33d Street,	New York, N. Y.
Dr. SAMUEL B. ST. JOHN,	26 Pratt Street,	Hartford, Conn.
Dr. GEO. STRAWBRIDGE,	1500 Walnut Street,	Philadelphia, Pa.
Dr. T. Y. SUTPHEN,	999 Broad Street,	Newark, N. J.
Dr. J. OSCROFT TANSLEY,	28 West 43d Street,	New York, N. Y.
Dr. LEWIS H. TAYLOR,	41 South Franklin Street,	Wilkes Barre, Pa.
Dr. SAMUEL THEOBALD,	304 West Monument Street,	Baltimore, Md.
Dr. CH. HERMON THOMAS,	1633 Locust Street,	Philadelphia, Pa.
Dr. WILLIAM THOMSON,	1426 Walnut Street,	Philadelphia, Pa.
Dr. JOHN VAN DUYN,	111 South Salina Street,	Syracuse, N. Y.
Dr. J. J. B. VERMYNE,	2 Orchard Street,	New Bedford, Mass.
Dr. O. F. WADSWORTH,	526 Beacon Street,	Boston, Mass.
Dr. LEROY P. WALKER,	25 East 24th Street,	New York, N. Y.
Dr. JAMES WALLACE,	121 North 16th Street,	Philadelphia, Pa.
Dr. DAVID WEBSTER,	327 Madison Avenue,	New York, N. Y.
Dr. J. E. WEEKS,	154 Madison Avenue,	New York, N. Y.
Dr. J. A. WHITE,	200 E. Franklin Street,	Richmond, Va.
*Dr. W. H. WILDER,	103 State Street,	Chicago, Ill.
Dr. CHAS. H. WILLIAMS,	15 Arlington Street,	Boston, Mass.
Dr. WM. H. WILMER,	1330 N. York Ave., N. W.,	Washington, D. C.
Dr. F. M. WILSON,	317 State Street,	Bridgeport, Conn.
Dr. J. P. WORRELL,	20 South 7th Street,	Terre Haute, Ind.
Total, ...		138.

HONORARY MEMBER.

Dr. C. SCHWEIGGER, ...	Berlin, Prussia.
Whole Number, ...	139.

MINUTES OF THE PROCEEDINGS.

THIRTY-SECOND ANNUAL MEETING.

PEQUOT HOUSE,
NEW LONDON, July 15, 1896.

The Thirty-second Annual Meeting of the Society was called to order by the President, Dr. G. C. HARLAN, at 10 A. M. The President announced the following committees :

Committee on Bulletin — Drs. C. A. OLIVER and MYLES STANDISH.

Committee on Membership — Drs. JOHN GREEN, ARTHUR MATHEWSON, SAMUEL THEOBALD, W. H. CARMALT, and C. S. BULL.

Auditing Committee — Dr. J. J. B. VERMYNE.

Dr. Jno. Green read a memorial notice of Dr. H. W. Williams of Boston, one of the former presidents of the Society. (See p. 479.)

DR. S. D. RISLEY of Philadelphia.— If this be the proper time, I wish to call attention to the death of Dr. Albert G. Heyl, a member of this Society, who was with us last year and read a paper. He is probably well known to most of you, and I will not speak at length of him. At the close of last year's meeting he went to the hills of New England for a rest. He was found in his room dead one day shortly after returning from a walk. When here at the meeting he seemed to be in his usual health. He was a man of marked individuality, but though I had the honor of being his colleague for many years and with him established a hospital in Philadelphia, and although seeing him there constantly, I did not know him any better at the close of these years of service than I did the first day. It seemed impossible to know him intimately, as we know most of our friends, and yet I always admired the man. He was deeply read, not only in our branch, but in general medicine; and you must have been struck by his acquaintance with what other men had done in the same line of work of which he may have been writing or

speaking. He was a religious man and led, I believe, a consistent life. In his death we have lost a good member and a scientific worker.

Dr. H. G. Miller of Providence.— It is with very deep regret that I announce the death of one of our best-loved members, Dr. J. F. Noyes of Providence. You older members need no information of the man's characteristics. My own acquaintance with him was within the last few years of his life, after age had compelled him to abandon active work in the profession. While still retaining his interest in our branch of medicine, he devoted his last years to works of charity and philanthropy.

On motion of Dr. H. D. Noyes it was ordered that the memorial read by Dr. Green be entered on our records and published in the Transactions with a photograph of Dr. Williams.

The Bulletin Committee reported, and the reading of papers was begun.

(1.) "Course and Prognosis of Orbital Tumors as influenced by Surgical Operations for their Removal," by Dr. C. S. Bull. Discussed by Drs. Knapp, Kipp, Johnson, Gruening, Noyes, and Bull.

(2.) "Tumor of Optic Nerve in a Child 3½ years old," by Dr. S. D. Risley.

(3.) "Melano-Sarcoma originating in the Ciliary Body," by Dr. S. D. Risley.

(4.) "Melano-Sarcoma of the Iris," by Dr. S. B. St. John.

(5.) "Primary Sarcoma of the Iris," by Dr. J. A. Andrews.

These four papers discussed by Drs. Kipp, Theobald, and Hansell.

(6.) "Cases of Osteo-Sarcoma of the Supra-Orbital margin and other parts of the Skull," by Dr. H. Knapp. Discussed by Drs. Bull, Knapp, Mathewson, Wadsworth, Green, Gruening, Reeve, Andrews, de Schweinitz, Norris, Randall, Mittendorf, and Noyes.

(7.) "Two cases of Cancerous Tumor of Choroid," by Dr. H. D. Noyes.

(8.) "Exostosis and Hyperostosis of Orbit," by Dr. R. Sattler. Discussed by Drs. Knapp, Friedenberg, Wadsworth, Andrews, and Sattler.

Drs. Norton of Lewiston, Me., J. F. Hill of Waterville, Me., G. F. Libby of Portland, Me., E. P. Swasey and Lovell of Worcester, Mass., Norris of New York, and McReynolds of Dallas, Texas, were invited as guests of the Society to take part in the discussions.

(9.) "Tuberculosis of the Conjunctiva, Infection and Death," by Dr. F. E. Cheney.

(10.) "Tubercle of Iris," by Dr. J. A. Andrews.

(11.) "A case of Peculiar Growth at the Inner Canthus," by Dr. A. A. Hubbell.

(12.) "A Microscopic Study of Blood Vessels of the Retina and Choroid," by Dr. Jas. Wallace. Discussed by Dr. Norris.

Adjourned to 2.30 P. M.

Session resumed at 2.30.

Reading of papers continued.

(13.) "A Novel Apparatus for Measuring the Range of Accommodation," by Dr. Jas. Wallace.

(14.) "Diphtheritic Conjunctivitis," by Dr. Myles Standish.

(15.) "Notes on Keratitis Superficialis," by Dr. B. A. Randall.

(16.) "Case of Hypopion Keratitis from exposure due to Orbital Tumor, with sections showing the origin of the pus," by Drs. Green and Ewing.

(17.) "Three cases of Membrana-Pupillaris Perseverans in which there is a Firm Attachment to the Lens Capsule, etc.," by Dr. W. F. Norris. Discussed by Dr. Abbott.

(18.) "Rupture of Iris at Pupillary Margin and in Continuity from Contusion of Eyeball," by Dr. G. C. Harlan. Discussed by Drs. Andrews, Johnson, Callan, Oliver, and Jackson.

(19.) "Iritis resulting from Chronic Cyclitis," by Dr. J. A. Andrews. Discussed by Drs. Richey and Gruening.

(20.) "Case of Sympathetic Irido Cyclitis," by Dr. B. L. Millikin. Discussed by Dr. J. A. Andrews.

(21.) "Suppurative Irido-Choroiditis of Obscure Origin," by Dr. R. L. Randolph. (By title.)

(22.) "The Use of Mercury in Traumatic Irido-Choroiditis," by Dr. C. W. Kollock. Discussed by Dr. Standish.

(23.) "Double Choked-disk caused by Cystic Tumor involving the Right Frontal Lobe" (autopsy), by Dr. H. F. Hansell.

(24.) "A Study of Ophthalmic Conditions in a case of Cerebellar Tumor" (autopsy), by Dr. C. A. Oliver.

(25.) "Bacteriological Experiments bearing upon the Sterilization of Instruments used in Cataract Operations," by Dr. S. Theobald.

(26.) "Absolute Alcohol as a Disinfectant for Instruments," by Dr. R. L. Randolph. Discussed by Drs. Kipp and Norris.

(27.) "Double Optic Neuritis due to Supposed Aneurism," by Dr. J. B. Emerson. (By title.)

(28.) "Double Chorio-Retinitis in the Macular Region following Lightning-Flash," by Dr. C. A. Oliver.

(29.) "Embolism of Arteria-Centralis-Retinæ, a Retino-Ciliary artery, supplying the Macular Region, with Preservation of Central Vision," by Dr. O. F. Wadsworth. Discussed by Dr. Mittendorf.

Adjourned at 5.30 for executive session at 8 P. M.

Meeting called to order at 8 P. M. Executive Session.

Dr. Green, for the Committee on Membership, reported favorably on the names of the following gentlemen, who were all elected to membership: Drs. WARD A. HOLDEN, W. B. MARPLE, F. D. SKEEL, H. Y. GRANT, N. D. HARVEY, A. E. ADAMS, G. W. ALLYN, and T. H. FENTON.

Treasurer's report, endorsed as correct by the Auditing Committee, was accepted and ordered on file.

Voted, That the assessment for following year be $5.00.

The Secretary presented a communication from Dr. Roosa, which was referred to the Executive Committee.

Voted, That a Committee consisting of President, Vice-President, the Delegate to the Congress of American Physicians and Surgeons, together with two other members to be selected by the President, be appointed a special committee with full power to arrange for the participation of this Society in the coming Congress, either independently of any other Society or in conjunction with another Society as may be by said special committee determined, also that in the discretion of said committee the time of the general session of the Congress to be assigned to this Society may be appropriated to an address or lecture by some member of this Society.

The following list of officers were nominated by the Executive Committee and elected by the Society:

President —Dr. Geo. C. Harlan.
Vice-President — Dr. O. F. Wadsworth.
Corresponding Secretary — Dr. J. S. Prout.
Secretary and Treasurer — Dr. S. B. St. John.
Publication Committee — Dr. S. B. St. John (*ex officio*), Dr. W. S. Dennett, and Dr. R. H. Derby.

Adjourned to 9 A. M. July 16th.

July 16. Meeting called to order at 9 A. M.

Executive Session.

Dr. Green, Chairman of the Executive Committee, reported that no action by the Society was called for on the communication of Dr. Roosa, which had been referred to the Committee.

Dr. Jackson moved an amendment to Standing Rule No. 3 so as to read "The Secretary shall, one month before the meeting, send a request to each member to forward the titles of such papers as he desires to present at the next meeting of the Society. Such titles shall be arranged by the Bulletin Committee and incorporated by the Secretary in the printed call for the meeting, and these papers shall have precedence over all others.

Dr. Mathewson reported the death of Dr. Richmond Lennox of Brooklyn.

Reading of papers resumed:

(30.) "The Management of Chronic Simple Glaucoma," by Dr. S. O. Richey.

(31.) "An Unusual Case of Glaucoma," by Dr. B. L. Millikin.

(32.) "Case Chronic Glaucoma with some unusual features," by Dr. R. L. Randolph (by title). Discussion by Drs. Jackson, Sutphen, and Risley.

(33.) "Clinical Notes on Angioid Streaks of the Retina," by Dr. G. E. de Schweinitz.

(34.) "Microscopic Examination of the Eyes from a case of Pernicious Anæmia," by Dr. G. E. de Schweinitz. Discussion by Drs. Mittendorf, Knapp, and Fryer.

(35.) "Two cases of a Rare Fatal Disease of Infancy with Symmetrical Changes at the Macula," by Dr. C. Koller. Discussion by Drs. Knapp, Randall, Wadsworth, Oliver, and Risley.

(36.) "Ophthalmoscopic Representation of a case of Traumatic Rupture of the Inferior Temporal Vein of Right Retina," by Dr. C. A. Oliver.

(37.) "Cyst of the Head of the Optic Nerve," by Dr. S. D. Risley. Discussed by Dr. Randall.

(38.) "The Pupil in Absolute Blindness," by Dr. G. C. Harlan. Discussion by Drs. Randall, Standish, Jackson, Wadsworth, and de Schweinitz.

(39.) "Case of Bilateral Necrosis of the Skin of both Eyelids," by Dr. C. J. Kipp.

(40.) "Successful Operation for Blepharoplasty embracing Outer Halves of both Lids by Single Flap from Forehead," by Dr. C. A. Oliver. Discussion by Drs. Buller and St. John.

(41.) "Question as to the Presence and Location of a Minute Fragment of Steel in the Eye determined by the Roentgen Rays, successful removal by Electro-magnet," by Dr. C. F. Clark.

(42.) "A case in which a piece of Copper was removed from the Vitreous, the metal having been located by aid of the Roentgen Rays," by Dr. C. H. Williams. Discussion by Dr. Clark.

(43.) "Binocular Lenses for the Examination of the Eye by Oblique Illumination," by Dr. E. Jackson.

(44.) "An instrument for quickly measuring the Axis of any Cylindrical Glass, either alone or in combination with any Spherical Glass," by Dr. C. H. Williams. Discussed by Dr. Clark.

(45.) "Amblyopia and Reading," by Dr. C. Koller.

(46.) "Treatment of Dermoid Cysts of the Orbit," by Dr. F. Buller. Discussed by Drs. Mathewson, Standish, Risley, and Buller.

Adjourned.

S. B. ST. JOHN, *Secretary.*

Present at the Thirty-second Annual Meeting:

Dr. S. B. St. John,
Dr. Wheelock Rider,
Dr. W. B. Johnson,
Dr. A. Mathewson,
Dr. R. L. Randolph,
Dr. W. W. Seeley,
Dr. C. J. Kipp,
Dr. L. H. Taylor,
Dr. H. G. Miller,
Dr. A. A. Hubbell,
Dr. Geo. C. Harlan,
Dr. W. H. Carmalt,
Dr. N. J. Hepburn,
Dr. H. D. Noyes,
Dr. S. F. McFarland,
Dr. C. S. Merrill,
Dr. Geo. F. Fiske,
Dr. R. A. Reeve,
Dr. C. W. Kollock,
Dr. B. L. Millikin,
Dr. G. E. de Schweinitz,
Dr. Edw. Jackson,
Dr. G. Hay,
Dr. Harry Friedenwald,
Dr. C. S. Bull,
Dr. John Green,
Dr. C. Koller,
Dr. L. A. W. Alleman,
Dr. H. Knapp,
Dr. E. C. Rivers,
Dr. J. A. Andrews,
Dr. S. Theobald,
Dr. B. A. Randall,
Dr. J. J. B. Vermyne,
Dr. C. A. Oliver,
Dr. Myles Standish,
Dr. S. O. Richey,
Dr. O. F. Wadsworth,
Dr. G. W. Hale,
Dr. J. B. Emerson,
Dr. C. T. Clark,
Dr. W. E. Lambert,
Dr. H. S. Oppenheimer,
Dr. T. Y. Sutphen,
Dr. D. W. Hunter,
Dr. F. W. Abbott,
Dr. Edw. Fridenburg,
Dr. Wm. F. Norris,
Dr. W. F. Mittendorf,
Dr. H. R. Price,
Dr. F. E. Cheney,
Dr. D. Harrower,
Dr. R. J. Phillips,
Dr. B. E. Fryer,
Dr. J. S. Prout,
Dr. J. D. Rushmore,
Dr. H. F. Hansell,
Dr. H. B. Chandler,
Dr. E. Gruening,
Dr. C. H. Williams,
Dr. Wm. Thomson,
Dr. S. D. Risley,
Dr. J. A. Lippincott,
Dr. P. A. Callan,
Dr. F. Buller,
Dr. F. M. Wilson,
Dr. R. Sattler.

Present by invitation :

Dr. C. E. Norton, Lewiston,
Dr. J. F. Hill, Waterville,
Dr. G. F. Libby, Portland,
Dr. E. P. Swasey, Worcester,
Dr. Lovell, Worcester,
Dr. Norris, New York,
Dr. McReynolds, Dallas.

Henry B. Williams

HENRY WILLARD WILLIAMS, A.M., M.D.

IN MEMORIAM.

BY DR. JOHN GREEN,

OF ST. LOUIS, MO.

Thirty-two years ago nineteen physicians interested in the study of the eye came together at the New York Eye and Ear Infirmary and, by the adoption of a plan of permanent organization and the presentation and discussion of scientific papers, founded the American Ophthalmological Society. Of the nineteen founders six are still numbered among our members; ten have been removed by death.

In the minutes of the first meeting of the society the name of Dr. Henry W. Williams appears as Chairman of the Committee on Nominations, on whose recommendation Dr. Edward Delafield of New York was elected to the office of President. At the fourth annual meeting, held in 1867, at Niagara Falls, the office of Vice-President was created, and Dr. Williams was elected to fill it. As Vice-President, and from the meeting of 1868 as President, he conducted the meetings of the society for seven years, with unfailing tact and courtesy. He was one of the many members of this society who took part in the Fourth International Ophthalmological Congress held in 1872 in London; of this body he was elected a Vice-President, and it was largely through his advocacy that it was decided to hold the Fifth Congress, in 1876, in New York.

As a member, as Vice-President and President, and for twenty years following his presidency, Dr. Williams exerted a positive and continuing influence in the counsels of this society. By nature conservative, he was also far-seeing in policy, and wise above most of us in his estimate of men. As a member of the Committee on Admissions, he not infrequently helped to turn the scale against the hasty acceptance of candidates, who, in respect of scientific attainments or of loyalty to high professional standards, might fairly be regarded as

unproved, or, in some instances, as possibly unworthy. In later years, when no longer officially associated with the committee, his interest continued unabated, and his valued suggestions and advice were always at its service.

As a contributor to the scientific work of the society, Dr. Williams was unobtrusive, confining his communications and remarks made in the course of our discussions to practical subjects suggested or illustrated by his large experience. He was thus rather a contributor from the stores of his own matured knowledge than an expositor of the discoveries and ideas of others. He was, however, always alert to inform himself of the advances made in ophthalmic science, and untiring in study when necessary to enable him to grasp and weigh new discoveries.

Henry Willard Williams, son of Willard and Elizabeth [Osgood] Williams, both natives of Salem, Massachusetts, was born in Boston, December 11, 1821. Studies preparatory to college were begun in the Boston Latin School and continued, after the death of his parents, in the Salem Latin School until ill health compelled their abandonment. In his seventeenth year he entered a counting-room on Central Wharf in Boston, as the beginning of a course of training for mercantile pursuits. Later he filled the position of Secretary and Publishing Agent in the office of the Massachusetts Anti-Slavery Society, where he won the esteem and lasting friendship of Wendell Phillips, Wm. Lloyd Garrison, Edmund Quincy, and other distinguished leaders of the anti-slavery cause. While holding this position he began the study of medicine, and in 1844, in his twenty-fourth year, he entered the Medical School of Harvard University. On the completion of his second course of lectures he visited Europe, where he continued his medical studies during a further period of about three years. In the first months of a long residence in Paris he became interested in the diseases of the eye, and, in addition to his work in general medicine and surgery, began a systematic course of study in the then famous ophthalmic cliniques of Sichel and Desmarres; he also followed the ophthalmic services of Friederich Jaeger and Rosas in Vienna, and of Dalrymple, Wm. Lawrence, Dixon, Critchett,

and Bowman in London. Albrecht von Graefe was a student of medicine; Helmholtz and Donders were young physicians but just entering upon their life work. Ophthalmic surgery had reached a high stage of perfection; ophthalmology, in the modern acceptation of the word, was as yet an undeveloped and comparatively uncultivated science.

Graduated in medicine at Harvard University in 1849, Dr. Williams, now in his twenty-ninth year, found active employment during the summer and early autumn as assistant physician to the Cholera Hospital established by the city of Boston on Fort Hill. From 1849 to 1851 he served as one of the visiting district physicians to the Boston Dispensary. From 1850 to 1855 he was instructor in the Theory and Practice of Medicine in the Boylston Medical School. In 1850 he organized a class of Harvard medical students for instruction in the diseases of the eye; in this work he was greatly aided by his life-long friend, Dr. Charles Edward Buckingham, who during several years placed freely at his disposal the very abundant and excellent clinical material at the old City Institutions at South Boston. On the expiration of his term of service as district physician he was elected to the position of surgeon, and later of ophthalmic surgeon and of consulting surgeon to the Dispensary.

Becoming increasingly identified with ophthalmic teaching and practice, and having very early attained to wide recognition as an exceptionally skilled and successful operator on the eye, Dr. Williams withdrew, after a few years, from general practice, to devote himself to ophthalmology. The time was pregnant of great and epoch-making discoveries. The ophthalmoscope, but newly invented by Helmholtz, had revealed for the first time to human vision the marvelous picture of the fundus of the living eye, at once opening a vast new field to the pathologist and endowing him with an instrument fully adequate to its exhaustive exploration. Whole chapters of the pathology of the eye were suddenly wiped out, and the writing of other chapters to fill the newly created void was beginning, as the new search-light was flashed again and again into the dark places, and previously unsuspected conditions were detected

and studied. A new era had dawned: — the physiology of vision was to be reconstructed on new or on rediscovered foundations; admirable inventions and far-reaching discoveries were to follow in bewildering succession, confounding the wisdom of the sages of the profession, and remanding the greatest of the masters to a new term of pupilage. The serious study of the German language, now become the key to the contemporaneous literature of the new science; a broader study of optics, in view of enlarged demands growing out of a new exposition of the functions of the eye as an optical instrument, of the anomalies and derangements to which it is subject, and of the manifold disturbances to which these anomalies and derangements may givè rise; the mastering of the technique of new instruments of precision; the application of newly acquired knowledge to the re-investigation of old problems which had hitherto defied solution; — such were some of the new requirements confronting the ophthalmic practitioner, requirements which he must meet, as best they could be met, after the special period of professional study might well be assumed to be closed, and the active work of life begun.

How completely Dr. Williams succeeded in bridging for himself the wide gulf dividing the new ophthalmology from the old, the high place which he won and held in the estimation both of an older and of a younger generation of his confrères abundantly attests. It may, nevertheless, be permitted to one who for nearly forty years, as medical student and physician, was privileged to know him, and whose earlier acquaintance ripened into an enduring and cherished friendship, brightened from first to last by unnumbered acts of helpful kindness, to bear witness to the persistent industry guided by broad knowledge and rare good judgment which he brought to every task that he took in hand, achieving success through unstinted, intelligent, and well-directed effort.

From the beginning of his professional life Dr. Williams showed himself at once conservative and independent. A careful observer of the work of others, he possessed in a high degree the faculty of discrimination in respect of the relative merits of teachers, and the value of their particular methods.

Learning from all, he owed no partisan allegiance to any single master or school. With Mr. Bowman, who was but about five years his senior, he was probably in closer accord than with any of the older men with whom he came in contact. Like Bowman he had read the literature and studied the methods of the older ophthalmology before the outburst of the new light which was presently to change the whole aspect of the science. The result was, in the case of both men, a confirming of the judicial temper, restraining enthusiasm within just bounds, and favoring reasonable deliberation in the acceptance of new theories based on newly announced discoveries.

In the operative surgery of the eye during the years of Dr. Williams's pupilage, there was much less divergence of practice than in the domain of ophthalmic therapeutics. The principles governing the operative treatment of cataract in the young and in the old, respectively, were already well established, and the supremacy of extraction in senile cataract generally acknowledged. The method of Daviel, as perfected by Beer, was, with unimportant variations, practiced by all the great masters of the art with a deftness and finish which have never been rivaled. Studying under such auspices, and endowed by nature with the gift of exceptional technical ability, it was only natural that he should adopt extraction in preference to the brilliant but uncertain operation of reclination then in vogue in this country. In the performance of extraction he was unexcelled, and it is characteristic of the man that he never departed very widely from the method which he had learned to practice so well, and which he believed to be, on the whole, the most satisfactory in its results. With Hasner, of Prague, he adhered to the classical flap-incision long after the peripheral-linear section of von Graefe had been generally adopted, and steadfastly withstood the tidal wave of opinion in favor of iridectomy as an integral part of the operation. He was one of the first,* if not the first, among ophthalmic surgeons to advocate and employ etherization as a general practice in cataract extraction. He also devised and adopted† the bold and original procedure of inserting, under anæsthesia, a delicate suture at the vertex of the flap, as

* 1853. † 1865.

a means of hastening the closure of the wound and lessening the risk of secondary prolapse of the iris. Later, following Lebrun, he favored a more nearly linear incision in the upper half of the cornea. He lived to witness the re-instatement of simple extraction in general favor, after many years of neglect.

On the fourth of August, 1856, at a meeting of the Boston Society for Medical Observation, Dr. Williams read his memorable essay, "On the Treatment of Iritis without Mercury," which inaugurated a radical reform in ophthalmic therapeutics. This paper was based on a series of sixty-four cases of iritis of different types, including all the cases of the disease which had come under his care during a period of somewhat over two years. A strong solution of atropia was systematically used in every case, and the only internal remedies administered were opium or morphine, quinine, and iodide of potassium, with an occasional laxative, and, in some cases, colchicum or iron. Those of us who can recall to memory the unhappy lot of patients, sufferers at the same time from iritis and from mercurialization carried *secundum artem* to the extent of inducing and maintaining pronounced ptyalism,—a plan of treatment which had been taught and followed almost from the time of the first recognition of the disease by Schmidt in the beginning of the century,—can best appreciate the self-reliance which dared to assert itself in opposition to entrenched authority, and the benefits conferred upon humanity by the substitution of a milder regimen supplemented by improved therapeutic methods. Quoting from the essay:

"I was first induced to vary from the plan of treatment . . . usually pursued, by having under my care, within a short period, several cases where, on account of the age or constitutional condition of the patients, it seemed desirable, if possible, to dispense with depletion and mercurials. The improvement was in some of these cases so rapid, and their termination so unexpectedly favorable, that the same method was cautiously adopted in the treatment of other patients."

In explanation of the reasons that had led him to follow a line of treatment so restricted in the choice of internal remedies, he writes further:

"It may seem that in the treatment of these cases routine has been too closely followed, and I should myself be disposed, now that I am satisfied it may be done with safety, to make use of a greater variety of remedies, adapted to different conditions and temperaments. But in making the trial of one *plan* of treatment instead of another of directly opposite character, it was desirable, in order to avoid uncertainty as to the results obtained, to deviate as little as possible from a fixed course. It is by no means assumed that mercurials or other antiphlogistic measures should be absolutely discarded from the treatment of this disease; but the results of these cases, many of which were of unusual severity, prove that it is by no means necessary to resort, immediately, to their use in all instances. If not essential, it is evident that remedies having, at least temporarily, an unfavorable influence upon the general health should be employed with great reserve."

The essential facts demonstrated by Dr. Williams in this essay are, first, that in the treatment of large numbers of cases of iritis, including many of graver type, it is possible to obtain entirely good results without the use of mercury,—consequently, that this remedy must be regarded as of secondary rank, and as such must be used with discrimination, and not as a matter of routine; secondly, that the inflamed iris is responsive to the mydriatic action of atropia when that aklaloid is used systematically in a sufficiently strong solution,—a fact which had previously been denied by many of the best authorities; thirdly, that atropia is a very effective agent, both in relieving the patient of the pain which is so prominent a symptom in iritis and in promoting a favorable course and issue of the disease. One of the cases (No. XV), reported at greater length in the essay, is especially interesting as a typical example of gumma of the iris treated, *tuto, cito et jucunde*, locally by atropia and constitutionally by potassium iodide.

Dr. Williams was a frequent contributor to ophthalmic literature. In addition to the numerous articles which he wrote for the medical journals, reports and transactions of societies, hospital reports, etc., he was the author of several larger works. His first literary venture in ophthalmology was

a translation published in 1850 of a work by Sichel, "Spectacles: their Uses and Abuses in Long and Shortsightedness," an octavo volume of 208 pages, long since numbered with the books which are of interest only to the student of the history of medicine. In 1862 he published "A Practical Guide to the Study of the Diseases of the Eye," a duodecimo of 351 pages. In 1865 he was the successful competitor for the Boylston prize, on the subject, "Recent Advances in Ophthalmic Science"; this essay was published in uniform style with the "Practical Guide," making a duodecimo of 178 pages. A revised edition of the "Practical Guide," enlarged by the addition of new matter from "Recent Advances," of 442 pages duodecimo, was published in 1867, and was several times re-issued, the last time in 1880. A larger work of 476 pages octavo, entitled, "The Diagnosis and Treatment of the Diseases of the Eye," appeared in 1881, and in a second edition of 496 pages in 1886. In these books Dr. Williams aimed to give a description of the diseases of the eye, including their diagnosis and treatment, in simple phrase and with so much of detail as to be of help to physicians, not ophthalmic specialists, when called upon to deal with such cases. As regards their scope and purpose, they may be described as conveying the message of a physician to fellow-physicians, divested in the main of technicalities, and avoiding elaborate discussion in matters of merely theoretical interest. The general impression is that of a personal message to the reader, telling him such things as he most needs to know, and investing each statement with the sanction of the writer's individual opinions and practice. Many of the chapters might very well have been cast in the form of letters addressed to a colleague supposed to have asked for information in an unfamiliar line of study. The continuing demand, absorbing repeated editions during a period of over thirty years, is the best evidence of the timeliness of the message, and of the very attractive manner in which it was delivered.

As a teacher of ophthalmology Dr. Williams won favorable recognition from the first years of his career as a physician. From 1850 as a clinical teacher at the City Institutions at

South Boston, later as surgeon and ophthalmic surgeon to the Boston Dispensary, from 1864 as ophthalmic surgeon to the City Hospital, from 1869 as lecturer on ophthalmology and from 1871 as professor of ophthalmology in the Medical School of Harvard University, he habitually devoted a large share of his time and strength to the work of instruction. His teaching was lucid and practical, and was always admirably suited to the just requirements of the particular class of hearers, whether physicians or students, to whom it was addressed. Through the long succession of ophthalmic internes and externes at the City Hospital, and the many classes of students taught by him at the Medical College, also through the numerous editions of his books, which were bought and studied by physicians, he exerted a continuing and wide-reaching influence.

The positions of ophthalmic surgeon to the Boston Dispensary, of ophthalmic surgeon to the City Hospital, and of lecturer and professor of ophthalmology in Harvard University were all newly created when Dr. Williams was appointed to them. In the case of most, if not all, of these appointments it may be truly said that the places were made because it was recognized that the man was at hand to fill them.

Identified as he was with ophthalmology from the beginning of a professional career extending through forty-six years, Dr. Williams never gave up his interest in general medicine He was regular in attendance at the meetings of the numerous medical societies of which he was a member, a valued participant in their scientific work, and especially active and influential in promoting and guiding efforts in the direction of strengthening the organization of the profession, and advancing what he considered its best interests. In the Suffolk District Medical Society he filled the offices of Secretary,* of Censor,† of Vice-President,‡ and of President.§ In the Massachusetts Medical Society he served as Councillor,** as Anniversary Chairman,†† and as President.‡‡. He was a member of the Boston Society for Medical Observation, of the Boston Society for Medical Improvement, and of the Boston Medical Associa-

* 1851. † From 1854. ‡ 1873. § 1875.
** From 1865. †† 1867. ‡‡ 1880–81.

tion; one of the founders and for many years President of the Massachusetts Medical Benevolent Society; Secretary and Treasurer of the Boston Medical Book Club; Trustee of the Boylston Medical Prize Fund; President of the Association of Physicians and Surgeons of the Boston City Hospital; Member of the American Medical Association; Member of the International Medical Congress of Philadelphia, 1876; Honorary Fellow of the Rhode Island Medical Society, and of the New Hampshire Medical Society; Foreign Honorary Fellow of the Edinburgh Medico-Chirurgical Society; Member of the Heidelberger Ophthalmologische Gesellschaft, etc. He was a Fellow and Councillor of the American Academy of Arts and Sciences; Member of the Boston Society of Natural History; Member of the Society of Arts of the Massachusetts Institute of Technology; Fellow of the American Association for the Advancement of Science; Member of the Essex Institute of Salem, Mass.; Member of the Thursday Evening Club, and of the Examiner Club; Trustee and Treasurer of the Boston Library Society; Member of the Boston Young Men's Benevolent Society; Member of the Bostonian Society; Member of the Bunker Hill Monument Association; Vestryman of Emmanuel Church, etc. In 1868 he received from Harvard University the honorary degree of Master of Arts; in 1871 the Harvard Chapter of the Phi Beta Kappa Society conferred on him the high distinction of honorary membership; he was for many years consulting ophthalmic surgeon to the Perkins Institution and Massachusetts School for the Blind. He was a member of the Somerset, Union, St.Botolph's, and Eastern Yacht Clubs.

In the wide range of activities represented by the many professional, scientific, and other organizations with which he was connected, Dr. Williams was conspicuous for fidelity and punctuality in the discharge of duty. It was his greatest happiness to be constantly employed, yet he never seemed to be hurried, and rarely appeared to be overworked. He found the relaxation which he needed in variety of occupation, in his family, and in the companionship of old and intimate friends. Some of his closest friendships were with physicians, companions in early struggles and in later success, most of whom

he survived. In the nature of things, their places, as one by one they became vacant, could never be adequately filled. Of younger men only the comparatively small number whom he admitted to a closer intimacy can fully appreciate the strong and fine qualities which endeared him to the friends who went before him. To quote the words of a friend,* who knew him long and well: — "He impressed his strong personality on his medical brethren, as he lived and worked largely for them. He was, all in all, a doctor first, and other things afterwards. . . . Of large stature and strong character, he was a conspicuous figure on all medical occasions. He was . . . a frequent and forcible, but persuasive, speaker, and an excellent presiding officer. . . . Conservative to a fault, he yet was kindly and thoughtful of his professional brothers. . . . He did not grow old, but retained his enthusiasm to a remarkable degree. . . . He was as sturdy and honest in suppressing quackery as in favoring his weaker medical brothers with professional advice and with substantial aid. . . . His mind was virile, set, consistent, naturally meeting with and contending with opposition. . . . He left his mark on his times and on our community."

In the spring of 1891 a severe attack of influenza, complicated by pneumonia, and followed by a tedious convalescence, led Dr. Williams to resign both his office of ophthalmic surgeon to the City Hospital and his professorship in the University. The Board of Trustees of the hospital elected him to the office of consulting surgeon, which he held until his death. On retiring from the Medical School he endowed the chair of ophthalmology, of which he had been the incumbent from its foundation twenty years before. From the effects of the influenza he never fully recovered; his capacity for sustained work was impaired; he suffered at times from bronchial irritation. He met with us for the last time in July, 1893. From October, 1894, he had frequent attacks of distressing dyspnoea, and he became more and more feeble. On May 8, 1895, by a determined effort, he attended the annual meeting of the American

* David Williams Cheever, M.D., LL.D., — *Boston Medical and Surgical Journal*, June 27, 1895.

Academy of Arts and Sciences, and read an obituary notice of Professor Hermann von Helmholtz. It was the last public act of his life. From this time he failed rapidly. The end came, without suffering at the last, in the early morning of June 13, 1895.

Dr. Williams married, in 1848, Elizabeth Dewé of London, England. Of their two sons the elder, Dr. Charles Herbert Williams, is a member of this society; the second son, Dr. Francis Henry Williams, lately assistant professor of Therapeutics in Harvard University, is a practicing physician in Boston. He married, second, in 1860, Elizabeth Adeline Low of Jamaica Plain, Massachusetts, who with five of their seven children, a daughter and four sons, survives him.

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THE COURSE AND PROGNOSIS OF ORBITAL TUMORS AS INFLUENCED BY SURGICAL OPERATIONS FOR THEIR REMOVAL.

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For some years past my attention has been turned to the prognosis of orbital tumors, whether primary or secondary, as influenced by surgical interference, with special reference to the frequency of return of the tumor and the rapidity of its growth. Such knowledge as I may have gained on the subject, has come almost entirely from my own experience, for ophthalmic literature is well nigh silent on the subject. None of the older authors make any reference to the matter, though all advocate early and radical operative interference. Of the

more modern writers on the subject, there are but two who touch upon the question at issue at all, but they speak with no uncertain emphasis. *Michel*, in his Lehrbuch der Augenheilkunde, 2d edition, 1890, says: "The prognosis in these cases is always bad, even after surgical interference. There is great danger of an unfortunate quick return locally of the tumor with extremely rapid growth. When the tumor proceeds from one or more of the facial bones in the vicinity of the orbit, the bony walls of the latter are certain to be involved, and the growth is correspondingly rapid." *Lawford*, in a paper in the Royal London Ophthalmic Hospital Reports, Vol. XII, in reporting a case of tumor of the orbit, in which five operations were followed by a return of the growth with increasing rapidity, and after the last operation by the rapid death of the patient, says: "An early and radical operation is too frequently followed by a return of the neoplasm and its rapid growth."

In considering briefly the increased rapidity of growth of malignant tumors of the orbit after surgical operations for their removal, it will be convenient to divide these tumors into three classes, viz.: 1st. Tumors which primarily were intraocular, and which have invaded the orbit secondarily. 2d. Tumors which originated in the orbit, whether in the cellular tissue or in the periosteum of its bony walls. 3d. Tumors which originated in the bones or sinuses adjacent to the orbit and involved the latter secondarily.

1st. *Primary intraocular tumors*, which involve the orbit *secondarily*. When an intraocular neoplasm has penetrated the sclera and involved the orbital tissue, or when it has extended backwards along the optic nerve, the prognosis is invariably bad. This condition is sometimes recognized before enucleation of the eye, but more frequently is not discovered until after enucleation has been performed. In such a case there is no certainty that an operation, no matter how radical, will remove all the diseased tissue; and in a very large percentage of cases, the growth returns in the orbit itself, or in some one of the sinuses or spaces adjacent thereto. Even complete exenteration of the orbit and removal of its periosteal lining does not prevent this, once the orbital tissue is involved. Indeed, it has

seemed to the writer that the removal of the periosteum from the orbit hastened the return of the growth, by depriving the underlying bone of its protective envelope.

2d. *Tumors which originate in the orbit.* In this second class, primary orbital tumors, malignant in character, in which the eyeball remains intact or is involved secondarily and late in the course of the disease, the same unfavorable prognosis, as to return and rapidity of growth, must be made. Even when the orbital tumor appears to be encapsulated, experience proves that there is no certainty that some germs have not been left behind. Moreover, malignant growths in the orbit are very rarely encapsulated.

3d. *Extra-orbital tumors, originating in the bones or sinuses adjacent to the orbit, and involving the orbit secondarily.* This third class of cases embraces the most serious and desperate of all. The cavities and bones usually involved are the sphenoid and ethnoid. The nature and origin of these growths may often be diagnosticated in the beginning, as soon as orbital symptoms arise, and sometimes even before any such symptoms present themselves. The prognosis in these cases must be put down as absolutely bad from the beginning. No matter where the origin of the growth, all the deep bones of the face and their communicating sinuses eventually become involved. By emptying the sinuses and extensive exsection of the bones diseased, we do not succeed in arresting the progress of the malady, and experience has taught the writer that every operation in these cases tends to increase the certainty of return and the rapidity of its growth, and in so far shortens the life of the patient. Each operation, being of necessity the more extensive and severe, saps the strength of the patient and weakens his powers of resistance.

The tendency of these malignant tumors of the orbit, whether primary or secondary, is to grow forwards or outwards, rather than inwards or backwards, and this fact probably explains why patients afflicted with such tumors live as long as they do, and why they usually die from general exhaustion, rather than from extension of the growth to the brain. It is the exception when these tumors cause death by extension to

the brain, whether through the roof of the orbit, or through the optic foramen, or through the sinuses at the apex of the orbit.

The tendency to extension outwards and forwards of these tumors may perhaps also explain the increased rapidity of their growth after exenteration of the orbit, or after the more radical operation of exsection of the diseased bones. The empty orbit, or the cavity left in the face by the removal of the diseased bones, are free spaces towards which there is no resistance to the extension of the neoplasm, while backwards or upwards its progress is hindered by a bony wall of varying thickness, in which absorption goes on slowly, even when the periosteum has been removed.

These brief remarks and the conclusions which follow are based upon the histories of thirty-six cases, all taken from the private practice of the writer, as it has been proved that patients in private practice can be more satisfactorily followed up than those in hospital practice. All these cases have been watched from start to finish by the writer, and the course of the disease and the results of operative interference may be read in detail in the accompanying histories of the cases. In a much larger experience, extending over a period of twenty-five years of hospital service, the same conclusions have been forced upon the writer.

Conclusions —

1st. The prognosis of all forms of malignant orbital tumors, whether primary or secondary, is unfavorable; and if the tumor be primarily one of the deep facial bones or their sinuses the prognosis is positively bad.

2d. Except in the case of encapsulated tumors of the orbit, surgical interference is almost invariably followed by a return of the tumor, and the growth of the secondary tumor is more rapid than that of the primary lesion. With each succeeding operation, the period of quiescence in the return of the tumor grows shorter, and the rapidity of the growth increases.

3d. The patient's family, and in certain cases the patient himself, should in the beginning be told of the serious nature of the trouble, and be warned that complete removal of all the diseased germs is a well nigh hopeless task. The burden of

the decision as to surgical interference must rest upon the shoulders of the patient.

4th. Repeated operations in these cases undoubtedly shorten the life of the patient. While it is therefore our duty to operate in all cases, in order to relieve severe or unbearable pain, we should be slow to operate merely for the sake of relieving temporarily physical disfigurement or deformity, especially if we are convinced that by so doing we shorten the life of the patient, even if that shortened life is rendered more bearable to the patient.

CASES.

CASE I. A gentleman, aged 63, first seen Nov. 1, 1873, vision of the left eye had been failing for nearly a year, and the eye was now blind. Cornea clear, no anterior chamber. Iris discolored. Lens opaque, T.+1. Constant dull ache. Diagnosis of intraocular tumor. Eyeball enucleated, and it was then seen that growth had involved the optic nerve, and had also perforated sclera just back of equator in infero-nasal quadrant and extended into orbit. Complete exenteration of orbit done, and large piece of optic nerve exsected. Growth returned in six weeks at apex of orbit, and grew rapidly. Second operation done two months after first, and periosteum of orbital walls removed as far as practicable. Return of growth at apex of orbit in less than two months, and within one month entirely filled orbit and began to appear in nose. Four months after second operation, the orbit was again emptied of the mass, the nose entirely cleaned out, including the turbinated bones, the floor of orbit removed, and the maxillary sinus emptied of a mass of gelatinous, vascularized tissue. The patient did not rally from this operation very rapidly, and before he had left his bed the growth could be seen projecting from the sphenoidal fissure. He declined all further interference, and lived for nearly six months with scarcely any suffering, and died of general exhaustion.

CASE II. A man, aged 57, first seen April 3, 1874. There was an epithelioma of the inner half of the left lower lid and the inner canthus. The growth had involved the conjunctiva and extended for some distance beneath the skin in all directions. The

diseased parts were carefully excised, the line of incision being made through healthy tissue. The whole thickness of the lid, including the conjunctiva, was cut away down to the fornix. After the bleeding had ceased the parts were carefully examined, and the orbital tissue seemed to be uninvolved. The empty space was then filled by taking a flap from the forehead, twisting it on its base in the usual way, and uniting the flap to the sound parts by necessary sutures. The wound healed without suppuration and with very little deformity. Four months later the patient appeared, complaining of a lump at the inner corner of the left orbit, which proved, on examination, to be a subconjunctival orbital tumor, which hugged the inner wall of the orbit. He was advised to have the entire contents of the orbit, including the eyeball, removed at once by a radical operation, in spite of the excellent vision still present, and to this he consented. Complete exenteration of the orbit was done, and though a most careful examination of the empty cavity showed an apparently healthy periosteum, the latter was also removed entire from the orbital margin to the apex of the orbit, and the cavity stuffed with iodoform gauze. Two months later the growth reappeared at the infero-nasal angle of the orbit, far back, and grew so rapidly that in less than four weeks the orbit was entirely filled. This was again removed, the ethmoid opened and found filled with the growth, and the bone was removed in sections through the orbit. The nasal cavity was opened into through the infundibulum, and free drainage established. In less than a month a nodule appeared in the inner end of the upper lid and grew rapidly in size, and early showed a tendency to extend upon the forehead and over the bridge of the nose. The position of the return of the growth rendered necessary an extensive plastic operation for its removal, and this the patient declined to have done. Two months after the last operation the growth appeared in the cavity occupied by the ethmoid, and grew very rapidly. The patient refused to have anything further done, and lived for nearly two months longer in great suffering before death relieved him.

CASE III. Boy, aged 2½ years, first seen June 5, 1874. All the signs of intraocular glioma in the right eye, the left eye be-

ing sound. Immediate enucleation showed that the tumor had perforated the sclera posteriorly close to the entrance of the optic nerve, and had extended into the orbit. The optic nerve looked healthy. The contents of the orbit were removed down to the periosteum, and the optic nerve was drawn forward and a considerable piece exsected. Nothing abnormal was noted in the orbit for nearly two months, and then a suspicious infiltration appeared in the vicinity of the optic foramen. This was immediately cauterized, but in spite of this grew rapidly, and within five weeks had completely filled the orbit. The child's general condition was bad, but a second exenteration of the orbit was done, and the entire periosteum was removed. This second operation was followed in less than a month by the reappearance of growth in the sphenoidal fissure. The child's general condition was so bad that no further operative interference was justifiable, but the location of the second return of the growth showed that the deep cavities of the bones at the base of the skull were involved. The tendency of this growth was forward and outwards, and, though the child lived for five months longer, there were no head symptoms until three days before his death, which occurred in profound coma.

CASE IV. A lady, aged 35, first seen June 15, 1874. Vision began to fail in the left eye three years before, and this eye had been entirely blind for three weeks. There was a yellowish reflection from the pupil, which was seen to be a highly vascularized new growth. Enucleation was advised, and was done two days later. At the operation it was found that the tumor had perforated the sclera at one point in the post-equatorial supero-nasal quadrant, and entered the orbit. Radical exenteration of the orbit was immediately performed, but the periosteum seemed healthy and was not disturbed. For four months nothing abnormal was observed, and then the growth appeared on the floor of the orbit far back. At the second operation the periosteum was stripped from the orbit, and the bony surface carefully cauterized. This was followed by slight suppuration, which soon ceased. Three months later the growth appeared at the junction of the inner wall and floor of the orbit, and was immediately removed and the bone again cauterized. Almost

before the resulting suppuration had ceased, a suspicious appearance was noticed in the sphenoidal fissure, and a few days later the growth was discovered far up in the nose. The growth was so rapid that the orbit became filled in less than a month, and two months from the time at which it was discovered in the upper nasal meatus, it had filled the nose, and could be seen from the nostrils. The patient declined any radical operation which would necessitate the removal of the facial bones, but consented to the clearing out of the orbit and nose. In the course of this operation the maxillary antrum was found involved, and a large mass was removed from its interior. The patient lived for nearly six months longer, and died of exhaustion. All the cavities of the bones of the face and skull were filled before death.

CASE V. Gentleman, aged 40, first seen July 27, 1874. Three years before a small pimple had appeared at the outer angle of the right lower lid, and had slowly increased, until when I saw him it had involved nearly the whole of the lower lid and had extended into the orbit. The eye was uninvolved and vision was normal. The whole lower lid and cul-de-sac were excised, and as much of the contents of the orbit as seemed involved were removed. The gap was filled by sliding the cheek and temple upward and inwards in the usual manner. The result was excellent, except for the absence of the lower cul-de-sac and some limitation of mobility of the eyeball. For five months the patient's condition was satisfactory, and then the growth returned in the floor of the orbit near the outer margin, and rapidly involved the ocular conjunctiva. He was advised to have the eyeball and entire contents of the orbit removed, and this was done. Extensive disease of the orbital tissue was found along the floor and outer wall, and the periosteum of the orbit was stripped off as far as the apex and excised. After the bleeding had ceased, the whole orbit was cauterized and loosely stuffed with iodoform gauze. The resulting suppuration was slight in amount. Within six weeks after the second operation, the growth returned on the outer wall of the orbit, and it was at once removed and the bone cauterized. For two months there was no return of the tumor, and then a suspicious growth was seen protruding from the sphenoidal fissure, and it was also felt in

the upper part of the nose. The patient declined all further interference, but he lived for more than a year after the last operation, and finally died of exhaustion. The growth had then filled the orbit, nose, maxilliary antrum, and extended out upon the cheek and temple.

CASE VI. Gentleman, aged 42, first seen August 26, 1874. Vision had begun to fail in the right eye in November, 1873, and when I saw him he could only see when looking directly downwards. There was detachment of the retina downwards, increased tension and infiltration of the orbital tissue on the nasal side. A tumor was diagnosticated, and he was advised to have the contents of the orbit removed. This was done three days later and extensive infiltration of the orbital tissue found, together with a choroidal sarcoma, melanotic in character, which had perforated the sclera in the region of one of the vasa vorticosa, and was continuous with the growth in the orbit. This necessitated the removal of the periosteum and subsequent cauterization of the bone. No growth of the tissue was found in any of the communicating cavities. Six weeks later, however, the growth was discovered in the sphenoidal fissure, and grew very rapidly. It soon appeared in the nose, and interfered so much with his breathing that he consented to a second operation. This consisted in the removal of the growth in the orbit and in the complete clearing out of the nostrils. Seven weeks later the growth was again removed from the naso-pharynx, for the relief of constant pain and to improve the breathing. Two months later a third operation was done, consisting in excision of the superior maxilla, and removal of portions of the ethmoid and sphenoid bones. Four months later he died semi-comatose, with symptoms of an extension of the growth into the cranial cavity.

CASE VII. Boy, aged 4, first seen January 31, 1876. Five months ago a swelling was noticed at the external canthus of right eye, just beneath the superior orbital margin. It had reached the size of a Lima bean, and was attached to the roof and external wall of the orbit. The eye was displaced downwards and inwards, and there was extensive infiltration of the orbit. The boy's parents were both tuberculous, and it was

thought, therefore, that the disease in the orbit might be of the same nature. An attempt was made to remove the growth and the diseased orbital tissue, leaving the eye *in situ*, but this proved to be impossible, and the eyeball was enucleated, though apparently sound, and then the exenteration of the orbit was completed. The child did well for nearly seven months and then an infiltration appeared at the apex of the orbit and grew so rapidly as to simulate fungus hæmatodes. The patient's general condition, which up to that time had been very satisfactory, also became markedly worse, so that another operation was deemed unwise. The child became rapidly emaciated, obstinate diarrhœa ensued, and death took place less than ten months after the first and only operation.

CASE VIII. Boy, aged 5, first seen April 26, 1877. Six months before a small subconjunctival growth was noticed at the lower and outer angle of the left orbit, which had steadily increased in size. It was pigmented, and the conjunctiva was movable over it. The mobility of the eye was unimpaired. There was marked malformation of the left ear, the lobe of the ear being detached from the concha, and the external auditory canal was entirely absent. The orbit gradually filled and the eye was displaced forwards, inwards, and downwards. Four weeks after I saw him an ulcer formed on the left cornea, and soon perforated, causing a large prolapse of the iris. The parents then consented to an operation, which they had hitherto declined, and the entire contents of the orbit, including the eyeball, were removed. The original growth was found firmly adherent to the periosteum of the outer wall, and the entire orbital tissue was infiltrated. The periosteum was also removed, though it appeared healthy. The child's condition was fairly good, and the case did well for five weeks, and then the growth returned on the floor of the orbit, near the margin. It was at once removed, and the bone cauterized. In three weeks it returned in another spot on the outer wall. This was also removed and the bone cauterized. In three weeks the growth reappeared in three different places on floor and inner wall of orbit, and on the malar prominence outside. Removal of all the diseased bones was then advised, but declined by the par-

ents. The child lived for nearly four months longer, and died of exhaustion without any head symptoms, about seven months after the first operation.

CASE IX. A gentleman, aged 23, first seen May 2, 1878. Eight months before a small tumor had been noticed at the outer angle of the right orbit. This had grown very rapidly in size, until it filled the entire orbit and extended upwards upon the frontal bone and outwards upon the temple. The eyeball was displaced downwards and inwards, and was entirely blind from atrophy of the optic nerve. The patient was told of the desperate nature of the case, and consented to an operation. The entire contents of the orbit were removed, the skin was stripped back from the forehead and temple, and all the diseased tissue was removed. The periosteum was then removed from the frontal, temporal, and malar bones as far as could be reached, and also from the interior of the orbit, and the bones cauterized. No communication was found between the growth and the frontal or maxillary sinuses. An examination of the orbit showed that the tumor had already extended into the sphenoidal sinus and cavity of the ethmoid, as the bone was perforated in several places. The os planum was removed and the contents of the ethmoid cells were emptied, and as much of the growth as possible was excised from the various fissures and sinuses. The patient was subsequently told that all the bones of the base of the skull were diseased, and that the growth would continue to increase, and probably with rapidity. In less than four weeks from the date of the operation it appeared in the nose, filled the ethmoid and began to protrude into the orbital cavity. The patient declined any further interference, and I could not urge it. He lived for about fourteen months and eventually died of some abdominal complication, the nature of which I never ascertained.

CASE X. A gentleman, aged 74, first seen May 23, 1879. For more than a year there had been a growth on the right eye, which began at the inner canthus, and extended forwards until it partially covered the cornea. When I saw him the growth had extended into the orbit. It was warty in appearance and very vascular. The right eye was partially blind

from cataract, and, as the disease had involved the orbit, I advised an immediate enucleation and removal of the contents of the orbit. This was immediately done, and the whole orbital tissue found diseased. The optic nerve looked healthy, but a piece was excised. The case was watched very carefully, but nothing suspicious was noticed for nearly three months, when a hard nodule was discovered at the apex of orbit. This grew very slowly for nearly two months, when it suddenly grew softer and then spread with extreme rapidity. The patient then consented to a second operation, which was made as radical as the nature of the case would admit. Three weeks from the second operation the growth again appeared at the apex of the orbit, increased very rapidly, the patient's condition became alarming, and he died suddenly five weeks after the second operation.

CASE XI. A lady, aged 26, first seen July 7, 1879. There had been failure of vision in the left eye for more than two years and the eye had been blind for about five months, probably from tumor of the choroid and detachment of the retina. It was now very painful from iridochoroiditis, and I advised its removal. Enucleation revealed the fact that the optic nerve was involved in the disease and that the sclera had been perforated close to the entrance of the optic nerve. The entire contents of the orbit were removed, the optic nerve pulled forward, and as large a piece as possible was exsected, and the periosteum was stripped from the bones all round as far as the apex and removed. For about three months there was no return of the growth, but early in October it made its appearance at the apex, and by the end of the month the growth had entirely filled the orbit and protruded between the lids. The orbit was again cleaned out, but all the sinuses were found to be involved. The os planum of the ethmoid was removed, and the floor of the orbit also, and the contents of the ethmoid, sphenoid, and maxillary sinuses cleaned out.

By *December 3d* a small nodule appeared in the upper lid near its center and was immediately removed. The growth did not return until *March 8th*, when a large nodule was found at the inner end of the upper lid which extended into the nose and also into the lower lid, and another mass was found at the apex of the orbit.

On *March* 19, 1880, both lids were removed, together with the superior maxilla, roof of the orbit, most of the ethmoid, and part of the palate bone. The operation was a prolonged one, but she rallied well and for two weeks did very well. A change for the worse set in, she became very weak and died, apparently of exhaustion, about four weeks after the operation.

CASE XII. A gentleman, aged 22, first seen December 15, 1879. There had been convergent squint in the left eye from infancy. For the last four months there had been ptosis of the left upper lid and exophthalmos. There was a growth involving the floor, outer wall, and roof of the orbit. Immediate operation was advised and declined.

On *February* 18, 1880, all the symptoms were much increased, and the entire contents of the orbit, including the periosteum, were removed, and the bones thoroughly cauterized.

By *April 5th* the orbit was again filled by the growth, and was again emptied and the ethmoid bone, from which the tumor seemed to come, was removed in pieces.

On *June 25th* the growth returned in the orbit and on the malar prominence and was again removed, together with portions of neighboring bones.

On *July 30th* a fourth operation was done and a large mass removed from the orbit and maxillary antrum.

By *September* 7, 1880, the growth had again filled the orbit and maxillary antrum, and protruded into the posterior nares. The superior maxilla was exsected, and the palate bone, part of the body and wing of the sphenoid, and the inferior and middle turbinated bones were removed. The soft parts healed rapidly, with scarcely any suppuration, and nothing suspicious was observed until five months later, when a mass appeared at the bottom of what had been the orbit, and grew very rapidly in size. No further operative interference was deemed justifiable. The patient lived for about eight months without suffering much pain and died, apparently of general exhaustion.

CASE XIII. A gentleman, aged 38, first seen January 12, 1880. The patient had had difficulty in breathing for about five years, and it was supposed that it was due to a tumor of the upper nares. About a year before the right eye began to pro-

trude, and about six months ago the exophthalmos began in the left eye. There had been failing vision for a year in both eyes. An examination showed that both anterior and posterior nares were filled by a growth which extended into both orbits, and into the right maxillary antrum, and probably sprang from the body of the sphenoid. There was complete atrophy of the right optic nerve and partial atrophy of the left optic nerve. He was urgent for an operation, in spite of the very unfavorable prognosis given, and consented to the enucleation of the right eye, which was blind. The right eye was enucleated. The floor of the right orbit was found defective posteriorly, and both antrum and orbital cavity and ethmoid filled with the growth. These cavities were entirely emptied of the tumor, and as much of the ethmoid bone as possible was removed. The turbinated bones were then excised, and the entire mass removed from the nose, in the process of which a free opening was made into the cavity of the ethmoid. The tumor also protruded into the left orbit, but could not be reached from the right side. The cavities were then thoroughly washed out and loosely packed with gauze. One result of the operation was an evident diminution in the degree of exophthalmos on the left side. In just two months the growth appeared in the right orbit from the ethmoid cavity and then increased rapidly in size. No further operation was attempted, and the patient died nine months after operation.

CASE XIV. A gentleman, aged 42, first seen September 13, 1880. There was a sarcoma of the choroid in the left eye, with detachment of the lower half of the retina. The eye was enucleated immediately, but it was found that the tumor had perforated the sclera in the infero-nasal quadrant, near the nerve entrance, and had extended into the orbit. Four operations were performed on this patient within a period of fourteen months, all of the most radical character, and the ethmoid, superior maxilla, palate, turbinated, and part of the sphenoid bones, were removed. The second operation was done four months after the first; the third was done three months after the second; and the fourth was done two months after the third. The patient lived only three months after the last

operation, and by that time the tumor had filled the orbit and nose and appeared on the face.

CASE XV. A gentleman, aged 46, first seen October 18, 1880. At that time there was a large epithelioma of the left lower lid at the inner canthus, which involved nearly one-half of the lid and had extended into the orbit. The diseased portion of lid was removed and as much of the orbital tissue as possible, but the patient would not consent to the enucleation of the eye, though told of the necessity for it. The gap was covered by a flap brought from the forehead, and the wound healed promptly. For three months there was no return of the growth, and then it appeared simultaneously in the orbit and at the apex of the flap. This patient was in vigorous health, and four more operations were done, the last one eighteen months after the first one. This was the most radical of all, as all the bones of the face and skull on that side were involved in the growth. This case was remarkable in that the growth returned within two weeks after the fifth and last operation, and the patient lived only two months after its final reappearance.

CASE XVI. A lady, aged 35, first seen December 6, 1880. There was a tumor of the left iris, ciliary body, and choroid, presumably sarcomatous, which had been growing for nearly three years. The eye was at once enucleated and carefully examined, but no signs of perforation were found, and the orbital tissue looked healthy. A microscopical examination showed that the tumor was a diffuse sarcomatous infiltration of the whole eyeball, all the tissues, save the lens and cornea, being involved in the process. The sclera was infiltrated by the sarcoma cells in many places, and I therefore gave an unfavorable prognosis as to the case. She was watched carefully, but nothing suspicious was observed in the orbit for seven months, and then a nodule was discovered far back, near the apex. This was removed at once and with the greatest ease, there being no adhesions, and the entire contents of the orbit carefully dissected out. An examination of the nodule showed it to contain muscular fibres infiltrated with small round cells. Within three months the growth returned in the orbit, apparently from the sphenoidal fissure, and all within reach was at once removed.

Within one month the tumor again grew from the sphenoidal fissure and increased rapidly in size. The patient became emaciated; developed a low fever, and sank steadily, and death occurred just five months after the last operation.

CASE XVII. A lady, aged 35, first seen December 16, 1880. The right eye had been gradually failing in vision for more than a year. There was a small tumor in the infero-nasal quadrant of iris, directly continuous with a tumor of the ciliary body, and detachment of the retina, downwards. The eye was enucleated and immediately bisected. The intraocular tumor was found to involve the choroid as far back as the optic nerve, and the nerve was diseased. This necessitated the immediate exenteration of the entire contents of the orbit, including the periosteum, which was done at once, and the bones were then cauterized. Nothing suspicious was observed in the orbit for four months, and then a peculiar swelling of the inner wall was noticed, which increased steadily, but not very rapidly, for two weeks, when its nature became unmistakable. The second operation consisted in the removal of the inner wall of the orbit, and as much of the internal structure of the ethmoid as could be reached. The latter was a gelatinous gray mass which contained a mass of small cells in a myxomatous matrix. The return of the disease in the ethmoid cavity was very rapid after this second operation, so that in five weeks the orbit was nearly filled. A third operation for the removal of the orbital contents showed that the growth had invaded the sphenoid bone and upper cavities of the nose. The patient declined any further surgical interference, and died in about eight months, with head symptoms pointing to an extension of the tumor to the intracranial cavity. The growth filled the orbit and nose, protruded into the pharynx, and had extended from the orbit, downwards upon the cheek, and outwards upon the temple.

CASE XVIII. A lady, aged 45, first seen August 1, 1881. There was a growth of the ocular conjunctiva of the left eye, on the temporal side near the corneal margin, which was as large as a bean, and had been growing for two months. It was carefully excised, and the sclera cauterized. The growth returned early in October, and by November 21st it involved the upper, outer,

and lower quadrants of the eyeball and covered the temporal third of the cornea. It extended back of the equator, and the eye was displaced inwards. The entire contents of the orbit, including the eyeball, were immediately removed. For five months there was no return of the growth ; but, early in May, a small nodule was discovered on the inner wall of the orbit, and, by June 7, 1882, the tumor filled the entire orbit. The contents of the orbit were again evacuated, and the periosteum stripped from the bones and removed as far as the apex. A careful examination of the bones and sinuses showed no demonstrable trace of the disease. In six weeks the growth returned on the floor of the orbit far back, and on being removed, it was seen that it also protruded from the sphenoidal fissure. After the third operation, the growth of the tumor was very rapid, not only outward into the orbit, but inwards into the ethmoid cells, and downwards into the nose. The patient refused all further operation, and lingered in much suffering for seven months, when death ensued.

CASE XIX. A gentleman, aged 35, first seen January 20, 1883. Health perfect. No rheumatism or syphilis. Left eye began to protrude fourteen months ago and exophthalmos has slowly increased. Now eye is pushed downwards and outwards as well as forwards, diplopia. Media, fundus, and vision normal. Palpation shows a soft, immovable but resilient tumor on inner wall of orbit. Right eye normal. It was thought the tumor might be encapsulated and an incision was made through the upper lid, just below the superior orbital margin, about an inch and a half long. The tumor was at once revealed and proved to be a soft semi-gelatinous mass, which had proceeded from the ethmoid cells and had caused complete erosion of the inner wall of the orbit. All attempts to save the eye were at once abandoned ; the globe and entire contents of the orbit were at once removed and the ethmoidal growth cleaned out. A further examination showed that the tumor had extended into the nose, and in all probability originated in the sphenoidal sinus. After the patient had recovered consciousness from the ether, he was told the serious nature of the trouble and that all the deep bones and sinuses were involved. He declined any more radi-

cal operation at the time. Two months later the same operation was repeated, the orbit, ethmoid, and nose being entirely cleaned out. The bleeding from this operation was profuse, and the patient was much prostrated before it could be checked. Within a month the tumor reappeared in the ethmoid, but the patient would not submit to any further operation. He lived for eleven months after this, but long before his death the growth filled the nose and he was obliged to breathe through the mouth. The disease also invaded the right orbit.

CASE XX. A young girl, aged 9, first seen December 11, 1883. Two years ago the right eye began to protrude, at first forwards and then downwards, and the exophthalmos has steadily increased. The vision, field of vision, and fundus were normal, and the media were clear. Nothing was found in the naso-pharynx or maxillary sinus. Subconjunctival veins in the cul-de-sac enormously engorged. The eyeball can be pressed back into place but at once resumes its abnormal position when the pressure is relaxed. Palpation of the orbit revealed nothing. The parents were told that it was a tumor of the orbit, possibly of the optic nerve, and that an attempt might be made to remove the tumor and save the eye, though the sight would be destroyed. To this they consented and the operation was done in the usual manner. The tumor was found at the apex of the orbit, entirely surrounding the optic nerve, and was apparently encapsulated. Subsequent examination showed it to be a sarcoma of the orbital tissue which had grown in the intra-muscular funnel around the optic nerve, but the nerve itself was not involved in the disease. The patient did not rally well from the operation and remained much prostrated for nearly five weeks. The cornea became cloudy but did not ulcerate. Towards the end of the third month after the operation, the eye began again to protrude and the orbital tissue was found infiltrated on the floor and inner wall of the orbit. Six months after the first operation the eyeball was enucleated and the entire contents of the orbit evacuated. The child never recovered from this operation and died from exhaustion at the end of the second week.

CASE XXI. A gentleman, aged 41, first seen February 25, 1884. There was protrusion of the right eye downwards and

forwards, but no limitation of motility. Vision had begun to fail two weeks before and was reduced to 20/100. A growth could be felt on the inner wall of the orbit, far back. This patient had suffered severely from constitutional syphilis. The eye was enucleated and entire contents of orbit were removed. The tumor was not encapsulated. Periosteum appeared smooth and healthy. Return of the growth on the inner wall of the orbit far back within three months. This was removed five months after the first operation, and it had then involved the floor and inner wall of the orbit, the apex and sphenoidal fissure, and there was erosion of the os planum of the ethmoid. The periosteum was then stripped up and removed and the bones cauterized. This operation seemed to hasten the return of the tumor in the orbit, as it grew with great rapidity from the sphenoidal sinus. One month after the second operation the growth was again removed from the orbit and the ethmoid was then found to be involved. Two more operations were done at intervals of two months, the growth being on each occasion removed from the orbit and ethmoid cavity. After the fifth operation the patient declined to have anything further done, but lived for more than a year before he succumbed to general exhaustion.

CASE XXII. A lady, aged 46, first seen February 8, 1884. Right eye began to protrude about two years ago and vision has gradually failed. The exophthalmos is forwards, inwards, and downwards. Constant pain in orbit and head. Media clear, V=0. Tumor can be felt on external wall and floor of orbit. Eyeball immovable outwards and downwards. The eye was enucleated and the entire contents of the orbit removed. Orbital tissue generally infiltrated by the growth, which also extended backwards through the optic foramen, and into the sphenoidal fissure. Ethmoid apparently uninvolved. Return of the growth from both sphenoidal fissure and optic foramen within five weeks after the operation, and as much as could be reached at once removed. Headaches became more severe, and the growth soon appeared in the upper nose. Orbit remained free for two months and then began to fill rapidly again from the apex. This was again removed, and a large mass was also

removed from the nose. The patient was not seen again until four months had elapsed, and then the orbit was again full and the ethmoid was found involved, with loss of part of the inner wall of the orbit. As the growth had increased in a forward direction, its extension backwards had apparently stopped, for the headaches had nearly ceased. The patient had grown very weak and emaciated and was in no condition for any further operation. She died four months later.

CASE XXIII. A little girl, aged 2½, first seen October 6, 1884. There was a small, hard, circumscribed tumor of the orbit at the upper and inner angle, which pushed the upper lid forward, and had been noticed for a year. This was removed through an incision made in the lid just beneath the orbital arch. It was firmly adherent to the ethmoid, and proved to be encapsulated. It was dense, smooth, and resistant. The trochlea was divided in the operation. The tumor seemed to be mainly connective tissue with very few cells. There was no return of any trouble for four years, when a lump was observed in the same location, which grew slowly in size for six months. Its growth then became more rapid, pushed the eye downwards, forwards, and outwards, and protruded beneath the lid. An examination showed extensive infiltration of the orbit, and the eye and entire contents of the orbit were removed. The inner wall of the orbit was partially eroded, and a large opening into the ethmoid cavity showed the growth protruding. It was soft, myoxatous in character, but not very vascular. The ethmoid cavity was emptied and thoroughly washed out, and the orbit treated as usual. In less than two months the growth appeared again in the ethmoid and orbit, grew with great rapidity; the child fell off rapidly in health, became cachectic, and died in a little less than four months, of what looked like general marasmus.

CASE XXIV. A gentleman, aged 52, first seen November 13, 1884. This patient had been twice operated on for epithelioma of the lower lid on the left side. When I saw him there was a tumor on the floor of the orbit, which extended the entire length of the orbital margin, and the flap of skin which formed the lower lid was infiltrated. The eye was pushed upwards and

outwards, and was blind. The patient insisted on an operation, though told that it would probably hasten the growth of the disease, as it could not be eradicated. The eye was enucleated, the contents of the orbit, densely infiltrated, were removed and all the infiltrated part of the lower lid cut away, and the place filled by sliding the cheek upwards. I did not see the patient for four months, and then the growth had filled the orbit, extended over upon the cheek as far as the middle of the superior maxilla and outwards into the zygomatic fossa. There were also some symptoms of a growth in the maxillary antrum. He was suffering great pain, and consented to removal of the growth from the orbit and from the external surface of the malar and maxillary bones, but declined to go any further. This operation showed that the tissues and skin of the face were involved as well as the bones. Subsequent to this operation the disease extended very rapidly upon the face and jaw, and involved, before the patient's death, the temple and auricle. He died three months after the second operation, which was the fourth operation in all.

CASE XXV. A gentleman, aged 50, first seen December 9, 1884. The right eye had been blind for nearly a year, and contained a large choroidal tumor, which had been suspected before from the general symptoms. There were no signs of perforation of the sclera, and the orbital tissue looked healthy, but, on opening the eyeball, the head of the nerve was found to be involved in the growth. The entire contents of the orbit were therefore removed, and as much of the optic nerve as possible exsected. Orbit remained apparently healthy for fourteen weeks, and then a small gray nodule made its appearance at the apex. This was at once removed and the apex cauterized. In three weeks another nodule appeared on the nasal side of the previous one, and was removed on the third day after its appearance, and the bone again cauterized. At this time nothing was observed in any of the sinuses. For nearly two months nothing abnormal was noted, and then three small nodules appeared, one at the apex, and two on the inner wall of the orbit, and grew with great rapidity. The patient's general condition was so bad that it was decided to postpone the operation. The

fourth operation was done six weeks after the appearance of the three nodules, and at this time the orbit was filled, and the growth protruded from the sphenoidal fissure. After the whole mass had been evacuated from the orbit, the inner wall of the orbit was found to bulge towards the orbit, and it was suspected that the ethmoid cells were involved in the disease, which proved to be correct. The general health of the patient was so enfeebled that no more operations could be thought of. He died four months later, apparently of general exhaustion.

CASE XXVI. A lady, aged 21, first seen January 12, 1885. There was a small tumor under the left lower lid, along the orbital margin, which pushed the lid forwards, and could be traced along the floor and inner wall of the orbit as far back as the finger could reach. It had been growing for about three years. By January 26th it had covered the entire floor of the orbit and extended up on the inner wall over the edge of the orbit, and down on the superior maxilla. The eye was displaced upwards and outwards. The maxillary antrum seemed uninvolved, and nothing could positively be made out in the upper nasal cavity. She had seen numerous surgeons, but was never willing to submit to any operation. The eye was nearly blind, and she consented to its removal. After this was done, it was found that the tumor was more extensive than had been supposed. It covered the floor, inner wall, and apex of the orbit, filled the ethmoid cells, the os planum being in places eroded, and involved all the fissures at the rear of the orbit, and also the superior nasal meatus. The hopelessness of the case was at once apparent. The tumor probably originated in the body of the sphenoid, and extended in every direction except backwards. The orbit, ethmoid, and superior nasal cavity were thoroughly evacuated, and as much of the tumor in the sinuses as could be reached from the orbit was removed. The orbit was loosely stuffed with iodoform gauze, and drainage established through the nose. The dressings were not removed for two days, and the cavities then looked healthy. No radical removal of diseased bone tissue was permitted by the family, on being told of the hopelessness of the case. The tumor returned first in the ethmoid five weeks after the first operation, and within six

weeks had nearly filled the orbit and upper nose. In all, four operations were done, at intervals of eleven, nine, and fourteen weeks. The patient died, seven months after the last operation.

CASE XXVII. A gentleman, aged 70, first seen Oct. 26, 1885. There was a tumor of the ocular conjunctiva of the right eye, on the nasal side, which had extended into the orbit. The primary growth was a conjunctival carcinoma, and had been removed eight months before I saw him. The eye was blind from cataract. I therefore enucleated it, and then removed the entire contents of the orbit. In six weeks the growth returned at the inferior margin of the orbit, apparently in the periosteum, but the lower lid was not involved. It was at once removed, the periosteum stripped off from the floor of the orbit, and the bone cauterized. Three months later a nodule appeared at the inner end of the lower lid. The inner third of the lid was excised, and the cheek was slid upwards and inwards to cover the defect. In less than two months the growth reappeared on the edge of the orbit and in the tissue of the cheek which formed the lid. Owing to the age of the patient I declined any further operative interference. The infiltration in the lid increased slowly, but that in the orbit grew very rapidly in all directions, and within two months had extended into the maxillary sinus and ethmoid. The patient, however, lived for a year before succumbing to the disease.

CASE XXVIII. A lady, aged 20, first seen Nov. 16, 1885. During early childhood a small tumor appeared at the inner angle of the left upper lid, which was hard and freely movable at first. It remained about the size of a large pea until three months before I saw her, since which time it had grown rapidly in size. It was firmly attached to the roof and inner wall of the orbit, pushed the upper lid forwards, and the eye downwards and outwards. I removed the tumor through a curved incision in the upper lid, following the line of the orbital margin. It was firmly adherent to the bone and seemed to be encapsulated. The cavity around it seemed smooth and healthy. Wound healed readily and eye resumed its normal position. The tumor proved to be a fibro-sarcoma, and though apparently

encapsulated, I gave a bad prognosis. The patient did well for a year, being under occasional observation. At the end of that period an infiltration of the orbital tissue appeared on the inner wall of the orbit, which rather rapidly extended to the floor, and caused exophthalmos. The eye was normal, but it was deemed impossible to remove the tumor without enucleation of the eyeball, and this was at once done. The growth was found to extend far back along floor and inner wall of orbit, and the whole orbital contents were removed and the periosteum stripped up and excised. Growth returned in four months on inner wall and apex of orbit, and grew very rapidly. Was again removed, and in less than two months appeared at the apex of orbit and in sphenoidal fissure. Patient became rapidly marasmic and emaciated. A fourth operation was done, and the orbit emptied, but patient died three weeks after the last operation.

CASE XXIX. A lady, aged 46, first seen Nov. 22, 1886. At that time there was an epithelioma which involved the inner half of the right upper lid, but seemed to be confined to the lid margin and skin surface. It was removed by a free incision through apparently healthy tissue, and the vacancy filled by sliding the cheek upwards and inwards, the operation being facilitated by a horizontal incision at the external canthus, and a vertical incision down along the side of the nose. The flap healed rapidly, and nothing suspicious was noted for fourteen months. Then a nodule appeared on the floor of the orbit near the margin, and was at once removed. For four months there was no return, and then appeared a general infiltration of the orbital tissue on the floor of the orbit. The eye was normal, but it was deemed necessary to sacrifice the eye in order to get at the disease, and to this the patient consented. The entire contents of the orbit were removed, including the periosteum, and the sinuses were found apparently healthy. In four months the growth appeared again at the apex of the orbit, and a nodule of infiltration was also found outside the orbit on the surface of the malar. The mass was at once removed from the orbit and the cheek, but in two months it began to grow again at the bottom of the orbit. There was no return in the cheek.

The patient declined to have any further operation done, and she lived for eighteen months longer without much suffering, but with a rapid increase in the extent of the growth, so that before her death the orbit, nose, and maxillary sinus were filled by the tumor.

CASE XXX. A gentleman, aged 79, first seen Dec. 9, 1886. For twenty years there had been a growth at the external angle of the right lower lid, which was ulcerated, and when I saw him the orbital tissue was extensively involved, the conjunctiva and cornea were ulcerated, and the eye practically blind from cataract and opacity of the cornea. He was in feeble health, but insisted on an operation for the relief of the severe pain. The entire contents of the orbit, including the eye, were removed. His strength rapidly failed, and in less than six weeks a suspicious tumor appeared at the bottom of the orbit and along the inner wall. All his vitality seemed to be spent in the growth of the tumor, which extended very rapidly, and caused his death from exhaustion four months after the operation. At that time the tumor had filled the orbit and extended out upon the cheek.

CASE XXXI. A gentleman, aged 51, first seen May 13, 1887. Five months before a small tumor had appeared at the upper and inner angle of the orbit, which a surgeon had advised should be removed at once. This was not done, and it had increased slowly in size, and had recently begun to cause some pain. There were opacities in the lens, but in other respects the eye was normal. I advised an immediate operation, and gave a bad prognosis. He could not decide to have the operation done, and I did not see him again until September. The tumor then extended backwards along the inner wall and floor of the orbit as far as the finger could reach, and forwards between the lids, and the eye was crowded upwards and outwards. The condition was much more unfavorable, but he then consented to an operation. The entire contents of the orbit were removed, together with the eye and a piece of the optic nerve. The periosteum and sinuses did not appear to be involved. The pain was relieved at once, and he became very hopeful, but in about three weeks he began to complain of a deep-seated pain and

pressure in the orbit. Nothing was found after most careful examination, but the pain increased, he complained of general headache and fullness in the head, and of a dimness of vision in the other eye. Ophthalmoscopic examination showed beginning choked disc, which pointed to an extension backwards towards the chiasm, an unusual course for such cases to take. Two weeks later the growth could be seen in the optic foramen and sphenoidal fissure, and the head symptoms became more pronounced. He sank rapidly and died comatose, about fourteen weeks after the operation. No autopsy was allowed.

CASE XXXII. A gentleman, aged 46, first seen November 11, 1887. Nine months before, began to have pain in left orbit and left side of head, and soon after had a profuse purulent discharge from left nostril and pain was relieved. Long subject to naso-pharyngeal catarrh, and this was supposed to be an abcess in the ethmoid which had discharged. In August the pain returned in the orbit and the eye became red and painful. Early in October the left eye began to protrude and diplopia ensued. A growth could be felt on the inner wall and floor of the left orbit, and the superior nasal meatus was blocked by the same growth. Vision in the left eye was only 20/200, and there was optic neuritis with numerous hemorrhages. I gave a very unfavorable prognosis and was unwilling to operate, but he begged for relief from the pain, and I consented. The eye was enucleated and the contents of the orbit were removed. The os planum was absent and the ethmoid cells were filled with the growth. This was removed, a large opening was made into the superior nasal meatus, the nose was entirely emptied of the growth, and a careful examination was then made of the orbit. The tumor was seen projecting from the sphenoidal fissure, and probably originated in the sphenoidal sinus. The maxillary sinus was apparently not involved. Drainage was kept up through the nose for two weeks. In five weeks the growth appeared in the ethmoid cavity and apex of the orbit, and was again removed. This patient submitted to five operations. At the third operation, the ethmoid, superior maxilla, palate, and part of the sphenoid were removed, and only seemed to facilitate the return of the tumor. He died four

weeks after the fifth operation, and eleven months after the first operation.

CASE XXXIII. A gentleman, aged 44, first seen August 7, 1889. Five years ago a small tumor appeared at inner angle of left orbit, which he was advised to have removed, but declined any operation. It grew slowly in size but was painless. Exophthalmos began three years ago and the eye now protrudes downwards, outwards, and forwards, and is blind. A large growth could be felt on inner side, roof, and floor of orbit. It was hard, immovable, and non-sensitive. The eye was enucleated and was found firmly attached to the growth. The tumor was intimately adherent to the periosteum throughout its extent, and the latter was carefully stripped up and removed and the bones cauterized. The original tumor had been of rather slow growth, but within two months a nodule was observed on the floor of the orbit and grew with great rapidity, so that a month later it was as large as a large almond. At the time of its removal there was another small nodule on the inner wall and one at the apex. These being excised, a careful examination made it probable that all the bones of the orbit were diseased, and all further interference was abandoned. Within two months of this second operation, the entire orbit was filled by the tumor, and the patient, in about a year, died from general exhaustion.

CASE XXXIV. A gentleman, age 52, first seen November 17, 1891. At the age of eighteen a small tumor made its appearance at the upper and inner angle of left orbit. It grew very slowly in size and two years later was removed. Two years later it reappeared in the same spot and grew very slowly and painlessly for about three years. It then remained unchanged until a year before I saw him, a period of twenty-six years. It then began again to increase in size and when I saw him in 1891 it was as large as a lima bean. I removed it through an incision in upper lid, beneath the orbital arch. It recurred in about nine months and grew more rapidly, pushing the lid before it. Fifteen months after my first operation, the eye being nearly blind, I removed it again, together with the eye and all the contents of the orbit. Ten months later it had

nearly filled the orbit and I removed it again. In five months it had again filled the orbit and encroached upon the nose, and both cavities were thoroughly evacuated. Within a month it began again at the apex of the orbit and at the upper and inner angle of the orbit, and this nodule soon involved the inner end of the upper lid and the entire superior orbital margin. There was an infiltrated gland over the zygoma, another in front of the auricle, and several enlarged cervical glands. The tumor is hard, nodular, and sensitive. I declined to operate again, although the patient urged it. He died about a year later with head symptoms.

CASE XXXV. A young lady, aged 16, first seen April 25, 1893. Both eyes defective from high mixed astigmatism. At the age of 12, four years before, she began to complain of pain in the left orbit and the eye began to protrude. There was more or less constant headache, and vision slowly grew worse in left eye. For a year this eye had been blind. When I saw her the whole of the rear of the orbit seemed to be filled by a hard, painless tumor. Nothing abnormal in nose or pharynx. Eye enucleated and contents of orbit removed, including periosteum, to which tumor was firmly adherent. Inner, upper, and outer walls of orbit intact. In three months the disease simultaneously recurred on inner wall and floor of orbit and grew rapidly in size. After two weeks it was carefully removed and the bones were cauterized. In nine weeks to a day a nodule appeared at the apex, and two more on the floor of the orbit. They were at once removed and the places again cauterized. In two months the disease again appeared in the orbit and also in the nose, and the pre-auricular gland became enlarged. This time the tumor grew with phenomenal rapidity and filled the orbit in twenty-four days after the last operation. A fourth operation was about to be performed when the patient caught cold and died of pneumonia on the eighth day. There was a very marked tendency to cancerous disease in this patient's family.

CASE XXXVI. A gentleman, aged 53, first seen January 10, 1894. In October, 1892, this patient had a severe inflammation of the eyelids of the left eye, which was suppurative or

pseudo-membranous in character, and which ended in orbital cellulitis and loss of sight, though the eyeball did not suppurate. One year later he began to complain of pain in left orbit and soon after the left eye began to protrude. When I saw him, four months later, the eye protruded forwards, inwards, and downwards, and was immovable, and there was constant pain. A tumor could be distinctly felt on the outer wall and roof of the orbit. An operation was urged and was done at once. The eye was enucleated and the contents of the orbit were removed. The roof and outer wall were found extensively diseased, and also the floor of the orbit far back, and in one place in the roof there was a hole leading into the anterior fossa of the skull. This had not been suspected. The patient did well for about four months and then the disease seemed to return all at once in numerous foci in the orbit. The frontal headache returned with great intensity and, owing to the opening into the cranial cavity, I declined to operate again. The patient, however, lived for nearly fourteen months after the operation and died of exhaustion, with no more cerebral symptoms than the severe headache which he had so long.

DISCUSSION.

DR. H. KNAPP of New York. — With few exceptions I can fully endorse the prognosis given. There is one class of tumors which at the first is not very malignant, but which may become so, that is adenoma of the lachrymal gland. When those tumors are removed they at least do not recur in a long number of years. I have at present one case under observation. I operated upon a young lady fifteen years ago for a very large tumor. I thought I got it all out, and had the good news from her that no recurrence had taken place. Last year she wrote that she thought she had a recurrence, and when she came to visit me she said that even six months after the first operation she found that the eye protruded again, but the tumor grew very slowly and caused no discomfort. I removed the new growth by an osteoplastic operation after Krönlein. Only one operation, as far as I know, has been done in this country. The tumor, which was originally an adenoma now proved to be a disseminated orbital sarcoma. I removed the first tumor as thoroughly as it could be done, but I know from other cases of disseminated sarcoma that even when after re-

moving the eyeball you feel that no parts of the tumor are left, the pseudoplasm quickly recurs. I believe that these tumors have a limited malignancy, and no relapse may occur for many years, but ultimately it will.

DR. C. J. KIPP of Newark.— I have removed a number of orbital tumors and can endorse all that has been said. I have recently seen a patient in whom a relapse occurred eight years after the removal of a sarcoma, involving the lachrymal gland. The second operation which included the removal of the entire contents of the orbit was soon followed by the return of the growth.

DR. W. B. JOHNSON of Paterson, N. J. — I think that Dr. Bull's remarks in regard to orbital tumors, providing that they originate in the surrounding parts, or in the bones of the orbit, are fully correct, and can be substantiated by any one of us. Regarding those which start in the eyeball or nerve the prognosis is much more favorable. Some fourteen years ago I removed a myxo-sarcoma of the optic nerve from the orbit, and I arise to state that that tumor has not yet returned. The case was reported in Knapp's Archives. At the last Pan-American Congress I reported a number of cases, in which tumors of malignant form all caused death, and recently I reported one case in the Annals of ophthalmology and otology, where I attempted to remove everything that might be tainted with the malignant infection — the tumor, eyeball, and superior maxillary bone — but the result was recurrence and death. However, there are many of these cases in which the pain is so marked a symptom that operation would seem to be desirable, if possible, after stating the prognosis, even though the tumor subsequently recurred.

DR. H. D. NOYES of New York.— I am not sure that my remarks are pertinent to the paper, but this occurs to me, namely, that when we remove epithelial growths, commencing in the lids, after their removal we are sometimes confronted by growths in the orbit, which may take on the form of sarcoma. Such is the history of a number of cases. I call to mind four cases where I was obliged to perform operations for the removal of epithelioma of the lids and surrounding parts, and successively the eyeball became involved, and the contents of the orbit had to be removed. I can speak of these four cases to this effect that in two of them all the neighboring parts have become deeply involved in sarcomatous growths, and will probably end in destruction of life. On the other hand I remember two cases where, after removing the contents of the orbit, qui-

escence ensued, and for a long period of years no repetition of the disease took place. In one of them fifteen years elapsed without return of the affection, and the patient died of apoplexy.

DR. EMIL GRUENING of New York. — We have certainly to except from this bad prognosis adenoma of the gland and also tumors of the optic nerve. In 1877 I removed a tumor of the optic nerve and eyeball, and the patient is living now without any recurrence. There are a number of such cases on record. Mine was a myxoma of the optic nerve. Dr. Knapp had a similar case of epithelioma.

DR. H. KNAPP of New York.— I wanted to say before that tumors of the optic nerve should be excepted. The one spoken of by Dr. Gruening had the appearance of an adenoma, but it proved later to be an epithelioma. The patient is living to-day with no relapse.

DR. C. S. BULL of New York.— I have had no experience with tumors of the optic nerve, and so said nothing of them. In regard to tumors of the lachrymal gland I have seen but two cases, one of which proved to be an endothelioma of the gland, and did not return; the other was adenoma, at first of a simple type, but returned as diffused small-cell sarcoma, and caused the patient's death.

TUMOR OF OPTIC NERVE AND RETINA, GLIO-SARCOMA.

BY S. D. RISLEY, M.D.,

PHILADELPHIA.

May B., aged three years — a pale, badly nourished child, was brought to the clinic at the Wills Eye Hospital, Philadelphia, April 6, 1896, because of a swelling of the right eyelids, which began three days before and had steadily increased. The child had been restless, peevish, and had slept badly for several nights prior to the onset of the swelling.

The eyelids were œdematous, of a dark, dusky red hue, and the swelling was so great as to entirely conceal the ball, and so prominent as to suggest exophthalmos. When the lids were separated by firm traction with two lid elevators an extensive chemosis of the conjunctiva was revealed, the dropsical mem-

brane rolling out between the parted lids and completely concealing the cornea. There was no discharge of pus.

The chemotic conjunctiva was freely incised, but notwithstanding the free escape of fluid no satisfactory study of the cornea could be made. Hot and astringent compresses were ordered for continuous application at home, together with a general tonic regimen.

In two days the œdema and chemosis were somewhat diminished, but the conjunctiva was again incised and the escape of fluid favored by hot applications. By including the chemotic membrane in the hold of the lid elevators the central part of the cornea could be seen, and was found to be steamy and gray.

The ball was stony hard, the pupil large medium, and a yellowish reflex was visible through it from the interior of the eye, both by oblique illumination and by diffused light. There was well marked exophthalmos. The case was regarded as one of malignant intraocular tumor, which in all probability had already invaded the orbit. This opinion was shared by my colleague, Dr. Geo. C. Harlan, who kindly studied the case with me.

Enucleation was advised, and the child admitted to the wards of the hospital. The hot astringent applications were applied continuously for two days, and at my next visit I found the child prepared for operation; but the œdema and chemosis had almost disappeared, and the exophthalmos was greatly diminished.

The general condition and comfort of the child was so much improved that operation was deferred.

The lens was transparent. The yellowish mass in the vitreous chamber presented the appearance of a collection of flocculent pus. There were no blood vessels on its surface. The tension of the ball was still too high, but had greatly diminished, and the steamy condition of the cornea had disappeared. The child remained in the hospital for two weeks, subject to continuous improvement in both local and general conditions.

I was then inclined to regard the first diagnosis as erroneous

and looked upon the case as one of pseudo-glioma, the acute stage of which I had witnessed. This opinion seemed to find corroboration in the rapid decline of the high tension to normal or possibly subnormal. The child was then allowed to leave the hospital, and was brought back from day to day as an out patient. A mercurial bandage and tonic were directed. I expected to witness the usual process of a shrinking pseudo-gliomatous ball with its recurring attacks of inflammatory reaction. On the contrary, in about two weeks the intraocular tension was once more too great, and rapidly increased. The lens was driven forward through the dilated pupil by the yellowish exudate behind it, being saved from complete dislocation into the anterior chamber by the attachment of the uveal surface at the pupillary margin to the anterior capsule.

The exophthalmos, if any, was no longer a notable feature. Excision was again advised. The child was once more admitted to the hospital and the operation performed under ether narcosis, just two months from the onset of the first symptoms noticed by the child's parents.

The excision progressed as usual until the attempt was made to sever the optic nerve. It was then found impossible to dislocate the ball, but the scissors were carried as far back as possible and the ball removed by cutting through a tough cartilaginous growth deeply placed at the apex of the orbit. The posterior pole of the ball was found closely occupied by a neoplasm, it being impossible to differentiate the optic nerve from the mass.

The apex of the orbit was filled with the rigid mass which was closely adherent to the orbital tissue, and was removed piecemeal.

The part occupying the apex of the orbit was seized with a pair of strong forceps, dragged strongly forward and cut off as deeply as was regarded prudent. It was found that about 5mm. of apparently healthy optic nerve had been secured. This, together with the fragments of the tumor and the ball, were placed in formaline, and subsequently submitted to Dr. Aloysis D. B. Kelly for pathological study.

The appearance of the hardened ball is admirably shown in

the macroscopic specimen here presented and also in the sections for microscopic study.

The child made a good recovery, without reaction or symptoms of cerebral involvement. The orbit healed in a perfectly typical manner, and at the present writing, six weeks after excision, the orbital tissues are healthy.

There was at no time any evidence of glandular involvement.

The following is Dr. Kelly's report:

"On section the eye is seen almost filled with a grayish white mass, which, occupying the entire posterior part of the globe, advances regularly forward and invades the opaque yellowish white vitreous, which is of necessity very much reduced in size. The mass is also distributed irregularly over the external aspect of the posterior section of the eye, and invades the optic nerve. The pupil has become much dilated by the presenting and obtruding lens, and the anterior chamber is reduced in size. The choroid has become absorbed. The new growth is composed of densely aggregated small round cells, connected with which it is impossible to demonstrate any prolongations, and only an occasional minute blood vessel can be seen.

"The growth penetrates and is distributed irregularly throughout the vitreous as noted, and it is in part degenerated. This same structural formation of small round cells is seen adherent to the posterior external aspect of the globe, where it forms quite a large mass. It further penetrates the optic nerve to quite a considerable depth, in which tissue the cells are generally arranged in more or less cylindrical groups by the disarrangement of the normal structure of the nerve which the proliferating cells displace."

P. S.— Since the presentation of the above case on July 15th, the child has been kept under observation until the fatal issue on September 20, 1896.

Just six weeks after the enucleation of the ball, the orbit was found filled with a hard nodular mass, which steadily increased, adhering to the lids, and pressing them before it.

Until on September 7th its size outside of the orbit was 10 cm. in its several diameters. On the 20th of September it had increased to 15 cm., its surface having broken down into an offensive ulcerated mass. On this date the child was seized, according to the description of its parents, with general convulsions, which, after several hours, ended in death.

No post-mortem examination was secured.

MELANO-SARCOMA, ORIGINATING IN CILIARY BODY.

BY S. D. RISLEY, M.D.,

PHILADELPHIA.

Hiram B., a farmer from the interior of Pennsylvania, aged sixty-one, presented himself at the Wills Eye Hospital, Nov. 11, 1895, with a black, nodulated mass projecting from the left orbit and tightly constricted by the eyelids. No portion of the sclera was visible, and the mass was apparently fixed, pointing slightly downward and inward, and appeared to fill the entire orbital rim.

The tentative diagnosis was melano-sarcoma, and immediate excision with probable exenteration of the orbit advised. Its almost certainly malignant character and danger of recurrence were explained to the patient.

He gave the following history, on presenting himself at the clinic: More than two years before he quite accidentally discovered that he could not see with his left eye. He sought the advice of a charlatan, who gave him drops, under the use of which, after a month, the eye became painful and subject to attacks of inflammation. The pain he described as "a stabbing neuralgic pain," which radiated from the eye to the occiput and periorbital region.

The tumor had been present a year and a half, and he did not think it had enlarged much during the past year. He was not suffering at the time of his visit, but the mass was extremely tender to pressure, and he was liable to recurring attacks of pain in the orbit and head, which he ascribed to cold.

The right eye was healthy and V $\frac{6}{vi}$ with + 3. *sp.* + .50 cy. ax. 90°. The man was admitted to the hospital and the ball enucleated on November 15, 1895. Under the anæsthetic the spasmodic constriction of the lids disappeared and the spring speculum could be introduced as usual. The tumor was then found to spring from the anterior part of the eye-ball alone, its base occupying quite accurately the corneo-scleral limbus. The sclera was smooth, white, and apparently healthy, so that the ball was excised in the usual manner and without difficulty. Careful study of the enucleated ball revealed no nodules on its surface and there was no evidence of the disease having extended to the orbital tissues. They were therefore allowed to remain. A typical recovery followed, and the patient was discharged from the hospital in about the usual time.

The tumor and the ball formed a dumb-bell shaped body, the former being the same size as the eyeball, nodulated, a dull black color and enclosed in a thin gray pellicle through which coursed a few blood vessels which could be traced backward to their origin at the scleral limbus. The specimen was placed in ten per cent. formaline and subsequently placed in Dr. Aloysis D. B. Kelly's hands for pathological study. One-half has been mounted macroscopically and preserves accurately the appearance presented after excision. The point of origin is seen to be in the ciliary body at the nasal side and the microscopical sections exhibit the characteristics of melano-sarcoma.

The following is Dr. Kelly's report:

"The eye after enucleation weighed 165 grains. Protruding from the front of the eye, attached at about the sclero-corneal junction, is an irregularly spherical mass, about three-quarters of an inch in diameter and half an inch in thickness. On section the eyeball is greatly distorted in shape, the cornea is flattened by the mass growing externally, and the lens has come into close contact with the cornea, advancing with the growth of an intraocular new formation which is seen filling almost the entire cavity of the globe, the anterior chamber is reduced to a minimum. The intraocular growth is of reddish brown or black color. In the mass protruding from, and attached to the front of the eye is an admixture of white, gray, and black coloring. The growth has evidently taken origin in the ciliary body of the

nasal side of the eye. It has subsequently perforated the eyeball in the neighborhood of the sclero-corneal junction and grown externally. It has also invaded the choroid, where it is now degenerated. On low magnification it is seen to be composed of a number of nodules of varying size, adherent to each other by very delicate bands of connective tissue. More minutely these nodules are composed of densely aggregated round spindle and other irregularly shaped cells, with well stained nuclei. In association with them there is usually a great quantity of pigment."

P. S.—A note from the patient, dated July 10, 1896, states that he is in good health, that the orbit is healthy.

PRIMARY SARCOMA OF THE IRIS.

By S. B. St. John, M.D.,

HARTFORD.

Sarcoma of the iris is one of the rarest of eye diseases. De Wecker (*Traitè d' Ophthalmologie*, 1886) says: "It is extremely rare; our records, so rich in all kinds of curious and rare cases, are silent on this subject." Norris and Oliver's recent work says: "Sarcoma of the iris rarely occurs primarily." Dr. J. A. Andrews (*N. Y. Medical Journal*, 1889, p. 595) gives a resumè of "all published cases to that date," 25 in number, but I have found three which escaped Dr. Andrews' search. Hirschberg's (*Graefe's Archives*, xiv, 3, 285) Basedow's case (*Arch. für Augenheilkunde u. Ohrenheilkunde*, III, 2, 180) and Kleinschmidt's (*Gaz. Hebdomadaire*, 1884). In 20 cases in which the age was given the average is 40 years. Vision is usually greatly reduced, but it may be unimpaired. In a very few cases where the disease has not involved the periphery of the iris it has been possible to save the eye by removing the affected part of the iris, but enucleation is the usual resort. In view of the infrequency of the affection I wish to place on record the following case:

This case was under my observation only for one week, so that the history is necessarily extremely meager, but it seems to have been very uneventful.

P. F., aged 50, a laborer, came to me May 14, 1896, saying that for about one year he had noticed a black spot upon the

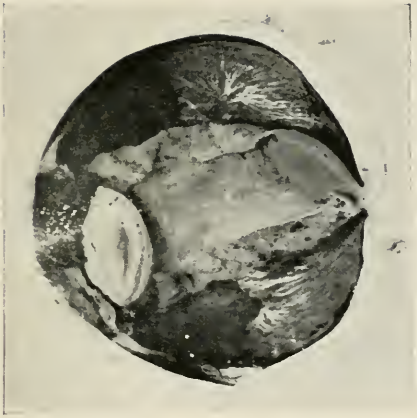


FIG. 1.

SARCOMA OF IRIS. GROWTH SEEN IN SECTION IN FRONT OF LENS.

FIG. 2.

SAME AS FIG. 1 BUT NEGATIVE. RETOUCHED TO SHOW EXACT EXTENT OF GROWTH.

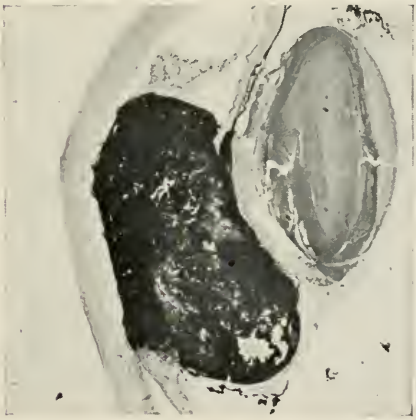


FIG. 3.

MICRO-PHOTOGRAPH OF SECTION OF GROWTH.

colored part of his left eye. When first seen it was of the size of a large pin-head, and he thinks it began at the marginal part of the iris. There was at no time any pain, nor other subjective symptoms, till loss of vision was noticed some three months since. Examination showed a large dark brown mass in the anterior chamber, nearly filling the external half of that space and pushing the iris back. The growth encroached upon the pupil, and at one point where it seemed to be in closest contact with the cornea there was a grayish spot the size of a pin-head as if the cornea was becoming affected by pressure. Tn V. $= \frac{6}{10}$ ecc. inwards. No view of fundus, lens slightly hazy R. V. $= \frac{20}{20}$. Enucleation advised and performed a week later. The sections both macroscopic and microscopic showed the growth to be a melano-sarcoma. [See accompanying illustrations.]

PRIMARY-SARCOMA OF THE IRIS.

By JOSEPH A. ANDREWS, M.D.,

NEW YORK CITY.

The specimen which I pass around shows a growth of the iris, which had been noticed by the patient — a woman, aged 43 years — for a long time. There was no pain, and the vision was not disturbed; but there was circumcorneal injection and the tension was thought to be +.

I enucleated the eye, and the specimen shows, as you will see, a *spindle-celled sarcoma* (pigmented) originating in the stroma of the iris. Schlemm's canal is noticeably narrowed, and surrounded by a considerable collection of spindle cells. The same cells are seen beyond this point toward the ciliary body.

The point of interest is the involvement of the tissues beyond the iris. The second stage of the disease had, apparently, been reached and because of the extension of the sarcoma beyond the reach of an iridectomy, any attempt to excise it and save the eyeball would, no doubt, have failed. The case, therefore, shows, as I indicated in a paper (*New York Medical Journal*, 1889, pp. 595–598) some time ago, in which I made an analysis of the cases of primary sarcoma of the iris, published up to

that time, that it is impossible to determine, in a given case, whether the ciliary body is involved. As was shown in the paper referred to, primary sarcoma of the iris is observed most frequently in women, and the spindle-cell variety predominates.

DISCUSSION.

DR. S. THEOBALD, Baltimore.— I would mention an instrument that I have used for many years that is of especial value in enucleating the eye where there is a malignant growth. I got it many years ago in London. It is a pair of forceps devised to seize the sclerotic, having quite sharp teeth on each blade, and it is possible with them to grasp the sclerotic firmly and draw the eyeball forward as strongly as one pleases. One can thus cut the nerve further back than is possible with the ordinary fixation forceps. I have succeeded with these forceps in cutting off three-quarters of an inch of the optic nerve.

DR. H. F. HANSELL, Philadelphia.— I find there is a great difference of opinion in relation to the tension in these cases. Some writers report that it is increased and others diminished. My own experience is limited, but I have seen glioma, sarcoma of the choroid and tumors of the iris, in which I have been unable to detect the increased tension. That is said to be a sign of intraocular tumors. When secondary glaucoma has been induced the tension must be plus, but before this very late stage tension is usually normal or perhaps diminished.

DR. C. J. KIPP, Newark, N. J.— Years ago I removed from a man a sarcoma of the iris by an iridectomy, and at the time of his death, years after in a railway collision, there had been no sign of a relapse.

A CASE OF MULTIPLE ROUND-CELL SARCOMA INVOLVING THE BONES OF THE ORBIT, CRANIUM, AND FEMUR OF THE RIGHT SIDE.— DEATH — AUTOPSY.

BY DR. HERMAN KNAPP,

OF NEW YORK.

Mr. President and Gentlemen: I beg to put on record the history of a case which in its ophthalmological aspect is novel to me.

On October 7, 1896, I was asked to meet, in consultation,

Dr. F. A. Castle, the family physician of the patient, and Dr. F. H. Bosworth of New York, about the illness of Mr. Walter E., a prominent lawyer, æt. 62. The following anamnestic notes are taken from the detailed history of the case which Dr. Castle had the kindness to put at my disposal.

FAMILY HISTORY. — The patient's mother and a maternal uncle had decided *bone-softening* in their later years, but both were well aged at their decease. No other hereditary tendency recognized, unless it be a general capacity for endurance.

PERSONAL HISTORY. Some indications of *rachitic troubles during childhood.* General health, otherwise, good. In the last years of his life he had attacks of sneezing, which were considerably relieved by treatment of hypertrophic nasal tissue. Furthermore, he suffered from osteocopic pain in his upper and lower extremities, and from periods of *mental depression*, coincident with numerous responsibilities and worries. Prior to 1894 he had several times been abroad on account of fag from overwork, worry, and a hacking cough unattended by expectoration or physical signs. From these trips he always returned in better health and spirits.

Early in the winter of '94 and '95, feeling tolerably well, he went, under protest, to South Carolina. Soon after reaching the South the sciatica and cough increased, the pulse became accelerated, and the temperature moderately elevated. Notwithstanding fairly good appetite and digestion, he emaciated and lost strength. Finally, pain and weakness confined him to bed. He slept badly, had disturbing dreams, and some nights was quite flighty.

On May 4, '95, he returned to New York, and required the use of an ambulance to reach his home. His paroxysmal pains in the limbs of both sides continued and extended to the sacrum and coccyx.

In the middle of June slight swelling of the lids, and puriform discharge from the conjunctiva of the right eye set in; he had frontal and occipital headache, and tenderness of the right eyebrow. Soon the swelling of the eyelids passed away, but there appeared a tumefaction of the outer part of the supra-

orbital region and protrusion of the right eye, with occasional diplopia. His headache increased, and on the night of June 23d there was vomiting, and, for the first time, he declined food. On June 25th there was decided stupor and, on the next day, coma with absence of all reflexes. On June 27th partial consciousness returned, and by the 29th some discharges of urine and fæces were normal. From that date there was progressive improvement, and he began to sit up, at intervals, daily, and even to walk a little without assistance.

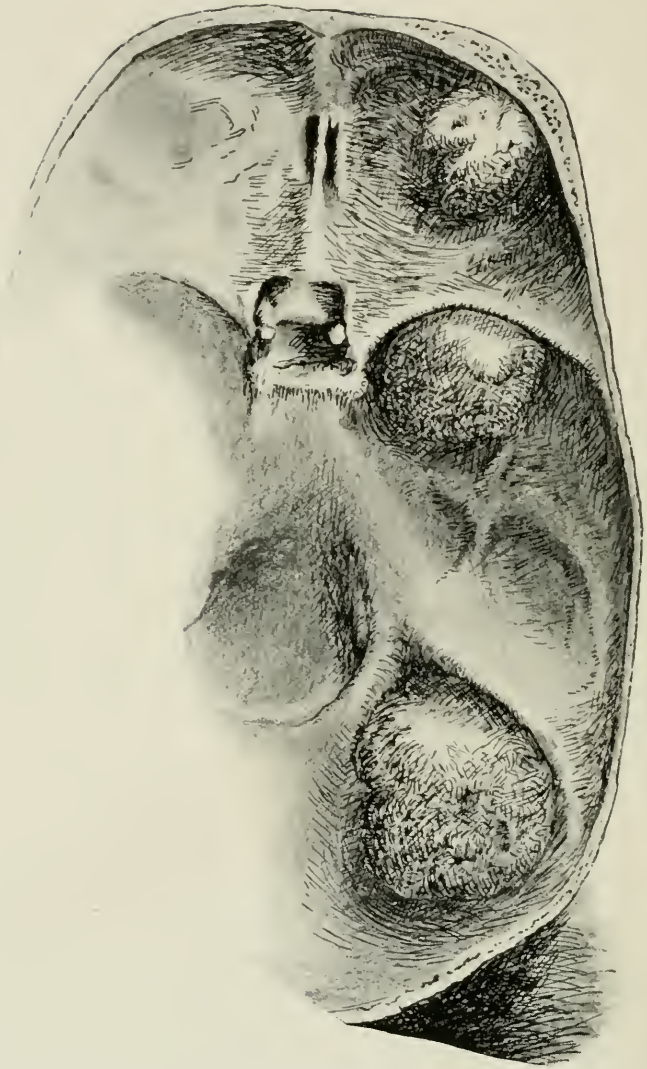
On September 8th he was taken to the seashore.

On September 16th, during an effort to help himself into bed, his right *femur broke* in the upper third. Again he became unconscious (stupor), feverish, and had involuntary discharges. He rallied gradually, gained strength, so that on September 27th, on his return from the seashore, he endured a drive of about six miles and a railroad trip of a hundred, without apparent injury or discomfort. Meanwhile, the fracture seemed to have united, leaving a swelling of the surrounding tissue.

On several occasions he was examined by other physicians in every direction, but no satisfactory diagnosis was made. Tuberculosis seemed to account better than anything else for most symptoms.

CONDITION AT THE TIME OF THE CONSULTATION, October 7, 1896. The patient was lying in bed, very much emaciated, did not speak, but felt movements downward, exophthalmus. Pupils responsive, *optic discs normal;* S. and F. could not be examined. On outer half of right brow a hemispherical swelling, about 2.5 cm. in diameter, the border presenting a hard ridge continuous with the surrounding bone, the center was slightly depressed, and of fleshy softness. Below the superior orbital margin there was a tumor of tendinous hardness under the periosteum, extending backward into the orbit, its posterior limit not reached on palpation. Inner part of supra-orbital region and orbit normal. Movements of eye good.

My opinion was that the tumor was a periosteal sarcoma with osseous spiculæ. Prognosis bad. Advised to make an exploratory incision above the brow, and proceed according to conditions found.



OSTEO-SARCOMA OF THE RIGHT ORBIT AND THE ANTERIOR MIDDLE, AND POSTERIOR FOSSÆ OF THE SKULL.

The patient sank rapidly, and died comatose four days later.

Autopsy, October 12, 1896. Opening of *head* only allowed. On removing the calvaria, a round, slightly uneven tumor, 3 cm. in diameter, its crest 3 mm. above the level of its base, was situated at the right parietal bone, near the vertex. Incised it showed a fleshy mass imbedded in the corroded bone, which could easily be pierced with a chisel. The supra-orbital tumor was of the same character.

The *meninges* showed venous hyperemia and subarachnoid, serous, whitish, but not purulent infiltration. The brain and cerebellum were normal, but presented depressions from the tumors presently to be described. Arteries strongly atheromatous, sinuses normal.

The *supra-orbital tumor* had pierced the frontal bone above the brow, and rested as a spherical, soft, uneven mass, the size of a walnut, on the horizontal plate, which it had also pierced, forming an uneven tumor in the whole upper part of the orbit between bone and periorbita, about 1 cm. thick.

The orbital tumor *extended* through the superior orbital fissure into the *middle cranial fossa*, expanding there into a round tumor, about the size of a walnut. Dr. Castle, who assisted me in the autopsy, made the accompanying excellent sketch of the base of the skull, which serves to illustrate the description materially.

Independent of the tumor in the anterior part of the skull, there was *another larger* one, of the same kind, springing from the lateral portion of the posterior surface of the *petrous bone* (see plate) involving in its growth the adjacent part of the cerebellum.

Histology of the tumors. All these parts were removed, and, after hardening in formol, examined microscopically. They exhibited the uniform picture of a sarcoma, composed of large, round cells with almost no intercellular substance. Unlike the osteo-sarcoma, which originates in the periosteum, and leads to the formation of bone, the tumors appear to have originated in the interior of the bone and destroyed both the diploë and the hard tables of the bone.

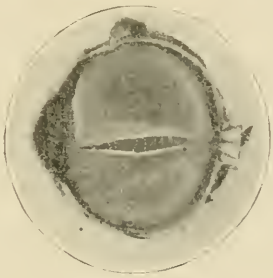
1. CARCINOMA OF THE CHOROID — 2. SARCOMA OF THE CHOROID.

BY HENRY D. NOYES, M.D.,
NEW YORK CITY.

1. Mrs. F. A. H., aged 55, came to me September 4, 1895. She had complained of her right eye for some months and in May had consulted an oculist, who found no other trouble than the need of glasses. Failing of relief she asked advice of another oculist in July, who saw her a few times and made the diagnosis of tumor at the region of the macula. He advised enucleation. Unwilling to submit to the operation she sought my advice early in September. She was a stout, well-nourished person, who had enjoyed good health but had been twice operated upon for tumor of the right breast; for the first time in 1880, and the second time in 1889. The axillary glands were not involved, or at any rate were not removed. She says that there is at the present time a lump in the same breast. In 1893 she had a uterine tumor removed. Whether the last named was of the same character as the mammary tumors is not known, but presumably they were all of a cancerous nature to a greater or less degree. These facts would, of course, have weight in forming an opinion as to what might take place in the eyeball.

She was suffering moderate pain in the eye, it was slightly hyperaemic, not specially tender on pressure, tension normal. Pupil a little enlarged and not quite round, reacted to light. Vision eccentric and the central part of the field was occupied by an absolute scotoma of an oval shape which, on the vertical line, extended from 12° below to 40° above the center, and laterally about 20° to each side of the center. There was no peripheral limitation. Media clear, with the exception of a few vitreous opacities. At the middle of the fundus it was easy to discern a separation of the retina whose elevation was eight diopters, which would give, allowing for a probable hyperopia

of 1.D, a thickness of two mm. The retina was finely striated, there were no hemorrhages, and it seemed opaque. One could faintly see black spots beneath it. These dark spots and the striæ were most pronounced when viewed obliquely, and at the edge of the illuminated surface. Under the upright image there is a notable lack of definite outline in what can be seen, and by the inverted image the dark spots became more emphasized. The retina is not floating and while the diagnosis of choroidal tumor is not rejected, it is not now easy to assert its presence by unmistakable characteristics. The optic nerve and



the periphery of the fundus, normal. It was deemed justifiable not to advise enucleation but to rely on the use of a mixture of cocaine and eserine to relieve pain, and to apply warm water.

Four weeks later the scotoma had changed its form to a horizontal oval, but covered about the same area. The eye had been fairly comfortable. The fundus showed little change. A few whitish specks resembling cholesterine appeared on the diseased surface and its middle was roughened like shagreen leather. Six weeks later she reported that while generally comfortable the eye had, within a fortnight, been more painful. It was now found that the supra-orbital nerve was excessively sensitive to pressure at the notch. The region of the macula less mottled, and less elevated, can be seen with +4.D instead of +8.D. All the lower half of the retina is now lifted by serous effusion in two large blebs with a distinct vertical cleft between them. Advised quinine in full doses to be followed by Warberg's tincture, in view of the sensitive state of the supra-orbital nerve. Was seen again after two months, viz., January,

1896. The subretinal effusion was somewhat larger and continued to show the division into two blebs. No important change at the region of the macula. Retina *in situ* over the upper half of the fundus. Has found relief by the use of quinine. Continued comfortable until the latter part of May, when pain and moderate ciliary congestion occurred, and prevented the use of the other eye. There are no glaucomatous symptoms, tension rather minus than plus, a good deal of lid irritation and the pain is of a burning and smarting quality. If the globe be compressed between the thumb and finger at the equator, which its prominence in the orbit permits, a decided and disagreeable pain is produced. The detachment of the retina has now become complete except at the extreme periphery upwards and outwards. By means of cocaine the superficial congestion was relieved in a few days, but in view of the hopeless condition of the eye and that it was becoming unbearably troublesome, enucleation was advised and consented to. About a quarter of an inch of the nerve was excised: hemorrhage was copious. Reaction was unusually severe, but after eight days recovery was complete. No growths were to be felt in the orbit.

Examination of the specimen. (See figure, p. 539.) After lying in a solution of formaline for eight days a vertical section was made through the optic nerve. There was total separation of the retina, pushing it forward to the lens. The subretinal fluid had the consistence of jelly and was of a smoky color. Close inspection revealed thickening of the choroid to about 1.5 mm. over a pretty wide area, reaching from the optic nerve nearly to the equator. Whether it extended to an equal distance in all meridians the vertical section made it impossible to say. We evidently had a choroidal neoplasm with tendency to diffusion in area, but with little tendency to increase in thickness. Hence the absence of serious symptoms denoting intraocular pressure.

At my request, Dr. Wilson of Bridgeport, Conn., kindly placed at my disposal the following notes of the case during the period that Mrs. H. was under his observation, and before I saw her:

"May 16, 1895. Within the last ten years patient has had

twenty to twenty-five attacks, she thinks, in which she saw only the half of objects. The dividing line was perpendicular, but she cannot tell which was the blind half. The attacks lasted about an hour, and usually ended in headache, for which she had to go to bed. She does not now have hemianopia.

O. D., V = $\frac{20}{100}$ with + 1.50$_s$ V = $\frac{20}{20}$.
O. S., V = $\frac{20}{30}$ with + 0.75$_s$ V = $\frac{20}{20}$.
June 18, 1895, O. D., V = $\frac{18}{200}$ with + 3.00$_s$ V = $\frac{20}{50}$.
O. S., V = $\frac{20}{40}$ with + 0.75$_s$ V = $\frac{20}{20}$.

"There is no record of any unusual ophthalmoscopic appearance; the fundus was carefully examined, because I ordered strychnia at this visit and I infer that I suspected that the nerve was at fault."

(The increase in hyperopia and the reduction of vision seem to indicate that elevation of the retina must already have begun at the macula.—H. D. N.)

"August 14, 1895. A small circumscribed mound at the macular region, summit can be seen with + 4.D; the surface striated; mound about the size of the optic disc:— color darker than surrounding retina. V = $\frac{1}{100}$. Now for the first time tells me that a tumor was removed from the right breast in 1882, and another from the same breast in 1889. Enucleation advised. September 3, 1895 — No change; enucleation declined."

REMARKS. My description begins the day following the brief note of Dr. Wilson. I was informed by the patient of his diagnosis, and studied the conditions with care. I cannot but believe that the appearances discovered three weeks previously were more distinct than at this stage, yet in my own mind the conclusion in favor of tumor was preponderant. The question which the patient presented was whether immediate enucleation was necessary. To that I answered that delay was permissible, and the limits within which such delay is allowable is the point to which I wish to call attention. Under certain conditions to be carefully understood and differentiated, I believe one is justified in deferring the performance of an operation. It is to be understood that a patient must be held under sufficiently fre-

quent observation, and be informed of the possible outcome. In the case of Mrs. H. both these conditions were complied with. She consented to be examined at such periods as I named, and agreed virtually to abide by my decision in whatever course should be taken. It was my purpose to spare her the necessity of enucleation so long as the eye remained comfortable, and while there were no apparent risks from infection or any extension of the disease outside of the eye.

To the pathologist the very earliest stage of a tumor is the period when it gives him the greatest satisfaction to discuss it. For certain tumors, especially gliomata, we are not justified in procrastination, because of their virulence and propensity to rapid extension beyond the eyeball; but with melanotic tumors, which are usually sarcomata, the dangers are not so pressing. Usually we meet them after they have attained considerable size, because they most frequently spring from the eccentric parts of the globe. In the beginning they do not obscure sight nor excite symptoms. The duration of the quiescent period we can never know. Herein our clinical knowledge must always be faulty. When, however, a tumor begins at or near the macula, the damage to sight promptly awakens the patient's attention and he seeks advice.

In the case under discussion, realizing that the ophthalmoscopic appearances might well be interpreted as significant of tumor, and recognizing the probability which the previous history of mammary and uterine tumors lent to this belief, I was not convinced that the condition was so perilous as to require insistence on the drastic measure of enucleation. The discomfort endured was not great, and did not occur frequently or continue for long periods. The history showed that the constitutional infection was moderate in degree and slow in progress, the first tumor having begun 16 years before the eye trouble. As a fact, the duration of the intraocular tumor was ten or eleven months, and its encroachment into the intraocular cavity was never great. There is no evidence that it caused any infection outside the eye, and delay gave the patient a welcome reprieve. In fact, the decisive reason for removal of the eye was the irritating pain and inability to use the other eye.

In my judgment the clinical history justified the temporizing policy which was adopted. The features of the case were peculiar, to wit: the very long continuance and slight manifestations of a cancerous diathesis; the ocular tumor exhibited for a long time very slight tendency to growth, and was likely to be confined within the globe; finally that the indications for enucleation were to be founded rather upon the symptoms of local disturbance and distress, such as pain and inflammation, than upon the probability of ulterior mischief to parts outside of the eye. The tumor, moreover, was metastatic and secondary, and might therefore be dealt with more deliberately than if it had been primary or a tumor of greater size. Its tendency to increase in extent rather than in thickness, and the preceding history of mammary growths rendered the diagnosis of carcinoma more probable than sarcoma. This characteristic naturally made the liability to glaucomatous symptoms less probable, because there was less invasion of the cavity of the globe.

The following account by Dr. John E. Weeks, pathologist to the New York Eye and Ear Infirmary, gives the microscopic examination, and determines the diagnosis both clinically as well as pathologically.

DEAR DR. NOYES:— The microscopical sections of the eye from Mrs. H. are not perfectly satisfactory to me because of a fault in the embedding process. I expect to have some better sections in a few days, and will forward them to you. A short description of the condition of the eye follows:

Globe of normal size.
Cornea normal.
Iris adherent to cornea throughout.
Posterior chamber shallow.
Lens disciform.
Retina totally detached; albuminoid sub-retinal exudation.
Choroid thickened to 1 mm. throughout its posterior half.
Sclerotic normal.
Nerve (optic) of normal size.

Microscopical Examination. CHOROID.— The thickened choroid presents numerous connective tissue trabeculæ, lightly pigmented, enclosing numerous alveoli of various sizes. These alveoli are partly or

wholly filled with cells which resemble epithelial cells. In many places the alveoli are only lined with these cells, the rest of the space being partly filled by fibrin. There are few vessels in this part, the vessels of the choroid proper being much reduced in size and crowded to the anterior or to the posterior side of the new-formed tissue. The new-formed tissue apparently advances in the layer of large vessels. About the optic nerve entrance the alveoli are quite small and well-filled with the new cells. The pigment layer of the retina, which remains attached to the choroid, is more or less disturbed by the presence of colloid masses which spring from the lamina vitrea of the choroid.

Optic Nerve. The connective tissue trabeculæ are increased in size in some parts of the nerve; there is also a slight increase in nuclei, a condition of incipient atrophy.

Very sincerely,

JOHN E. WEEKS.

The infrequency of choroidal carcinoma makes a reference to recorded cases of value. Uhthoff in 1891 contributed a paper, "Zur Lehre von dem metastatischen carcinom der choroidea," to the volume in honor of Prof. Virchow's seventieth birthday "Internationale Beiträge zur wissenschaftlichen medicin," Hirschwald. He cited two cases of his own, and quoted fourteen other cases in literature. There are no observations previous to 1872. Uhthoff's paper is condensed in *Jahresbericht für Ophl.*, 1892, p. 181. Besides the sixteen which he presents three others are to be found: one by G. Schulze, *Jahresbericht*, 1894, for 1892, p. 344; another by Kamocki, *Jahresbericht*, 1894, for 1893, p. 324; and de Schweinitz and Meigs, *American Journal Medical Sciences*, August, 1894. From a mediastinal tumor metastases took place into the brain, the optic nerves, and into both choroids — making with my own case a totality of twenty cases. All were of metastatic origin. The primary disease was in the mammary gland in fourteen cases. In both cases by Uhthoff, each eye was affected, and he records six others which were similar, making nine in which the affection was double. Singularly, in both of Uhthoff's cases, and in that of de Schweinitz and Meigs, the optic nerves, either one or both, were implicated. As to the characteristics of his tumors, in all but three, they were of small

thickness (from 1 to 3 mm.) and their area usually not extensive, although in some instances the choroid was invaded up to or beyond the equator — extension into the optic nerve, in one case; penetration through the sclera, one case (posteriorly and the tumor small, Kamocki). In only three cases were glaucomatous symptoms provoked. The region of the posterior pole was the place of origin in all cases, and in one, the iris and ciliary body were also implicated. Detachment of the retina was noted in almost all cases. It was apt to occur early, and if total, as frequently happened, the extent of effusion was not necessarily in any direct proportion to the size of the growth.

The noteworthy features of carcinomatous tumors are their small size, discoid character, disposition to affect the posterior polar region, that both eyes are involved in numerous cases, the rarity of glaucomatous symptoms, the frequency of retinal detachment, that they grow rather rapidly, that they seldom extend beyond the globe, that there may be other deposits, viz., in the optic nerves, the brain, the lungs, etc., and that they are not primary but metastatic, and the primary disease is most frequently in the mammary gland. The great majority of the patients are women, viz., fifteen out of twenty.

Note. Another case of carcinoma of the choroid appears before this MS. goes to press, viz., by Abelsdorff, *Archiv. für Augenheilhunde*, Bd. xxxiii. Hft. 1 und 2, s. .34, August, 1896. (German edition.) The patient was a woman, with mammary cancer, and metastases took place in both eyes. When first examined, the right eye showed at the macula a patch of yellowish-white exudation or opacity, and at the periphery both above and below a region of white discoloration with detachment of the retina with $+5.50$ V $= 6/35$. In the left eye there was greenish-gray detachment of the retina occupying the entire outer half of the fundus and reaching to the disc. Vision = fingers at 10 cm. The patient sought advice because of the trouble with sight, and laid no stress upon the disease of the breast, nor was any cancerous disease discovered in other localities. She seldom came under inspection, and at her death, fifteen weeks after the first visit, permission was gained to examine the eyes, but nothing more. Carcinomatous infiltration had then in-

vaded the whole choroidal tract of each eye and in the right had extended to the ciliary body, in the left to the ciliary muscle. The microscopic appearances are given in detail. The author says that he found the origin of metastasis in numerous embolisms of cancerous cells in the posterior ciliary arteries of both eyes. He also says that the ophthalmoscopic appearance was such as in itself to have justified the diagnosis of exudative choroiditis with secondary detachment of the retina. It was the existence of mammary cancer which determined the correct diagnosis. In this respect, as well as in the general infiltration of the choroid, this case presents features identical with those of the one which I report. It adds another to the list of female patients, and to those in which both eyes were involved, and to the number originating in the mammary gland. The total number of reported cases, is, therefore, now twenty-one, and of these sixteen have been women. Under date of October 21, Mrs. H. was examined, and there was discovered detachment of the retina in the infero-nasal quadrant of the remaining eye. Beyond and near the ciliary region small isolated brown spots were seen in the choroid. It seems most probable that this eye is likewise attacked by carcinomatous disease. She has had a cancerous tumor removed from the right breast during September.

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2. SARCOMA OF THE CHOROID.

Mrs. E. T., aged 50, was first seen February 23, 1886. She had for a long time suffered from pelvic peritonitis and associated ailments, and been under care of Dr. T. A. Emmet, who referred her to me when symptoms of disease appeared in her right eye. While reading, a rainbow appeared before the eye, obstructing the vision, and she afterwards described the appearance as that of a scimeter constantly in front of her. There was slight refractive error. $V = \frac{18}{20}$. Examination discovered a hemorrhage which began just outside the disc, and extended on a curved line below the horizontal meridian upward and outward toward the equator, where it could no longer be traced. It resembled a large leech in outline. After a few days floating bodies appeared in the vitreous which were apparently the fragments of the clot separated from the retina and broken

into pieces. During the succeeding eight months absorption of the blood slowly took place until vision with + 1/48 s = $\frac{18}{20}$ and the fundus seemed normal.

November 12, 1886. Looking very obliquely up and outward through the dilated pupil one can see a cluster of vessels projecting into the vitreous, and not connected with the retinal circulation. There is at this locality detachment of the retina, which is now for the first time discernible. Three months later, and a year from the first attack in the eye, the retinal detachment was greater and could be seen through a small pupil occupying the upper and outer quadrant of the fundus. In June, vision had fallen to 0. 4 with the best correction; minute yellow dots seen clustered at the macula. At this time, seventeen months after the outbreak, suspicion is awakened that the detached retina conceals a tumor. Six months later more positive symptoms had declared themselves. The pupil a little dilated and oval, at the upper and outer part of the sclera are two anomalous large vessels; between them a black speck: T normal. There is a black mass pushing from above, and outwards towards the middle of the globe, on whose surface are no blood vessels visible, but it gives under bright oblique illumination a reddish reflex. Diagnosis of tumor, which had already been intimated, was now definitely declared, and confirmed by Dr. Knapp. Enucleation advised, and the operation performed January 3, 1888. On section, a tumor was found in the expected locality, viz., in the ciliary region, about 9 mm. in diameter, and a melano-sarcoma, as described in the following letter:

NEW YORK, Aug. 12, 1896.

DEAR DR. NOYES:

Microscopical examination of the tumor found in Mrs. T's eye, proves it to be a melano-sarcoma which has developed from the choroid immediately posterior to the ciliary body. The growth appears to have developed from the layer of large vessels. The ciliary body, the choroid in the immediate vicinity, the sclera and the retina are infiltrated with pigmented sarcoma cells. A portion of the post-ciliary retina appears to have taken part in the formation of the tumor, probably in a secondary role. The peculiar shape and arrangement of cells in parts of the growth indicate a development from the cells from that portion of the retina which are epithelial in

origin. The occurrence of mixed mesoblastic and epiblastic tissues in the formation of tumors has been observed in other parts of the body and I do not see why it should not occur in this part of the eye.

Very truly yours,

JOHN E. WEEKS.

The noteworthy points in the history are: that the onset of trouble was a large retinal hemorrhage, whose precise point of origin could not be discovered but was probably in the ciliary region; nine months later detachment of the retina ensued, which slowly increased but presented no features to awaken suspicion of tumor until after six months more had passed. At this time the dark hue and apparent solidity of the mass attracted attention. After another six months, there was no reasonable doubt of the nature of the disease. There was at no time very serious inconvenience, much less was there acute pain, but the patient could use her eyes for much of the time to only a limited degree, and complained considerably of this disability.

It will be noted that the choroidal tumor was a primary lesion, that when removed it had probably been growing at least a year, and perhaps for a longer period. The patient was seen in October, 1895, nearly seven years after removal of the eye, and is entirely free from local recurrence, and from any sign of cancerous growth in other parts of the body. Her health has much improved. The exemption from relapse or infection after so long a period constitutes the reason for reporting the case.

The urgency of prompt enucleation is recognized to be very great in cases of choroidal or uveal sarcoma, not merely on account of the liability to severe local inflammatory symptoms, but because, being the primary disease, infection and propagation to other parts is very prone to occur. On this subject, however, our judgment cannot be the same to-day as it was, say, five years ago. Larger experience shows that a long period of exemption occurs with greater frequency than was formerly believed. Fuchs (der Sarcom der Uveal tractus, 1882, p. 276) put the average duration of life in forty-five cases at two years — the largest period of exemption being five years — death by metastasis. In his text-book he merely declares that "sarcoma of the choroid is to be regarded as one of the most malig-

nant of diseases — one which in very many cases ends in death." (American edition, 1892, p. 325.) We have in a paper by J. B. Lawford and E. Treacher-Collins, Royal London Ophthalmic Hospital Reports, December, 1891, notes of one hundred and three cases of sarcoma of the uveal tract in which the eye was removed, tabulated with a view to prognosis. In seventy-nine the after-history could be traced. Of these, thirty-nine were alive, and forty had died. Of the forty deaths, twenty-one died within two years, and nineteen survived for periods varying between four and eleven years. In twenty-six of the forty cases of death, the cause was known to be by metastasis, and the average duration of life was two years and four months. Of thirty-nine cases, known to be living, twenty-seven had survived for periods varying between three years and nine and one quarter years, two survived sixteen years, and one survived eighteen years. Considering these to be permanent cures in a sense sufficient for practical purposes, the recoveries amount to 25%. There are also thirteen cases living at periods varying from thirty-five months to fourteen months — while six cases had been observed during periods varying from ten months to seven months. It is not claimed that exemption for three years precludes the possibility of death by metastasis because cases of this occurrence after longer terms of escape are above mentioned, but the general tenor of the study of these cases teaches that a decidedly more favorable prognosis may be held than was regarded possible previous to five years ago.

Some final observations may be pertinent respecting contrasting features of carcinoma and sarcoma of the choroid respectively. Carcinoma is extremely rare, apt to appear about the posterior pole, is small, never great in thickness, liable to diffuse extension, does not quickly occasion severe local symptoms; with notable frequency has been known to affect both eyes, is itself metastatic, seldom extends outside of the globe, does not of necessity compel immediate enucleation. Sarcoma is by far the more frequent, attacks any portion of the uveal tract, is apt to be a massive tumor, may fill the globe, is disposed to grow upon the exterior of the eye, to extend into the optic nerve and to appear in the orbit, involvement of both eyes almost unknown, severe local symptoms likely to arise early; even though

these are absent prompt enucleation is imperative because it is a primary lesion and may at an early stage produce infection. In both carcinoma and sarcoma detachment of the retina is a frequent and early occurrence. The most recent account of intraocular tumors is by Axenfeld; Spezielle pathologische, Morphologie und Physiologie, der Sinnesorgane — Lubarsch und Ostertag, Wiesbaden, 1896. He relies chiefly upon the work of Fuchs, 1882, and although he mentions the paper of Lawford and Treacher-Collins he does not analyze it, and of course fails to present the more favorable views which this paper entitles us to hold.

DISCUSSION.

DR. C. S. BULL, New York. — A word in regard to the point Dr. Noyes made in reference to the tumor in the region of the macula. I think I would accept everything he has said in the matter of therapeutics if he is willing to make a distinction between patients having intraocular growth without any history of previous growths elsewhere in the body, and patients having a distinct history of such growths. I would be willing to postpone an operation and run the risk of extension provided there had been no history of malignant disease in that patient or in his family, but if such history existed, I would not be willing to take upon myself the responsibility. The tendency is more marked in such cases for rapid growth than in patients free from such history.

DR. H. KNAPP, New York. — There are only about two dozen cases of metastatic choroidal tumors on record, all having much the same history. I have seen one case in the living where nothing could be done for the eye. Their progress is slow and it is best not to attack them unless there is great discomfort. A little over ten years ago I presented a picture of a small intraocular tumor near the macula measuring $2\frac{1}{2}$ mm. in diameter, which I think was smaller than the one here presented. It was easily distinguished, sharply circumscribed, and the tumor blood vessels very distinct. The retina appeared to be healthy. The man had only a slight opacity in his field of vision, but I advised him to have the eye removed, and he consented. He kept perfectly well for ten years, or more, and died last year of the ordinary symptoms of metastatic disease of the liver. In regard to the life of patients suffering from intraocular sarcoma, I think they all die of the disease if you give them sufficient time. I have followed cases for twelve or fifteen years, without any symptom of relapse, then they began to get

pale, and developed fatal sarcoma of the liver. I have a number of patients on record where the operations were done between five and twelve years ago, and I am told they are perfectly healthy, but there are cases recorded where patients have lived for twenty years and then eventually died from secondary tumors. So, whenever there is once a malignant sarcoma in the eye, be it never so small, it is actually at that time already disseminated

DR. ARTHUR MATHEWSON, Brooklyn. — In regard to the small size of tumors, I have had one which is a little thicker, but not so broad as this. Some metastatic tumors appeared in the orbit, but a few months later all signs of them were gone. Some years later he died of liver sarcoma and after death the tissues of the orbit were examined but no trace of sarcoma was found.

DR. O. F. WADSWORTH, Boston. — There should be a sharp distinction made between primary sarcoma of the choroid and the intraocular growths of metastatic origin, as is carcinoma. A few years ago I reported a case of metastatic carcinoma of the choroid to this society. When I first saw the patient I made out the growth and advised enucleation, and it was only then that I learned that a growth had been removed from the breast some time before. Under those circumstances I told the patient that it was unnecessary to operate then, that operation might just as well be deferred until uncomfortable symptoms were felt. The lady, however, decided to have the eye removed and it was done. With regard to sarcoma of the choroid, which is certainly very malignant, I think we must operate as early as possible. If there is any chance of stopping the growth, it should be greater after early removal. A few years without recurrence is not sufficient to give immunity to the patient. Dr. Knapp has said that these growths always recur if time enough is given, and perhaps that is so. Certainly one must not feel safe for many years. But as certainly recurrence may not occur for a very long time. Within a few months a man came to me and reminded me of his brother-in-law whose eye I had removed twenty-two years ago, and told me that the man was now in good condition and in perfectly good health. The operation was done for sarcoma of the choroid, though the diagnosis of tumor was not made before the enucleation. The man came to me with a staphylomatous and hard eye, and was suffering pain. Hemorrhage in the vitreous prevented any vision of the fundus. Afterwards a growth was found, which extended from near the optic nerve to the ora ser-

rata, and perhaps one-third of the way around the globe in the equatorial direction. The case was reported in the Transactions of this Society for 1874.

Dr. Emil Gruening, New York.— Dr. Noyes raises the question as to whether it is advisable to temporize with these cases. It is manifest that in cases of extraocular sarcoma we have no hope at all, but in the intraocular cases it is shown that there is some immunity. Cases of immunity running over many years are quite frequent. From this standpoint I think we are not allowed to temporize. When we have reason to believe that the case is of cancerous character we should urge upon the patient the necessity for prompt operation.

Dr. R. A. Reeve, Toronto, Canada. —In such a discussion a year or two ago, I mentioned a case in which I had taken out an eye containing a melanotic sarcoma. The patient came back fifteen years later with a sarcoma of the orbit, having at that time intense cephalalgia. He lived two years longer, however.

Dr. W. F. Norris, Philadelphia. — I think I have previously mentioned in a discussion at this Society a case where I operated fifteen years ago, and the patient is living in good health. It was also a spindle-celled sarcoma.

Dr. B. Alex. Randall, Philadelphia.— Following the suggestions of Dr. Hansell I would like to ask if it is not the general experience that in these intraocular growths there is at least a *stage* of increased tension. I have certainly seen a transient increased tension in almost all of them.

Dr. W. F. Mittendorf, New York.— I would like to report that my experience has not been at all so favorable. I have made it a point to follow up such cases, and they have all died in from one to five years, except two or three that have been operated upon within the last two years. I feel, however, inclined to remove the eye always for such growths.

Dr. H. D. Noyes, New York.— I remember when I removed the eyeball of a lady, for sarcoma, that I said to my assistant that the general prognosis was death within two years from invasion of the liver. I think it is only fair to put on record cases exceptional to that old rule and I am glad so many cases have been given to improve the prognosis. No hard and fast rules regarding the operation can be laid down.

IVORY EXOSTOSIS OF THE ORBIT.

BY DR. ROBERT SATTLER,

CINCINNATI, O.

This contribution to the diseases of the bony orbit adds another typical example of ivory exostosis to the list of published cases.

The rather uncommon occurrence and the accepted unknown origin of these growths, surround each new observation with interest.

Proptosis is common to all. In most cases it is from the first a conspicuous symptom. The hard osteophytes of this region have other characteristics in common. They necessarily cause great deformity. Their growth is slow and often painless. In most cases they spring from the thin inner wall, adjacent roof, and margin of the orbit. In texture they are hard and of ivory-like compactness. In shape and dimensions they offer the greatest variation. Irregular or nodular in form, from a small crest-like projection, they grow to such proportions that they may completely fill the cavity of the orbit or even project beyond its confines. Their attachment is generally firm and broad and is surrounded by an area of sclerosed or hypertrophied bone. Vision is not necessarily impaired, but the movements of the globe are even during the early stages of growth more or less interfered with, and as the lumen of the orbit is more and more encroached upon, they become more restricted.

The etiology of exostosis orbitæ is obscure. Traumatism, syphilis, and scrofula, are alleged causes and in many cases furnish the predisposing element. The presence of localized inflammation or degenerative processes attacking either the layers of the bone itself, the diploë, the pericranial or dural covering, must be assumed. What the real nature, however, of these pathological changes may be, or, where their starting point is, remains to be determined.

In a certain number of cases it would appear that they are associated with and dependent upon low grades of periorbitis and ostitis, the result of chronic lesions of the adjacent sinuses.

The accompanying report of a case of ivory exostosis of the inner wall of the orbit (right side) evidences that the bony growth was connected with pathological changes in the sinus frontalis and anterior ethmoidal cells. The patient, however, never experienced evidences of periorbitis or acute trouble in the sinus. He cannot recall to mind tenderness or discomfort, much less, severe pain, in the region affected.

The discovery that the sinus frontalis was the seat of pronounced disease was only made at the time of the operation.

Another case observed several years ago offered even more convincing proof of the causal relationship between exostosis and pathological changes affecting the frontal sinus and the anterior and middle ethmoidal cells.

A. T., aet. 27, for five or six years has had attacks of periorbitis at intervals of several months. The region affected was the upper and inner margin of the left orbit. During these attacks, which often lasted several weeks, proptosis and diplopia were prominent symptoms. The suffering was excruciating. Palpation disclosed bulging of the inner wall of the orbit and exquisite tenderness to even the slightest pressure. Careful examination of the inner wall and roof of the orbit led to the discovery of a crest-like projection suggesting an exostosis. After the subsidence of the acute symptoms its outline and projections could be readily determined. He remained under

observation for two years and an expectant course of treatment, (consisting of local treatment to the nose, mercurials, etc.,) was resorted to with negative results.

The patient finally consented to the proposition which I made when he first consulted me, and that was to open up and explore thoroughly the sinus frontalis and the adjacent cavities. A free opening was made with chisel and mallet from without. The pericranium was thickened and eburnated. A large opening was made in the sinus. It was found enormously dilated and filled with glairy mucus but no granulation tissue was present. The most careful search could not discover evidence of caries. The anterior ethmoidal cells were then explored and also found dilated and filled with stringy mucus, but no evidence of bone ulceration could be detected.

Tamponade with iodoform gauze through the external opening (which was so large that the little finger could be introduced easily) was resorted to for several months with complete subsidence of the annoying symptoms and an arrest of growth of the osteophyte on the nasal side of the orbit. It is probable that the operative interference resorted to in this case averted the growth of an orbital osteophyte.

Pain, recurrent attacks of periorbitis, hyperostosis of the entire marginal region of the orbit and unmistakeable evidences of sinus disturbance were all prominent symptoms.

In the case which furnishes the subject matter of this contribution, all these symptoms were conspicuous by their absence. From the time he first noticed the growth until it reached its present dimensions, *i. e.*, during three years, he never experienced pain and there was complete absence of all clinical evidences of sinus disease. The only annoyance was the deformity and increasing exophthalmus.

The history of this case is as follows: E. M. R., an intelligent, well-nourished young man of twenty-five, with an excellent family history and previous good health, no history of syphilis or serious injury, noticed for the first time about three years ago, a small, hard nodular projection under the upper and inner margin of the right orbit. When he discovered it it could only be felt but not seen. Six months after this he

began to notice occasional diplopia and increasing prominence of the right eye, and from this time the tumor was distinctly visible. The growth was slow during the first two years but advanced more rapidly during the last year.

To hide the increasing prominence and deformity of the eye, he commenced to wear a shade and, as the diplopia was also relieved by this device, he continued his work without interruption until he visited Cincinnati, in February, 1896, for consultation. With the exception of what he terms "winter colds," he was in good health. These catarrhal paroxysms recurred with regularity during the fall of the year and lasted until spring. He was never compelled to consult a physician for this disturbance. He did not notice that these colds in any way modified or influenced the condition or the growth of the bony mass, and he never experienced pain or even tenderness in or about the steadily increasing growth in the right orbit. The only unpleasant sensation he can call to mind was that firm pressure against the growth brought on a sensation of faintness.

On February —, 1896, the date of the first examination, there was found an enormous degree of exophthalmos. The globe was dislocated outward, downward, and forward. The lids were much stretched over the prominent eyeball, and the palpebral fissure was transformed into a long, narrow, slit-like opening. More forcible attempts to separate the lids caused extrusion of the globe. Occupying the upper and inner margin of the orbit was a hard, nodulated mass, projecting in this locality fully one-half to three-quarters inch beyond the margin; with the finger this could be traced obliquely backwards towards the apex of the orbit. Firm pressure against this mass brought on syncope. A most searching examination disclosed a normal fundus and unimpaired function of the eye. With corrective lenses (mixed astigmatism, due probably to the compression of the globe,) V. = 1.

On the following day an operation, having for its purpose a careful exploration of the orbit in order to determine the nature and attachment of the growth, was undertaken. The lid commissure was first carefully closed with three firm catgut

sutures. A long incision within and parallel to the eyebrow, and another at right angles to this towards the frontal region, just over the prominent part of the growth, afforded satisfactory inspection and palpation of the tumor. It was found bony and hard and made up of a number of larger and smaller nodules with a broad, firm base. The margin of the orbit and the adjacent superciliary region was enormously thickened. With chisel and mallet, the thickened free margin of the orbit was first removed in order to reach more effectually the attachment of the growth. This accomplished, a deep groove was chiseled into the sclerosed bone around the base of the growth. An attempt was then made to embrace the whole mass in the grasp of a strong bone forceps. Only after firm traction and twisting, and not until several attempts to deepen the groove around the growth, was it removed from its attachment to the bone. We then discovered that the frontal sinus had been opened, and also the anterior ethmoidal cells. A portion of the os planum was splintered and removed. A thick ropy substance exuded from the sinus and cells. After thorough cleansing and curetting of these cavities the opening was packed with gauze. The weight of the bony growth was 15.3 grammes. Recovery was unattended by complications.

The interesting features of this case are briefly reviewed: the painless progress of the exostosis, the absence of all local and subjective disturbances pointing to chronic ethmoiditis or sinus disease and the unimpaired function of the eye. It also suggests a probable origin for the exostosis, if we assume that localized trophic disturbances of the adjacent bones or their coverings came about as necessary sequences of the chronic lesions of the accessory sinuses of this locality. Lastly, it was interesting because the attacks of syncope which could be so readily produced by firm pressure against the tumor suggested an intra-cranial attachment or at least a rarefaction of the orbital plate of the frontal bone. That this was not the case was disclosed by the operation. The syncope was probably due to a pushing in of the entire inner wall of the orbit and compression of the thick mucilaginous contents of the distended sinuses.

DISCUSSION.

DR. H. KNAPP of New York. — Sarcoma has been so completely discussed that it has overshadowed Dr. Sattler's paper. Such cases as he reports are rare. With regard to the method of removing them there are some that break loose from their attachments and are easily removed. In general, I think that all kinds of these tumors should be removed as early as possible.

DR. EDW. FRIDENBERG of New York. — The question of removing exostosis of the orbit is not quite so simple, for the results of treatment in former years have been bad. The majority of the patients die of meningitis. Latterly the results have been better, because, I suppose, of antisepsis, and because we have learned better how to operate. Often in these cases, if an attempt is made to remove parts of the tumor, where its entire removal seems impossible, the danger is very great. It is difficult to state in any case whether we can obviate the danger. Outward appearances do not tell us accurately where it extends inwards. For that reason I was pleased to hear Dr. Sattler state that he made a exploratory incision, and after proving that it could be removed, he did so. I think we are justified in making an exploratory incision and promising the patent that he will continue the operation if we find it advisable.

DR. O. F. WADSWORTH of Boston. — I should like to point out a condition which may give rise to a mistake in diagnosis. In the case of a tumor over the frontal sinus, after making several examinations, I was convinced that it was bony, but there proved to be only a dense periosteum firmly distended by thick pus.

DR. J. A. ANDREWS of New York. — In connection with Dr. Sattler's admirable paper I wish to emphasize the advisability of operating early in exostosis of the orbit. It is, of course, not so imperative to operate early in these cases as in sarcoma, but we should not defer the operation for an indefinite time.

A CASE OF TUBERCULOSIS OF THE CONJUNCTIVA, PROBABLY PRIMARY, FOLLOWED BY GENERAL INFECTION AND DEATH.

BY DR. FREDERICK E. CHENEY,

OF BOSTON.

My patient, a little girl eleven years of age, was first seen at the Massachusetts Charitable Eye and Ear Infirmary, February 20, 1895. For about three months it had been noticed that the left eye was watery, and at times discharged a little yellowish matter. Of late, the upper lid had dropped a little.

Upon examination, there was found to be a slight ptosis and œdema of the left upper lid, and when the lid was everted a lesion was discovered on the conjunctival surface, which presented the following appearances: Situation at the outer side of the center of the tarsal cartilege, and nearer the upper than the lower border. Shape, a fairly well defined oval about 6 mm. horizontally, by 4 mm. vertically. The borders were slightly elevated, and the surface was covered with numerous small, rounded granules, grayish-yellow in color, rather hard and gristly to the touch, and bleeding on slight irritation. The conjunctiva of both lids was moderately injected, and there were a few shreds of thick, stringy, yellowish matter. The globe was perfectly normal. Examination of right eye negative. Glands in front of left ear somewhat enlarged. The diagnosis was made of probably tuberculosis of the conjunctiva.

An examination of the child's general condition was made by Dr. J. J. Minot, at the Massachusetts General Hospital, two days later, with the following result. Four years ago she had measles, followed by bronchitis. Since then she has had an occasional slight cough, but it has been no worse of late. No sputum; no pain; appetite poor; constipation; frequent nosebleed. Examination of lungs negative. Temp. 99.4. Family history negative. Two older sisters living, both perfectly well.

The mother, who is an intelligent woman, says she is very sure there has never been consumption in either her or her husband's family.

A number of slides were prepared from the conjunctival ulcer and examined at the hospital; also at the medical school by Dr. McCullem. Numerous tubercle bacilli were found, which left no doubt as to the diagnosis. Examination of nose and throat by Dr. Algernon Cooledge, Jr., gave a negative result.

The patient was again seen March 2d. There was no marked change in the appearance of the ulcer, but along the upper inner border of the tarsal cartilege there had developed a few small tracoma-like grandular elevations. March 7th. The growth had increased considerably in size, and was more grayish in color. There was also two small, round, grayish ulcers near the upper inner border of the tarsus, which had apparently resulted from a breaking down of the grandular elevations noticed at the last visit. A few swollen glands on the left side of the neck were noticed for the first time. March 9th. Under ether, the larger tuberculous area was carefully dissected out, the cut being carried entirely through the tarsal cartilege, as were also the small ulcers at the inner angle of the lid. There was no return of the growth over the area first noticed, but a number of small ulcers appeared from time to time at the inner upper tarsal border, which were removed, and the surfaces cauterized. After April 6th there was no recurrence of ulceration or granulation of the conjunctiva. Under tonics and good food the child improved considerably in her general appearance, but the enlarged glands in front of the left ear did not disappear, and those of the neck continued to increase in size, not only on the left but on the right side as well. She was last seen at the hospital May 26th, when there was a very decided change for the worse in her condition. For two weeks she had had no appetite, and had lost flesh rapidly. There was a marked increase in the size of the glands of the neck, especially on the left side; no cough; slight elevation in temperature. Examination of chest by Dr. Minot, negative. Eye perfectly normal.

The child died July 4, 1895. The mother wrote me that the throat became very troublesome soon after her visit to the

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hospital. She experienced great difficulty in swallowing, and two days before her death "the throat looked a grayish-white color. She only coughed when an attempt was made to swallow." Dr. Chas. Jordon, her physician, wrote me that the cause of death was "tuberculosis, involving the right lung and, to all appearances, the messentery gland."

It is of course impossible to say with certainty that this case is one of primary tuberculosis of the conjunctiva, though it seems probable that it is. Repeated examination of the chest, throat, and nose were negative in result, and aside from an occasional slight cough nothing in the child's condition suggested trouble with the lungs or throat. A thorough removal of the tuberculous conjunctiva did not, certainly, prevent a general tuberculosis; but when it is remembered that the glands in front of the left ear were involved when she was first seen, and those of the neck soon after, the extension of the process is easily accounted for. The early removal of these glands might perhaps have given a different result, and in a similar case it would certainly be the course I should advise.

TUBERCLE OF THE IRIS.

BEING A REPORT OF A CASE OF TUBERCLE OF THE IRIS, WITH REMARKS ADDRESSED TO THE INQUIRY: DOES TUBERCLE EVER OCCUR PRIMARILY IN THE IRIS?

BY JOSEPH A. ANDREWS, M.D.,

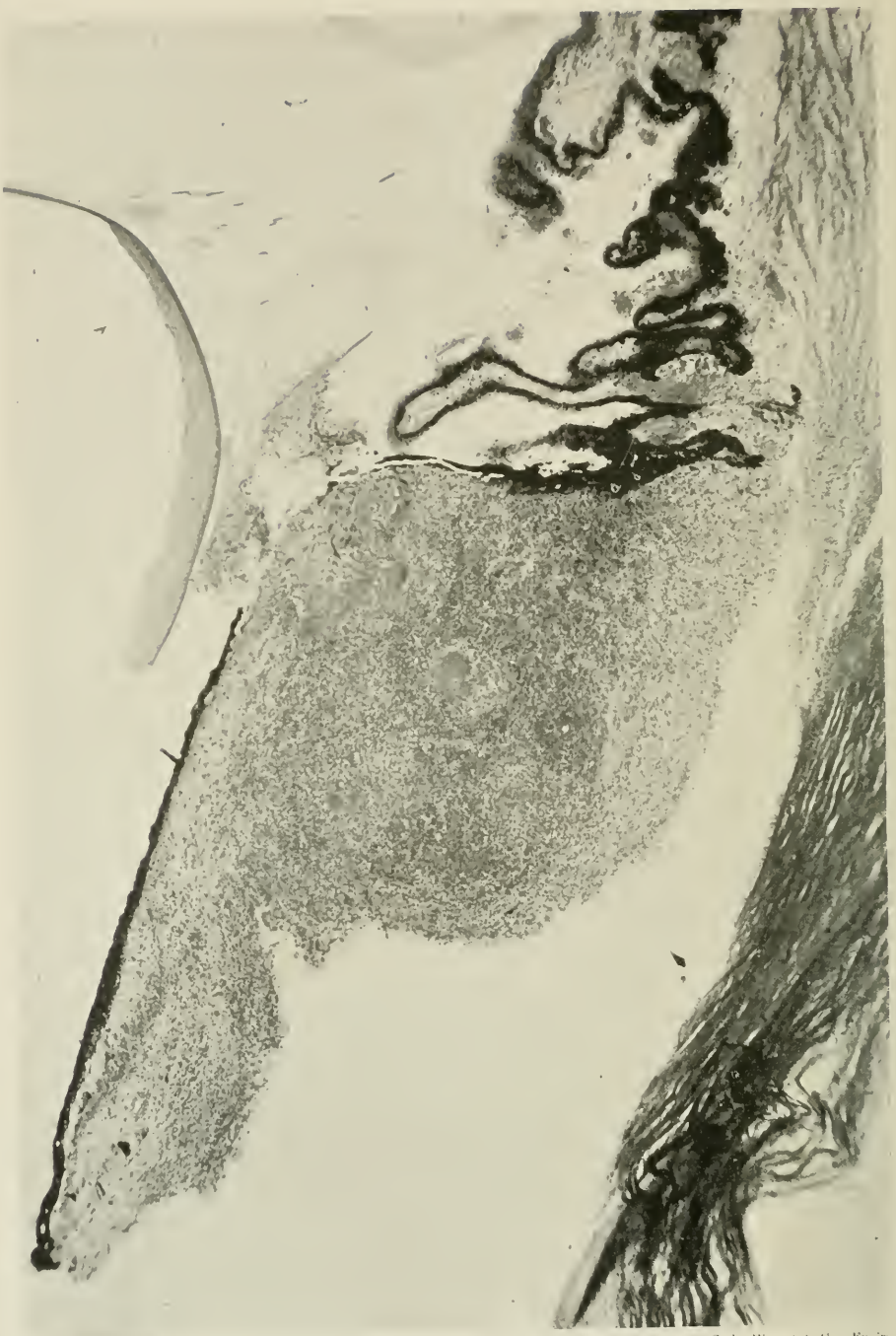
NEW YORK CITY.

Tubercle of the iris is a comparatively rare disease. It has been mistaken for syphilitic gumma, and even for malignant disease. It is claimed by some observers that it does occur primarily in the iris. With a view of ascertaining the facts bearing upon the differential diagnosis, and the question relating to the primary seat of the disease, I have prepared a brief synopsis of all the cases of tubercle of the iris which have been recorded in medical literature up to the present time.

Cases of tubercle of iris in which the eye was enucleated, including successful and unsuccessful cases:

CASE I. Andrews, J. A. The patient, a girl, æt. 17 years, was seen by me on February 24, 1894, in consultation with Dr. C. W. Townsend. The lower half of the iris of right eye was occupied by a nodular growth of a light yellowish-gray color, with a few faint red blotches resembling hemorrhages; no vessel on growth; faint circumcorneal injection; sclerotic white (the colored drawing which I pass around shows the appearance of the growth well); cornea clear; upper half of iris was apparently unchanged; tension normal; no pain; no signs of intracranial disturbance; nor was there evidence of tubercular or syphilitic disease elsewhere in body; family history negative as to syphilis and tuberculosis. The patient had been under treatment for gumma of iris for two or more months before consulting Dr. Townsend. The effect of mercurial treatment had been negative. It was believed that syphilis could be excluded; moreover, the clinical picture of gumma of iris was absent. The case, it appeared to me, resolved itself into the question of the diagnosis, between sarcoma of the iris and tubercle. In color, sarcoma of iris varies. It may have a *flesh tint* or be *reddish*-gray, blackish, or light brown; the color depending on the amount or absence of pigment and the degree of vascularity. From what I had seen of tubercle of iris in rabbits after inoculation, I was disposed to regard the case as one of tubercle. The nodular appearance, color of the growth, and course of the disease, and absence of active inflammation pointed to tubercle, and this was my diagnosis. I advised enucleation. The parents of the girl would not consent to the operation. Dr. Mittendorf, who was next asked to see the patient, expressed the opinion that the trouble was, in all probability, the result of a simple inflammatory exudation, and advised tentative treatment. Dr. Townsend informed me, that four or five weeks after I had seen the patient with him, she showed signs of intracranial disease, whereupon the eye was enucleated.

I am indebted to Dr. Mittendorf for the eye, which I obtained from him for microscopic examination. The photomicrograph, Plate B, which accompanies this paper (for which I am



Dr. Andrews' Case

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TUBERCLE OF IRIS

1-4 inch Bausch & Lomb Objective—190 diameters

indebted to Dr. Edward Leaming of the College of Physicians and Surgeons, New York) was made for me with a ¼-inch Bausch & Lomb objective × 190 diameter, from one of my sections of the growth. The clinical features of the growth are shown in the colored picture on Plate A. In the absence of any indication of a syphilitic taint, the photomicrograph may be regarded as furnishing a picture of the histological characteristics of tubercle. In the cell infiltration are seen nodules consisting of closely-crowded lymphoid and epithelioid cells. In the middle of the nodule is seen a poly-nucleated giant cell; immediately surrounding the giant cells is necrotic tissue. The connective tissue envelope usually found in gumma is absent in all of the sections. Other sections of the growth show cell infiltration of ciliary body. All other parts of the eye — *i. e.*, sclerotic, cornea, choroid, retina, and optic nerve — were apparently normal. No inoculation experiments were made by Dr. M. The eye had lain so long in Müller's fluid that I did not expect to be able to demonstrate presence of bacillus tuberculosis. I removed as much of Müller's fluid as I could by soaking eye in distilled water, after which it was transferred to alcohol. A great many sections were made and stained with Ziehl's fluid; some of the sections remaining in the staining fluid for twenty-four hours. The bacillus tuberculosis could not be found.

CASE II. Gradenigo (Venice, 1868), see "Annal d'Oculistique," 1870, p. 175. Man, aet. 21 years. On right side conjunctival oedema, with intense pericorneal injection, and *round gray spots* of pin head size in cornea (Descemet's memb.?). Iris showed slight diffuse discoloration, with six or seven submiliary nodules; contracted pupil and posterior synechiæ. Hemorrhages occurred several times in eye. After some time several nodules could be seen in fellow-eye, but unaccompanied by inflammatory symptoms. Eye was not enucleated. After three months patient died. *Autopsy* revealed general miliary tuberculosis, with both old and recent tubercles. This is the first recorded case of tubercle of iris.

CASE III. Weiss ("Arch. f. Ophth.," 1877, p. 57). Man, æt. 51 years. Patient had recently recovered from pneumonia, when eye trouble began. Well-characterized tubercle were found in all parts of eye. Patient was apparently healthy.

Eye was enucleated. Five months after enucleation there developed upon upper jaw, or on side corresponding to diseased eye, a tumor which, after removal, proved to be an enlarged lymph-gland, containing cheesy matter and tubercles.

CASE IV. Guilio Saltini ("Annal d'ottal.," Vol. IV, 1875, p. 127). Girl, æt. 16 years. Attempted excision, but had to enucleate. Patient did well?

CASE V. Samelsohn ("Niederrheinische Gesellschaft für Natur und Heilkunde in Bonn," December, 1878). Girl, æt. 17 years. The tumor was nodular and of a *yellowish-white* color; it extended to middle of pupil in horizontal meridian, and had no vessels. The growth perforated the eyeball. Samelsohn reported again on the case in 1880. Before enucleation small particles of tumor were removed from anterior chamber, and put into eye of rabbit. They were completely absorbed; tubercle of iris did not ensue. Immediately before enucleation eye was opened, and part of the granulation mass placed in eye of rabbit. This experiment resulted in nothing, but upon a second and third trial the inoculation was followed by positive results — *i. e.*, tubercle of iris. In one of the rabbits tubercles spread throughout the organs of body, with exception of lungs.

The microscopic examination of the cheesy mass in anterior chamber had been fruitless, but inoculation experiments confirmed the diagnosis. This is the first case on record in which the diagnosis of tubercular eye disease was confirmed by inoculation experiments. There were other signs of tubercular disease in patient; case was, therefore, not one of primary tubercle of iris.

CASE VI. Parinaud ("Société de Chirurgie," July 9, 1879). Boy, æt. 12 years. *Whitish* infiltration in iris. Pus in ant. chamber. Trouble began as progressive dimness of sight, without pain.

CASE VII. Alexandre ("Recueil d'ophth.," 1884). Antecedent family history, negative. Enucleation. Inoculation of eye of dog, twenty days later, tubercle of iris appeared, containing *tubercle bacilli*.

CASE VIII. Perls ("Arch. f. Ophth.," Bd. XIX, p. 221,

1873). Boy, æt. six months. Mother said to be healthy; father had contracted syphilis a year before the boy was born. Father had infiltration in apex of right lung, followed by formation of a cavity. Boy showed no signs of congenital syphilis. Boy was strong and well nourished. When first seen by Perls boy was suffering from acute *kerato-iritis*. In iris of left eye was a slightly-elevated, circumscribed nodule, which Perls regarded as a gummy tumor. Prof. Julius Jacobson concurred in this diagnosis. In spite of use of mercurials, eye trouble grew worse, but general condition of boy remained good. Gradually apex of child's right lung became infiltrated, and he became reduced by cough, loss of appetite, and slight fever. Convulsion occurred three days before death, which took place about one month after first seen by Perls. AUTOPSY showed *disseminated miliary tuberculosis*. The trouble appears to have begun as a cyclitis, progressing to suppurative corneal ulcer and infiltration of entire iris. Plainly not primary tubercle of iris.

CASE IX. Arthur Costa-Pruneda ("Arch. f. Ophth.," xxvi, III, p. 174, 1881). Records two cases of tubercle of iris. I. Girl, æt. 38 weeks. Not known how long eye had been affected. Born with sound eyes. No general disease. Mother had night-sweats and cough, with increasing weakness. L. E. purulent irido-cyclitis, with ectasia of ciliary region; slight irritation. *Enucleation.*

CASE X. Successful inoculation experiments. II. Boy, æt. 4 months. Iritis, with numerous *grayish nodules*. Syphilis excluded. *Enucleation.* Child died seven months after enucleation. Death believed to have been caused by tubercular meningitis. No inoculation experiments. No autopsy.

CASE XI. Deutschmann ("Arch. f. Ophth.," xxvii, I, p. 317, 1881). Tubercle of iris and ciliary body. Boy, æt. 5 years. Iritis, with complete closure of pupil; high degree of inflammatory degeneration; duration of disease, about 14 days. No trauma; eye was hard; whole extent iris and pupil of *gold-yellow* color; cornea slightly hazy. Prof. Leber, under whose care patient was, attempted to excise the growth, but the operation was followed by more inflammation. *Enucleation.* Heal-

ing was good. Child was doing well six years after enucleation. The eye was sent to Deutschmann for microscropic examination. No inoculation experiments. Deutschmann calls the case a *genuine iris tuberculosis.* Full account of histological examination.

CASE XII. Wolfe, J. R. ("Br. Med. Jour.," 1882, Vol. II, p. 299). Boy, æt. 8 years. Tubercle followed injury to eye. The tumor was divided into nodules of a *yellowish-white* tinge; fine vessels on surface of growth. Attempted to excise, but had to enucleate eye.

CASE XIII. Rütter, H. ("Arch. of Ophth.," 1882, p. 406). Case from Hirschberg's clinic. Boy, æt. 2 years. R. E. normal; L. E. high degree of pericorneal infection. Lateral half of anterior chamber filled with a *cheesy mass;* cornea transparent. *Gray miliary nodules in medial half of iris.* Pupil closed by thin exudation; above in sclera was a prominent *yellowish-white nodule.* Attempted to remove cheesy moss from anterior chamber; four weeks later enucleated eye. Child had twice been at point of death. At time of second attack of illness (cramps), the mother noticed a gray spot "in the pupil" of left eye. Child had marked hydrocephalus.

CASE XIV. Swanzy, H. R. ("Transactions of Ophth. Soc. of United Kingdom," 1882, p. 259). Girl, æt. 2 years. Apparently in good health; no syphilis on side of parents. Father suffered from chr. tubercular disease of right ankle joint. Mother also phthsical. One child died of tubercular meningitis. *Yellow-white* tumor, free from vascularization, situated in upper, outer quadrant of iris. It was 4 mm. long and $2\frac{1}{2}$ mm. wide. In lower quadrant of iris, near pupillary margin, were two minute tumors, size of pin's head. No posterior synechiæ, and but little pericorneal injection. Child seemed free from pain. *Enucleation.* Eye showed histological appearances of tubercle. This case was observed before discovery of bacillus tuberculosis. No inoculation experiment undertaken. Swanzy remarks that he regarded the case as one of *primary tubercle of iris.* Five months after enucleation child was very well.

CASE XV. Schell, H. S. (TRANSACTIONS OF AMERICAN OPHTH. SOC., 1883, p. 472). Colored plate not typical. Boy

æt. 9 years. Projecting from nasal side of pupillary margin was a small *yellowish-white nodule*, tinged with pink, the size of a pin's head; circumcorneal injection, pupil immovable. Vision 0. Eight months after first seen, anterior chamber was nearly filled with new growth which had a yellowish-tinge, with a few minute blood-vessels on its surface. *Intraocular tension* was increased. Eye was tender on pressure, but not otherwise painful. Nine months after onset of eye trouble the eye was enucleated. The microscopic examination is incomplete. It appears that the trouble began as an ordinary plastic iritis, which did not yield to mercury and atropine. Two months later child had well-marked signs of coxalgia in second stage. It appears that child never had been well. Mother had pulmonary phthisis. Twenty-four ounces of pus released from abscess on outer side of child's thigh. After enucleation child did well. Discharge from thigh ceased, and patient left hospital three months later with good movement of hip, and but slight shortening of limb. Dr. Schell remarked that he had removed the eye with hope of preventing extension of the disease.

CASE XVI. Wadsworth, O. F. (TRANSACTIONS OF AMERICAN OPHTH. SOC., 1883, p. 474). Girl, æt. 3½ years. Child's mother had noticed redness of left eye before consulting Drs. Wadsworth and H. Derby. Mother said that except when eye was looked at or drops put in there had been no complaint of pain. Examination showed cornea hazy; bulbus conjunctiva moderately congested; no marked ciliary congestion; pupil moderately dilated; upper portion of iris apparently thickly set with vessels; yellowish reflex from pupil; no record of tension. Diagnosis wavered between glioma and irido-choroiditis. Two weeks later eye was enucleated. At time of enucleation there was considerable circumcorneal injection. Above was a staphyloma in ciliary region. No trace of iris visible. The growth reached forward nearly to cornea; color of growth was *yellowish-white;* numerous blood-vessels and some hemorrhage on surface of growth. Child continued in comparatively good health for five months; then for five or six weeks she complained of headache, and died from tubercular meningitis. No

autopsy. *Bacillus tuberculosis* was found in growth. Although previous to enucleation family history pointing to phthisis was denied; it was learned after death of child that child's father and a brother of father had died of phthisis, and that the patient herself had been subject to bronchial attacks.

CASE XVII. Eperon ("Arch. d' Ophthal.," from Landolt's clinic, 1883, p. 487). Girl, æt. 5 years. Irido-cyclitis and minus tension when first seen; 20 days later hypopion, almost filling anterior chamber; perforation of cornea. *Enucleation.* No inoculation experiment; family history negative.

CASE XVIII. Eperon (ibid., p. 494). Girl, æt. 17 years. Calls this a case of chronic form of tubercle of iris. It was characterized by slow development. One of girl's sisters died of phthisis. Both eyes inflamed with small grayish infiltration in iris. *Iridectomy.* Recovery good; but subsequent history is wanting.

CASE XIX. Standish, Myles (TRANSACTIONS OF AMERICAN OPHTH. SOC., 1885, p. 59). Girl, æt. 14 yrs. Family history negative as to phthisis or syphilis. One year previous to appearance of eye trouble, girl had acute hepatitis. Four weeks before seen by Dr. S., patient had complained of general feeling of malaise. About same time right eye began to trouble her. No history of trauma. Eye became red and sight gradually became dim; not much complaint of pain. Examination showed conjunctiva bulbi somewhat hyperæmic in certain areas, near sclero-corneal margin; cornea somewhat hazy, with several deposits on membrane of Descemet; iris firmly attached to capsule of lens throughout its entire pupillary margin; pupil blocked by lymph. Above pupil, springing from iris near its ciliary border, was a *round protuberant growth*, 2 mm. in diameter, of a yellowish color, slightly tinged with pink; several small vessels seen to course over surface of tumor; vision = 6/200. Case was watched for four weeks, during which time tumor slowly increased to double its size when first seen; no pain; conjunctiva white; *i. e.*, no injection of vessels of conjunctiva; vision then was perception of light only. *Enucleation.* Patient made good recovery. Bacillus tuberculosis found in specimen of tumor.

CASE XX. Knapp, Herman ("Beitrag zur Tuberkulosenfrage." Festschrift v. Helmholz, 1891, p. 30; 16 colored drawings). Man, æt. 25 yrs. Had been treated for months by another surgeon for syphilitic iritis. Slight circumcorneal injection; cornea clear; dirty brown swollen iris with uneven surface and irregular pupil; tension normal; vision 10/30; visual field complete. A number of *grayish-yellow nodules* irregularly imbedded in iris; fellow eye healthy. *Enucleation.* Bacillus tuberculosis not found in specimens of growth. Inoculation of anterior chamber of two rabbits. No reaction for four weeks after inoculation; then, in one of the rabbits, fine nodules appeared in both irides. In another rabbit, thirty days after inoculation, a dozen submiliary nodules appeared in numerous places in iris of right eye. Under slight ciliary injection, the nodules increased in size and number.

CASE XXI. Redmond, D. D. ("Transactions Oph. Soc. Unit. Kingdom," 1892, p. 84). Girl, æt. 10 years. Delicate child. Child had had severe wetting a week before consulting Dr. Redmond, since which time eye had been inflamed. On examination, V. was barely equal to perception of light; pupil was occluded; iris was retracted; very deep ant. chamber. Treatment: Mercury and instillations of atropine, but matters grew daily worse. In a week a *grayish deposit* began to appear in iris, which rapidly increased. In three weeks, perception of light was abolished, the anterior chamber being full of grayish exudation, with little reddish matter on surface resembling hemorrhage; ciliary region had become staphylomatous. Diagnosis of tubercle was made and eye enucleated. Microscopic examination. Cornea and optic nerve normal.

CASE XXII. Higgins, Charles ("Transactions Ophth. Soc. of Unit. Kingdom," 1892, p. 83). Boy, æt. 2 yrs. Healthy looking. Child had a fall one month before first seen by Dr. Higgins, at which time something was found to be wrong with R. E. Had begun to suffer from diarrhœa and pain in head. No history of phthisis in family. Mother had had four stillborn children. When first seen, R. E. showed *yellowish nodule,* was seen in iris near angle of anterior chamber, at its outer and lower part; some smaller spots were scattered about on surface

of iris; there was severe iritis; a film of lymph covered pupil; cornea was hazy; no reflex from fundus; T. + 1; eye appeared to be very painful. Child took gray powder for a fortnight, but eye grew worse. *Enucleation.* Did not demonstrate presence of bacillus tuberculosis. Five weeks later child was fat and in "excellent health"; tubercles in iris; bacillus tuberculosis found in iris. Child made a rapid recovery, and one and a half years after the operation was strong and healthy.

CASE XXIII. Knaggs, R. L. ("Transactions Ophthal. Soc. Unit. King.," 1892, p. 79). Boy, æt. 9 months. R. E. had been noticed by parents two months before consulting Dr. Knaggs, to be altered in color. Examination showed aqueous of R. E. to be turbid; iris cloudy; projecting from anterior surface of iris were from fourteen to twenty white nodules size of pin's head. Except for faint ring of ciliary injection eye was not inflamed. L. E. normal. Child subject to profuse head sweats and bronchial attacks. No external signs of syphilis, and nothing in history to suggest it. Four sisters, a paternal aunt, and a cousin of child's mother all died of phthisis. Mercury had been used without avail. Later growth became larger and of a yellowish color. *Enucleation.* No mention of bacil. tuberculosis; no inoculation experiments. Child died from tubercular meningitis seven weeks after enucleation.

Cases in which tubercle of iris was successfully excised.

CASE XXIV. Treitel, Th. ("Berlinei Klin. Wochensch.," 1885, p. 445). Boy, æt. 12 yrs. Gave history of injury to left eye by falling against a bundle of straw three months before consulting Dr. Treitel. R. E., normal. L. E., V = fingers at 12 ft.; no improvement with glasses. Upper lid slightly swollen; slight photophobia; no change in position or mobility of eye; slight pericorneal and episcleral injection; cornea, slightly hazy; on posterior wall of cornea, in lower half, were five irregularly arranged whitish-gray precipitates about size of pin's head. Small superficial infiltration of cornea, externally near sclera; fine vessels extended to the precipitates on posterior surface of cornea; a *reddish-yellow* colored growth, size of small pea, at middle of temporal half of iris; on surface of growth was a

network of fine blood vessels; surface of growth is uneven; tension slightly diminished; eye not sensitive to touch. No signs of disease anywhere else in body; had chr. bronchial catarrh; no inoculation experiments undertaken; no record of finding of bacillus tuberculosis. Treitel did a second operation (iridectomy) as there was a reappearance of the disease after first operation. Patient was dismissed from hospital and there the history ends. Not convincing as to cure.

CASE XXV. Terson ("Arch. d'Ophth.," 1890, p. 9). Girl, æt. 12 yrs. At outer extreme periphery of anterior chamber there was a *whitish-yellow* growth of size of pin's head; pronounced injection of sclera on level with growth; small grayish spots on Descemet's membrane; epithelium of cornea slightly elevated and wrinkled; no posterior synechiæ; no history of injury. Family history negative as to syphilis and tuberculosis. Treated with mercurials without avail. Four months after first seen, growth was excised through a corneal wound made with a Graefe knife. A small amount of vitreous escaped when growth was excised. Wound healed kindly and patient made a good recovery. Inoculated two guinea pigs. One of the animals was killed twenty days after inoculation; the other was killed thirty-eight days after inoculation. Numerous tubercles found four months after excision, patient was doing well.

Pagenstecher and de Wecker are also quoted as having successfully excised tubercle of iris; but I find no data relating to these cases.

CASE XXVI. Schneller. ("Inaug. Dissert. Halle," 1888). Boy, æt. 5 yrs. Nodular growths on iris were removed by iridectomy. A few weeks later, a new tumor appeared in iris; this disappeared under treatment by inunction and potas. iod. Two and one-half months later, patient was dismissed from treatment with eye perfectly free from irritation. Claims to have proved tubercular nature of growth by inoculation.

Cases of supposed spontaneous cure of tubercle of iris.

CASE XXVII. Liebrecht ("Arch f. Ophthal.," xxxvi, 4, 1890, p. 227). Girl, æt. 10 yrs. Came complaining that right eye had been red for one or two weeks; no pain; slight photo-

phobia. Instillation of atropine revealed following picture in R. E.: Slight ciliary injection; pupil attached below to capsule of lens. In center of somewhat swollen iris, were *whitish* nodules of different sizes. No vascularization surrounding the nodules; nodules were not vascular. Vision, normal. Ophthalmoscopic examination showed distinct haze of disc and neighboring retina; whitish haze about macula; cloudy vitreous; the participation of ciliary body showed itself by presence of numerous floculent deposits on Descemet's membrane. After four weeks, nodules began to become smaller; the other symptoms also receded. Four months later, only signs of former disease left was depressions in iris. Change in fundus had disappeared. Vision = 1. Treatment had consisted of use of potassium iodide. Hereditary gummous iritis was not disproven in this case. Tuberculosis was not proven.

Liebrecht thinks this case was one of attenuated tuberculosis.

CASE XXVIII. Van Duyse ("Arch. d'Opht.," 1892, p. 478). Girl, æt. 12 yrs. When first seen, she presented all the symptoms of a serous irido-cyclitis, with abundant precipitates on posterior surface of cornea; pupil moderately dilated by atropine; there was ciliary injection; conjunctival vessels hyperæmic; no complaint of pain, but there was photophobia. After two months, girl left dispensary. At time of leaving, she counted fingers at 2 metres. Treatment consisted of mercurial inunction to temples, and instillations of atropine and cocaine, and internal use of potas. iod. and cod-liver oil. No mention made of intraocular tension. Four months later right cornea showed *grayish* interstitial opacities. At inferior irido-corneal angle, were two *whitish-gray* nodules, about 2 mm. in diameter; a third nodule is situated a little higher and midway between pupillary border and periphery of iris; and a fourth nodule, 3 mm. in diameter, was situated at periphery; iris slightly vascular; the phenomena of irido-cyclitis had disappeared, but the affection was indolent. There was a mass of grayish miliary nodules in iris of left eye; they were more or less vascular on surface, especially at periphery. Treatment, instillation of atropine, periocular mercurial inunction, hot compresses, cod-

liver oil, and iodide of iron. Child was anæmic; no enlarged glands in neck; no splenomyolia; teeth showed no signs of hereditary syphilis; hearing normal; no swelling of long bones. Examination seemed to point to *latent* tuberculosis. There were signs of old pleurisy at apex of lungs. History of syphilis in father negative; mother very delicate and had facial lupus; one of patient's brothers died of meningitis, æt. 3 years.

Inoculation experiments, negative. Three months after second course of treatment was begun, nodules in iris had disappeared.

CASE XXIX. Denti ("Ophthal. Section of International Med. Congress," Rome, 1894), claims to have seen spontaneous healing of a case of tubercle of iris and ciliary body; half ant. chamber was filled with cheesy mass.

CASE XXX. Hippel ("Trans. Ophth. Soc.," Heidelberg, 1893, p. 86). Girl, æt. 25 yrs. Severe iritis, hazy vitreous. *Yellowish* nodules in iris; later a second nodule appeared in iris which grew into the first nodule; entire lower periphery of iris was involved. After three weeks the growths began to diminish in size without any treatment having been employed. The infection of globe disappeared entirely; and a month later iris appeared normal. Tumor returned three months later.

The older ophthalmologists regarded the eye as exempt from invasion by tubercle. Schüffel* was the first observer to prove that true tubercle sometimes occurs in a limited part of the body, without invasion of entire organism; *i. e.*, in scrofulous hypertrophied lymph-glands, in scrofulous ulcers of skin, etc. These observations were confirmed by Friedländer, Körster, and many others. These observations established the doctrine of local tuberculosis. In recent years much has been written to strengthen this doctrine. Northrup's† records of autopsies bearing on the question of primary infection, show that primary seat of tubercular infection was in bronchial lymph nodes in a great majority of cases. In 13 out of 125 cases, the tubercular process was limited to these nodes alone. One of the most interesting and valuable contributions to this question is by Dr.

* Schüffel, Undersuchungen über Lymphdrüsen Tuberkelose, 1871.

† W. P. Northrup, N. Y. Medical Journal, Feb. 21, 1891.

Ira Van Giesen of New York. It relates to a case of phosphorus poisoning in which he examined all of the organs of the body. He found miliary tubercles in only one of the bronchial glands, and nowhere else.

Structural type of tubercle. Virchow* defined tubercle as follows: "Tubercle is a small spherical growth, always proceeding from connective tissue, and consisting of small round cells, closely crowded together. The life of this neoplasm is a limited one. A degeneration of its elements very soon begins, and always first in the middle of the spherule. In most cases, the result is a cheesy deposit. Aside from this local character, the neoplasm possesses another, which necessitates its classification among the malignant tumors, *i. e.*, a decided tendency to spread throughout the entire organism." Later, Cohnheim endeavored to supplant Virchow's anatomical definition by an etiological one. He said: "Everything is tubercle which, when so inoculated, will not produce tubercle." Pathologists have elaborated Virchow's definition. Thus, they have described the tubercle as consisting centrally of either one or more multinucleated giant-cells, or some granular *debris* surrounded by giant-cells, with usually, but not constantly, large connective tissue cells, with large nuclei and granular protoplasm (epitheliod cells), situated outside of the giant-cells, and external to these, a zone of lymphoid cells. Langhans found giant-cells almost constantly present in tubercles, and claimed that their presence was typical, *i. e.*, that the giant-cells had a peculiar nature which distinguished them from those formed elsewhere. Köster† discovered the epitheliod character of the cells surrounding the giant-cells, and Cheyne and others maintained that the epitheliod cells are the more characteristic, as they are the more constant. Stress was laid, not alone upon the presence of giant-cells in tubercle, but upon the supposed peculiarity of this form of cell, consisting in the arrangement of the nuclei. Later investigations have shown that no one of these or other definitions strictly applies to tubercle. Thus, we know that the morphological characteristics of tubercular and syphilitic inflamma-

* Virchow, Die Kranknaften Geschwülste, Bd. II, p. 385, 1865.

† Köster, Virchow's Arch., XLVIII.

tion may so closely resemble each other that they cannot be differentiated; furthermore, we know that there may coexist in the same individual a mixed tubercular and syphilitic process. Therefore, pathologists no longer lay the same stress upon the varieties in structure of tubercle. Koch's discovery of the bacillus tuberculosis in 1882 gave to the anatomical picture of tubercle a conclusive diagnostic feature; for the medical profession has long since accepted the bacillus tuberculosis as conclusive proof of tubercular infection when found in the tissues of the body, no matter how puzzling the structural changes may otherwise be. Samelsohn's case, above quoted, shows how little reliance can sometimes be placed upon the anatomical diagnosis.

Primary and Secondary Tubercle in Eye.

It appears that E. von Jaeger* recognized tubercle ophthalmoscopically in 1855, and that the diagnosis was verified *post mortem.* A little later, Manz† found tubercle in the choroid, *post mortem.* But, A. von Graefe and Leber‡ were perhaps the first observers to diagnose it, positively, in the living eye (choroid). However, the disease of the eye was not primary in these cases, nor has it been shown to be since those days. A careful analysis of the cases of tubercle which I have tabulated above, shows that there is no positive evidence that the iris was the primary seat of tubercle in any instance. An autopsy has not excluded, even in the most favorable case, the possibility of a latent tuberculosis.

Diagnosis.

According to the descriptions furnished by the published cases of tubercle of the iris, the growth consists of one or more nodules, varying in size from that of a pin's head to that of a small pea, or even larger, the color being *light yellowish-white*, or *light grayish-white*, or light *grayish-yellow;* usually no vessels are seen on the surface of growth, although, in some instances, they have been present. There is generally little or

* Jaeger, Oesterreichische Zeitschrift f. praktische Heilkinde. 1855.

† Manz, Arch. f. Oph., Bd. IV, 2, p. 120. 1858.

‡ A. von Graefe and Leber, Arch. f. Oph., Bd. XIV, 1, p. 183. 1868.

no pain. There is usually very little injection of conjunctival vessels of globe. In a few instances there was considerable reaction, due to a blow, or some other cause, not explained. The disease may begin as a *serous or adhesive irido-cyclitis.* The course is generally insidious. The development of tubercle may be almost without reaction.

Differential Diagnosis.

Tubercle may, under certain circumstances, be confounded with *primary sarcoma of iris* or *syphilitic gumma of iris.* In the early stage of sarcoma of iris, when there is no increased tension, nor infection of the scleral vessels, it may be difficult to decide, although the color of sarcoma of iris resembles more that of gumma. Tubercle is of more rapid growth than is sarcoma of iris. The color of sarcoma of iris is *reddish-gray, blackish, or light brown, or flesh-color.* The color of tubercle has been given above. Sarcoma of iris occurs between the ages of 24 and 60,* whereas tubercle, according to the recorded cases, occurs in young subjects, *i. e.*, between fourth month and twenty-first year; in one instance it occurred in a man, aged 51 years. From gumma, it should usually be easy to distinguish it. The color of gumma is either an *iron-red* or *deep yellowish-red.* Gumma is always accompanied by considerable reaction, and there are generally other signs of syphilitic infection. Haab and others have laid stress on the location of the tubercle in the iris, *i. e.*, that it selected the inferior part of the iris, but this circumstance is of no diagnostic value whatever. I have seen syphilitic gumma at pupillary margin, at periphery of iris, and between pupillary margin and periphery. The same appears to be the case in tubercle.

Prognosis.

It appears from Leber's case that when the eye is enucleated in the absence of other signs of tubercle elsewhere in the body, the prognosis is not unfavorable. In this case the patient was reported well 6 years after the operation. In Higgins's case the patient was reported "strong and healthy," 1½ years

* Primary Sarcoma of Iris. By Jos. A. Andrews, M.D., N. Y. Med. Jour., June 1, 1889.

after enucleation. There is no definite data as to the condition of the patients, beyond a few weeks, who have been reported cured after iridectomy for excision of the tubercle. Such patients had been observed too short a time after the operation to justify the opinion that they remained free from tubercular infection. Liebrecht and Leber recognize an "*attenuated tuberculosis of iris,*" but this depends on the patient's powers of resistance to the bacillus tuberculosis. We cannot define what the conditions are in such instances.

Treatment.

When the tubercular process is limited to a small area of the iris, and does not encroach upon its periphery, and there are no signs of tubercular disease elsewhere in the body, the patient should be given the benefit of the doubt as to the disease being primary in the iris, and an iridectomy be performed including the growth in the portion of iris excised. When the disease is extensive and involves the ciliary body, and signs of tuberculosis elsewhere in the body are absent, the eye should be enucleated. In either event, the patient should receive such constitutional treatment as tuberculosis calls for. When there is evidence of meningitis or pulmonary disease, or other phenomena pointing to tubercular disease in some other part of the body, neither iridectomy nor enucleation can be of any avail; for in such cases, it is evident that the eye lesion is not the principal seat of infection.

A CASE OF PECULIAR CONGENTIAL GROWTH AT THE INNER CANTHUS.

BY ALVIN A. HUBBELL, M.D.,

BUFFALO, N. Y.

In March, 1888, I was called by the family physician, Dr. R. L. Banta, to see Walter G., a child about three months old who was born with a growth projecting from the inner canthus of the right eye. This growth was round, semi-solid, non-fluctuating, and was covered with normal skin. It was about an inch in diameter and had a large pedicel about one-third of an inch in diameter. By this it was attached to the inner extremity of the edge of the lower lid, to the inner canthus and skin over the lachrymal sac nearly up to the inner extremity of the upper lid, but not fully reaching it. It supplanted the caruncle and was adherent to the inner and lower part of the eyeball, its covering extending nearly to the center of the cornea. On the eyeball this dermal covering was so changed as to resemble, somewhat, mucous membrane in its smoothness, but was opaque and whitish in color. The upper lachrymal punctum and canal were preserved, but the lower were entirely absent. The lachrymal secretion seemed to find free exit as in normal eyes. The growth was quite movable and did not materially restrict the movements of the ball.

Figure 1 shows the general appearances and situation of the growth.

On March 28, 1888, assisted by Dr. Banta and Dr. W. B. Davis, of the United States Army, I removed the growth by first forming a flap, above, about one-half inch in length, and nearly the same in width with its base attached to the eyeball at the lower and inner margin of the cornea. A similar flap was next taken from the lower surface of the growth. Then I proceeded to dissect the pedicel from its attachments to the eyeball, carefully avoiding the ocular muscles, and from the in-

ner part of the orbit. During this dissection, I was greatly surprised to find a bone-formation in its orbital extremity. This extended backwards into the orbit towards the inner wall, to which it seemed to be attached at its end. Its anterior extrem-

FIG. 1.

FIG. 2.

ity was freely movable around this point of attachment. After the removal of this piece of bone, which was easily done, I completed the extirpation of the remainder of the growth, leaving no part of it behind, so far as I could see, except the flaps of skin. As soon as the hemorrhage, which was slight, had ceased, I retroverted the lower flap and carried its edge, with that of the upper eyeball flap, by means of suitably placed sutures, down into the lower retrotarsal space and fixed both of them in this position by pressing the sutures downwards beneath the skin of the cheek for half an inch and then bringing them outside and tying them. The flaps healed in this position and ultimately the appearance was that of a dense leucoma of the lower and inner part of the cornea, a cicatricial covering of the corresponding portion of the eyeball, and a cicatricial-looking edge of the lower lid at its inner third, and an absence, of

course, here, of the cilia. The upper and outer two-thirds of pupil were exposed to view and the movements of the eyeball were unrestricted and normal.

The final appearances are well shown in figure 2.

Examination of the growth showed that its principal mass was entirely composed of adipose tissue covered with skin, normal both in color and to the sense of touch, excepting where it was reflected on to the eyeball. Here it partook more of the character of mucous membrane, though thicker, whiter, and more opaque.

The bone-formation which extended from the pedicle into the orbit was flattened and about three-fourths of ani nch long, being 1/6 by 1/8 of an inch in its largest diameters, and was somewhat pointed at its posterior extremity.

I present this case as unique. I have not been able to find in medical literature anything in the least resembling it. It is peculiar in its location, in its perfectly-rounded form, in its being composed of compact adipose tissue, in its peduncular extremity containing a bone-formation, and in the entire absence of a cystic character.

CASES OF PERSISTENT PUPILLARY MEMBRANE, IN WHICH THERE WAS A FIRM ATTACHMENT TO THE LENS CAPSULE, WITH PARTIAL OPACITY OF THIS MEMBRANE AND OF A THIN LAYER OF UNDERLYING LENS SUBSTANCE.

BY W. F. NORRIS, M.D.,

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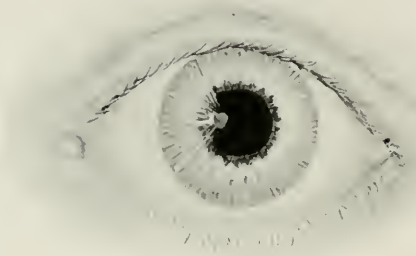
CASE I. FIGURES 1 AND 2.

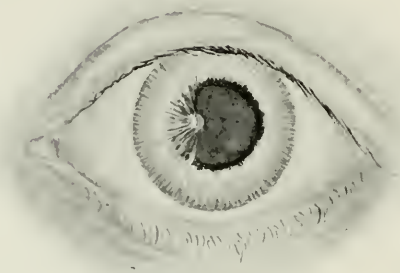
Mabel E. Gourley, æt. 19, complains of pain in her left eye when she attempts any near work. The patient is feeble and hysterical, and had a hysterical spasm during the examination. The R. E. appears normal, V. = 5/5, and with it she could read type 0.50 from 10—58 cm. The ophthalmoscope shows in this eye a vertically oval disc with a slight central-

Fig. I.



Returned pupillary membrane with capsular opacity, as seen by oblique light.

Fig. II.



The same eye, as seen by magnifying glass behind the mirror.

Fig. III.

Returned pupillary membrane with capsular opacity.

excavation, a broad scleral ring to the outside, and a slight semilunar area of partial pigment absorption beyond it. There is a choroidal ring above the disc, while its nasal and lower edges are veiled by hazy retinal fibres. The refraction is slightly hypermetropic, with a low grade of hypermetropic astigmatism. The L. E. presents an irregularly rounded opacity of the anterior capsule of the lens, a little to the nasal side of the anterior pole. This minute spot is divided into two portions, that nearest to the pupillary margin being much more dense and opaque than the thinner and more central portion. From the entire outer side of the nasal half of the iris arise numerous pyramidal bands, running radially to the central spot and gradually dwindling to mere threads as they approach it. These are of the same blue color as the iris itself, and their broad pyramidal bases are inserted so far out into the periphery of that membrane that they do not interfere with the pupillary excursions, the pupil being seen to contract and expand freely under the bands with the change of light and shadow. From the outer denser portion of the capsular opacity eight such bands take their origin, while from the inner and thinner portion five arise, two running upward and three downward. The whole mass forms a blunt triangle as is represented in Figs. 1 and 2, copied from beautiful and accurate water-color drawings by Miss Margaretta Washington. There is no other opacity of the lens substance except the small and nearly central dot. The eye ground is healthy, the disc being vertically oval with a slight central excavation and a trace of choroidal ring to the nasal side. There is a low grade of hypermetropia.

The right eye is entirely free from any such abnormality as exists in the left. Both figures represent the left eye. Fig. 1 exhibits the anomaly as seen by oblique light, while Fig. 2 shows it as seen by a magnifying glass behind the ophthalmoscopic mirror.

CASE II. FIGURE 3.

Irwin Fetteroff, æt. 18, comes on account of a marked conjunctival catarrh, which set in on the previous day. He also states that he suffered from frontal and temporal headaches. Vision in the R. E. is 5/5, in the L. E. 1/50. After instilla-

tion of atropia, the R. E. was found to have a hypermetropia of 1.75 D, while the L. E. exhibits a similar optical defect, amounting to 5 D. On the anterior surface of the left lens, a little above and to the nasal side of the anterior pole is a small white spot, to which are attached five strands of grayish material, which diverge from it as a center. The median strand is rounded and seems to be inserted into the outer surface of the iris, at its inner upper periphery. The two strands on each side of the above described central one run to the outer surface of the iris, close to its pupillary margin, and by this attachment prevent the full dilatation of the pupil at this point, even under the influence of a mydriatic, although the margin of the pupil is free, and retracts to a considerable extent. These strands are gray, near their insertion into the capsular spot, and are colored by brown pigment, near the margin of the pupil. There are no coarse changes in the fundus of either eye. The irides are of a yellowish-gray color.

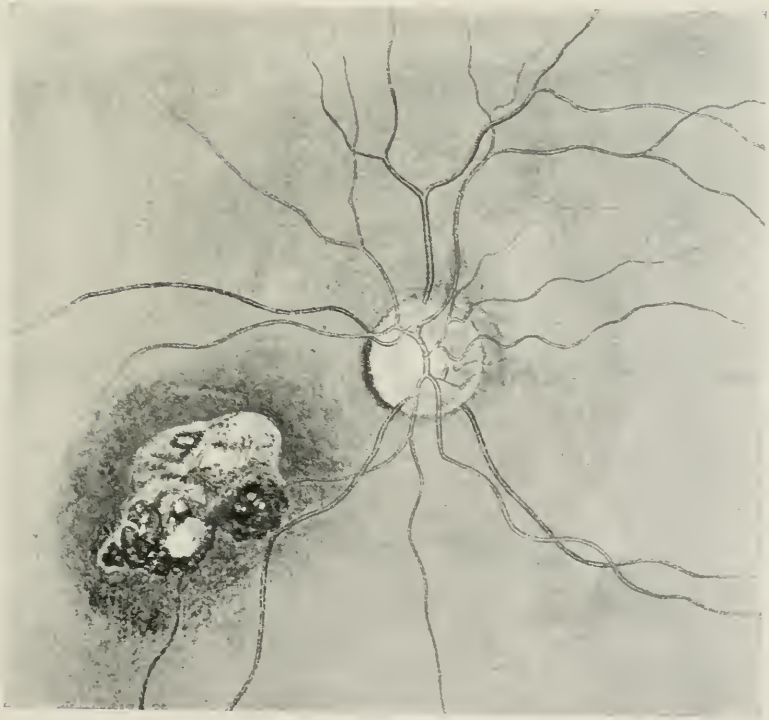
CASE III. FIGURES 4 AND 5.

Mary O'Donnell, æt. 18, complains of diminished acuity of vision, and of difficulty in using her eyes for near work. R. E., V. = 5/30; with it, reads 0.50 type from 5″ – 9″. L. E., V. = 5/40, reads 0.50 type from 5″ – 8″. Pupils react promptly both to light and to convergence. Both eyes showed high hypermetropic astigmatism, and when tested under atropia, the R. E., with + 4.50 cy. axis 120° had a visual acuity of 5/15, while L. E. with + 2 ⌒ + 1.50 cy. axis 110° had also 5/15. The L. E. shows a white spot on the anterior capsule of the lens, a short distance below and to the outside of the anterior pole, from which seven delicate strands of tissue, of the same blue-gray color as the iris itself, radiate to their insertion in the outer surface of the iris near to its periphery. There is also a fine strand at the upper outer margin of the triangle thus formed, which loses itself on the surface of the lens capsule before reaching the white spot. The interior of the eye (Fig. 5), shows a large spot of areolar choroiditis, surrounded everywhere by a broad border of choroidal tissue, which is dotted with granular pigment, but which has not itself become atrophic. The center of the atrophic area is situated about two

Fig. IV.

Returned pupillary membrane with capsular opacity.

Fig. V.



Choroidal changes in eye depicted in Fig. IV.

discs diameters from the disc, one edge of it lying close to the lower nasal vein, while the lower nasal artery runs through it, and is in places hidden by the massed pigment. This patch of choroiditis is possibly congenital, as there are no evidences of recent changes in the diseased area, and the remainder of the eye ground appears healthy. The fundus of the fellow eye presents no pathological changes.

CASE IV. (NOT FIGURED.)

Elizabeth C., æt. 37. In contrast with these marked cases is one which I have recently seen where there is a very delicate, persistent membrane, consisting of two minute strands which run from the outer surface of the inner upper part of the right iris and extend almost to a faint capsular opacity, irregularly quadrate in shape, situated just above the center of the pupil. The spot is so delicate that it requires sharp focussing to see it, either with the oblique light or with the mirror. The other eye is free from any such defect. Vision in each eye is $5/7\frac{1}{2}$, with a range of accommodation corresponding with the patient's age, and slight hypermetropia. On account of her temporal and frontal headaches she was tested for glasses under a mydriatic, and the correction for the R. E. was found to be + 0.50 ⌒ + 0.75 cy. axis 105°, and L. E. + 0.75 ⌒ + 0.75 cy. axis 90°. The eye grounds present no abnormalities.

As is well known, when we look at healthy and practically normal eyes with a magnifying glass behind the mirror, we often find some slight traces of persistent pupillary membrane which show as fine threads stretching from the external surface of the iris to the capsule of the lens, or at times forming loops along the pupillary margin of the iris by uniting with some similar strand. More rarely we find larger brown pigment filaments which stretch across the pupil from one side of the iris to the other, or at times from the iris to a small pigment spot on the lens. These are usually either single or few in number, but may be so numerous as to form a network. Persistent pupillary membranes, such as those which I have exhibited, consisting of broad and massive pyramidal bands,

often of the same color as the iris itself, and running to a white capsular spot near the center of the pupil, are of rarer occurrence. They are possibly due to some fœtal inflammation which glues the vessels of the pupillary membrane permanently to the anterior capsule, or possibly to an arrest in development which prevents the vessels of the pupillary membrane at this point from undergoing atrophy and closure of calibre at the same time at which this process sets in, in the remainder of the pupillary membrane. It is worthy of note, that in each case the capsular spot did not quite reach the anterior pole of the lens, and that lying at a short distance from this point, it would seem to correspond with the position of the head of the loop of some one of the leashes of vessels which normally ramify in the anterior part of the fœtal pupillary membrane. The capsular spot is probably at first limited to this membrane, and the slight secondary changes (such as were observed in two of the cases), are possibly due to the interference with the nutrition of the cells of the anterior epithelium by the overlying plastic exudate. In all cases the lenticular opacities were evidently congenital, connected with the existence of retained pupillary membrane, and in all they were confined to a single eye, and had but little effect in diminishing the acuity of vision, the opacity upon and beneath the capsule being very limited in extent. In every instance the eyes exhibited varying grades of hypermetropia and of the hypermetropic astigmatism. Three of the four individuals sought relief on account of asthenopic symptoms in near work, and the fourth on account of an attack of acute conjunctivitis. In one case in both eyes, and in another in one eye, the optical defect was high enough to cause considerable diminution in the acuity of vision. In the first and fourth cases, the pupillary margin of the iris played freely beneath the bands which extended from the periphery of the outer surface of the iris to the anterior capsule of the lens. In the second and third cases, however, some of the radiating fibres were inserted into the outer surface of the iris so near its pupillary margin as to prevent the full dilatation of the pupil and to limit the motions of the iris at and near their points of insertion.

DISCUSSION.

DR. F. W. ABBOTT of Buffalo, N. Y. — A few weeks ago a case of Persistent Pupillary Membrane was exhibited at the Buffalo Ophthalmological Society by Dr. A. G. Bennett.

Mrs. N., aged 23, complains of headache aggravated by sewing or reading, eyes smart and blur. Has dark-brown irides, both conjunctivæ hyperemic. Right eye shows small spot on anterior surface of lens, near the center, to which run two threads which are attached to the inner surface of the iris, and do not interfere with the mobility of the pupil. Upon full mydriasis four or five more very fine threads are seen arising from the inner surface of the iris and attached to the same spot on the lens. There was complete paralysis of accommodation.

O.D. with – 1. sph. ◯ – 2 cyl. ax. 165, V. $\frac{20}{50}$.

O.S. " – 0.50 cyl. ax. 99° V. $\frac{20}{20}$.

No membrane in left eye.

EMBOLISM OF CENTRAL ARTERY — CILIO-RETINAL ARTERY SUPPLYING THE MACULA — RETENTION OF CENTRAL VISION.

BY O. F. WADSWORTH, M.D.,

BOSTON, MASS.

At the meeting of this society in 1890, I reported a case of plugging of the central artery of the retina, in which the macular region was supplied by a "cilio-retinal" artery and central vision was preserved. In the *Jahresbericht für Ophthalmologie* for that year the reporter on diseases of the retina appended to the title of my paper a note, stating that, in his opinion, the case was, without doubt, one of tubercular meningitis of the optic nerve. It is difficult to understand how this diagnosis was reached, for in the case as published there was no symptom pointing to either tuberculosis or meningitis, unless, indeed, a transient headache at the time the defect of sight was first noticed is to be regarded as such.

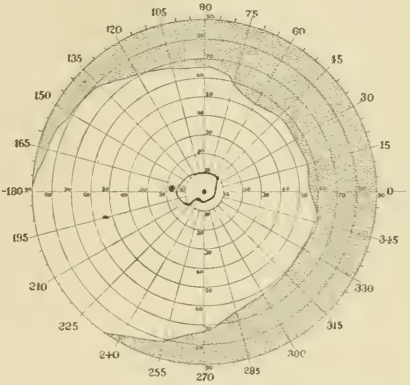
The case presented to-day offers a striking similarity in its essential features to the earlier one. There was the sudden

onset and marked, permanent, concentric contraction of the field, with retention of good central vision; the white haze involving disc and retina for a long distance, but leaving the macular region and the space between it and the disc free; the evidence of disturbed circulation in the retina; the "cilio-retinal" artery supplying the macular region. But there were differences in detail. In the earlier case there were certain areas at the edge of the unaffected region about the macula, on which the white haze was decidedly more dense in appearance than is usually found when the artery is stopped, and there was for a time an interruption and oscillation of the red-blood column in two of the veins. Neither of these appearances was observed in the later case. The first case was considered as one of thrombus, because no lesion of the heart or great vessels was discovered; in the second a lesion of the aortic valve gave opportunity for the formation of an embolus.

A lady of 68 years, in good general health, slipped and fell on the ice about noon, on January 31, 1896. She was moderately jarred by the fall, but got up without assistance, and there was no disability. During the following evening she two or three times noticed a blur before the left eye, and the next morning observed that the field of vision in that eye was much contracted, and seemed to have a somewhat jagged border. There was no pain or redness. She saw her physician, and drops were applied, which dilated the pupil. The condition remained unchanged till she consulted me on February 5th.

L. E. — Pupil rather large; ant. chamber of good depth; iris natural; T., normal; V., with — .50 $\frac{20}{40}$. The F. is much contracted in all directions, least outward. There are a few fine opaque striæ in the lens. The central artery rises to the level of the retina before division; its branches from their point of origin seem decidedly narrow. Close to the outer and lower edge of the disc an artery of moderate size enters, as from the scleral circle, and curves downward and outward, to rise again just beyond the center of the macula; about one P. D. from the disc it gives off a branch which runs upward and outward, and which again sends off a branch to run nearly horizontally outward. On the disc and around it, except on

the temporal side, a white haze extends for a long distance, gradually fading; near and on the disc the haze partially hides the vessels; above the macula a few fine vessels stand out sharply on it. From the disc edge outward an area of the retina which includes the macula is quite free from haze. The border of the haze bounding the lower side of this area lies a little below the cilio-retinal artery described, and is not very sharply defined; above the area the edge of the haze is fairly sharp, from the edge of the disc it at first curves outward and somewhat downward to about the level of the center of the disc, then recedes upward, and again descends to run nearly horizontally a little above the center of the macula; beyond this and to the outer side of the macula the haze is thin, and its border is quite ill-defined. At this visit no attempt was made to take the F. accurately. On three subsequent visits it was taken with care, and showed practically no variation.



R. E. — A few fine opaque striæ in the lens; in all other aspects normal; V. with — .75 cyl., axis 90° $\frac{20}{20}$ —.

Dr. V. Y. Bowditch kindly examined the patient, and found a slight hypertrophy of the heart and a murmur over the aortic valve, indicating slight roughening or stenosis.

February 8th. Little change in the conditions. Two minute hemorrhages have appeared at the outer edge of the disc. The F. as shown in Fig.

February 14th. V. with +50 cyl., axis 70° $\frac{20}{30}$ —. The haze is in general decidedly less; the arteries generally are seen more distinctly, and appear slightly larger than they did at the first visit, but the inferior and superior temporals still seem less large than normal, although, perhaps, not out of proportion to the corresponding veins. Of the two hemorrhages noted on the 8th, the upper is gone; the lower is now faint.

A week later (February 21st), and three weeks after the loss of sight, V. $\frac{20}{30}$ —; F. as on the 8th. A little haze remains visible above the macula; elsewhere there is hardly any. There is a dot of hemorrhage a short distance outward from the disc, a small striated hemorrhage downward and outward.

The lady lived at a distance from Boston, and was to go South shortly after this date. I expressed a desire to see her on her return, but as I was obliged to say that there was nothing to be done for the eye, it is, perhaps, natural that she did not visit me again.

In a note, dated July 17th, the patient writes that she thinks there has been no special change in the condition of the eye; that she is able to use her eyes as much as she wishes.

Embolism or thrombosis of the central artery is not very rare, cilio-retinal arteries are sufficiently common, and it is to be expected that the two conditions should occasionally coincide. That one observer should have had the fortune to meet two instances of plugging of the arteria centralis, in which, owing to the presence of a cilio-retinal artery, the macular region has been free from haze and central vision preserved, would indicate that others must have occurred. I have made no special search, but do not remember to have seen such cases reported. There have been described instances in which a small area adjacent to the outer side of the disc has been free from haze, and a small amount of vision retained.

NOTE. — Since reading the above paper Dr. Knapp has kindly called my attention to two cases reported briefly by him, Bericht der Ophth. Gesel., Heid., 1885, and to an article by Laqueur, Archiv. f. Augenheilk., German edition, 1895. In both of Knapp's cases the haze involved the macula; vision of small amount at first; in one case fingers at 6 m., later rising to 1; in the other sinking to 0. In Laqueur's case a band of retina from the outer edge of the disc to the periphery was free from haze; V. at first 2/3, later 1. Laqueur collected fourteen reported cases, including Knapp's. One, Mauthner's, V. = 1, was first seen four months after the attack. In all the others the haze invaded the macular region, the free space next the disc was generally quite small; V. at first from light perception to $\frac{15}{200}$, eventually 0 to $\frac{2}{3}$.

DISCUSSION.

Dr. W. F. MITTENDORF, New York. — I have seen three cases of this kind where complete blindness was prevented by the presence of a ciliary artery. In one of my cases the artery did not reach the macula, and central vision was distorted. These cases are not very frequent, and are very interesting. One of my patients died afterward of apoplexy, probably caused by an embolism formed in the brain. I have under observation at present a case which, while not exactly of this class, has some peculiar features. An embolism of the upper part of the artery produces total blindness in the lower and nasal part of the field. The rest of the eye normal, with normal central vision. In all these cases the history of rheumatism and subsequent heart trouble has been found.

A CASE OF DOUBLE CHOKED DISC, CAUSED BY CYST INVOLVING THE RIGHT FRONTAL LOBE OF THE BRAIN, WITH AUTOPSY.

BY HOWARD F. HANSELL, M.D.,

PHILADELPHIA, PENN.

The clinical history of the case briefly described below is characterized by no especial points of difference from the classical form of choking of the discs as a sign of brain tumor, with the possible exception of the absence of hemorrhages into the tissue of the retina, but it is of interest in that the case was followed for three years through its various changes until the death of the patient gave the opportunity for microscopic study of the pathologic alterations in the retina, nerve head, and nerve, and a determination of the causes that led to blindness and death.

Lizzie McK., a child's nurse, consulted me Feb. 15, 1893, on account of intense headache dating from exposure to the sun during the previous summer. The family history is irrelative. In her own person acquired syphilis and pulmonary disease could be positively excluded. The menstrual function was regular and painless. The patient was a stout, healthy-looking Irish

girl, weighing about 150 pounds. The headaches were frequent, but not constant, intense, but not localized. In the fall of 1892 she noticed dimness of vision, and visited a Philadelphia hospital with the purpose of securing glasses for relief both from the failing sight and the headache. A low minus spherical was ordered and worn, but produced no improvement. I found V. reduced to light perception in the R. and to one-half the normal in the L. The field of the R. for light was confined to that governed by the foveal region, and that of the L. was concentrically limited for both white and colors, and had no sector defects. Refraction slightly hypermetropic. The discs were enormously swollen, particularly the R., which seemed not only to project forward, but to hang down into the vitreous. The summit of the swelling was +7D. and the retina at the fovea +1D. The arteries were normal and the veins diminished in caliber. There were no hemorrhages. The swelling of the nerves did not extend laterally much beyond their borders, and the retinæ in the immediate neighborhood were healthy. The lower part of the scleral ring in the R. was hidden from view by the overhanging nerve. The R. eye was divergent. After free salivation V. of R. was increased in a small central field from L. P. to 20/40, and of the L. from 20/40 to 20/20; but the field of the L. did not widen. After maintaining the improvement for some weeks V. again sank to L. P. in R. and 20/100 in L. Stretching of R. optic nerve produced temporary improvement (20/100). The patient became gradually worse until the summer of 1895, when she became totally blind in both eyes. My next examination was in the spring of 1896. The choked discs had given place to atrophy with loss of caliber of the retinal vessels. The headache, that had disappeared in part, returned in great severity, and, in addition, the patient had attacks of general convulsions every few days, preceded by sufficient warning to grasp a support, without which she would have fallen to the ground. The pupils during the early course of the disease were dilated, but responsive to light and accommodation, but, later, when all perception of light was lost, remained dilated and fixed. My diagnosis from the first had been tumor of the brain, but I was unable to locate it or assign other cause than expos-

ure to the sun. Later I believed it to be in the anterior lobes, which opinion was concurred in by Dr. Charles K. Mills, who examined the patient at my request. In view of the rapid mental and physical degeneration, I considered the advisability of having the skull opened, and for this purpose made an appointment with Dr. W. W. Keen. On the morning, a few hours before the time set for his examination, the patient died suddenly in a convulsion.

The autopsy was made by Dr. Keen, assisted by Drs. Mills, Fegley, and myself. Upon exposing the brain it was noticed that the veins were tortuous and overfilled. The membranes were not abnormally adherent, and the contour of the convolutions presented nothing unusual. During the removal of the brain from its bed a large amount of fluid escaped from the lateral ventricles. The sense of resistance to touch was uniform, except in the region of the right frontal lobe, which was, over its entire extent, yielding, showing the absence of support. Upon further dissection an enormous cavity was found, occupying the area of the entire right frontal lobe, and surrounded by a shell of normal brain tissue. This cavity was connected with the right lateral ventricle by a canal through which the contents of the cyst had escaped and through which interchange of fluid during life had been constant. No cyst wall other than brain tissue, no debris, and no blood were contained in the cavity. The optic sheaths on both sides were enormously distended, as can be seen from the microscopic section. Just within the entrance of the right optic nerve into the orbital cavity two tumors the size of a small bean, and covered by a vascular sheath, were seen to lie in contact with the nerve, and probably to bend it slightly from its course. Their nature, according to the microscopic report, was tubercular.

Microscopic report by Dr. A. O. J. Kelly, Neurologic Laboratory of the Philadelphia Polyclinic:

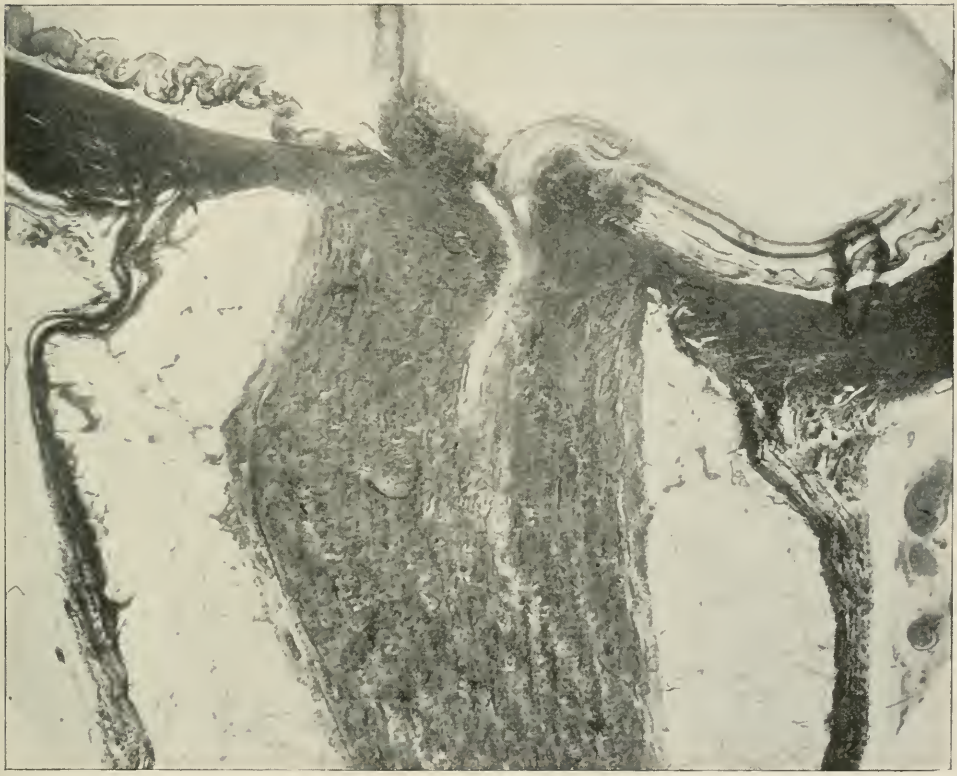
"The specimens are the right and left optic nerves, with the corresponding posterior segments of each eyeball and two small, tumor-like formations, each about the size of a pea, removed from the apex of the right orbit. Macroscopically, there is very evident an enormous serous distention of the sheath of

each optic nerve, the left being somewhat more distended than the right. Naked eye examination reveals also a very distinct swelling of each optic papilla, both manifesting the usual central depression.

"Microscopically, the excessive distention of the nerve sheath is very evident, being pyriform increasing from before — at the point of entrance of the optic nerve into the eyeball — backwards. At the point of greatest distention of the left sheath the distance between the sheath and the optic nerve equals about the diameter of the nerve. The distention of the right sheath is not quite so marked. The sheaths are throughout their course attached to the nerves by delicate fibrillary bands traversing the space.

"Transverse and longitudinal sections of both nerves reveal similar lesions. The sheaths are greatly thickened and contain the usual proportion of elongated nuclei, with here and there some small, round cell infiltration. In the nerve proper there is an extensive round cell infiltration and much new fibrous tissue formation. The epineurium, perineurium, and endoneurium are alike affected. The inner sheath of the nerve is quite markedly infiltrated, and the delicate fibrillary bands connecting the inner and outer sheaths are themselves increased, thickened, and infiltrated. The interneural trabeculæ are much thickened and infiltrated with round cells. In some places there is more progress towards fibrous formation. The blood vessel walls are much thickened, and in places surrounded by aggregations of round cells. The nerve fibers are degenerated in their entirety, appearing as irregular granular masses, the axis cylinders being nowhere in evidence.

"The papillæ are much swollen, increased in thickness, and exhibit, in addition to some new connective tissue formation, a very extensive cellular infiltration, most of which partakes of the nature of small round cells, but some of which has already begun to undergo the change to fibrous formation. The cellular infiltration is not only evident in the center of the papillæ, but persists to the edges. It is somewhat less marked in the lamina cribrosa, but immediately posterior thereto it again assumes extensive proportions, but is much more marked in the papillæ



LONGITUDINAL SECTION OF OPTIC NERVE, SHOWING CHOKING OF THE DISC FROM DISTENSION OF THE NERVE SHEATH, FROM A CASE OF CYSTIC HUMOR OF THE BRAIN.

than elsewhere in the course of the nerves. The blood vessels are distended and have thickened walls and in places are surrounded by a round cell infiltration.

"The several coats of the eyeball are separated from each other. (This may have been artificially produced.) The retina and choroid present many curves due to their displacement. Near the discs the nerve fiber layer of the retina is greatly thickened and infiltrated with small round cells; the blood vessel walls are much thickened and in places surrounded by a collection of round cells. There is extensive proliferation of the nuclear layers of the retina, particularly in the vicinity of blood vessels. In places the proliferating nuclear layers show a tendency to coalesce, overstepping their normal boundaries. The pigment layer persists to the edge of the disc.

"Microscopic examination of the two small tumors shows them to be lymphatic tubercular nodules. In some portions, aside from the increase of the stroma and some proliferation also of the lymphoid elements, the normal histology of the structure is not especially altered. In others, however, there is great development of large epitheloid cells, which, increasing and aggregating, displace the lymphoid elements of the tissue. Into some of these foci of epitheloid cell formation extensive hemorrhage has taken place. In others the tendency to the formation of homogeneously hyaline or faintly granular areas devoid of nuclei, or nearly so, is very evident. Bands of connective tissue of varying density pervade the structure. No tubercle bacilli could be discovered."

A condition noted by other observers, namely, extreme tortuosity of the vessels of the choroid, giving that membrane the appearance of great thickening, is also present.

A cyst is not anatomically identical with a tumor, but clinically they develop the same symptoms, and cannot be differentiated during life, for, while in the former there is no actual increase in the volume of the brain as there is in a new growth, giving rise to localizing signs, the increased volume of intracranial fluid directly dependent on the pathologic process will cause signs of general pressure, and mechanically the fluid will seek the nearest outlet, namely, the sheaths of the optic

nerves. In my patient the characteristic symptoms of brain tumor were present — double choked disc of high grade, concentric loss of field eventuating in total loss of vision, frequent and severe headaches, culminating, towards the close of life, in general convulsions. Localizing symptoms were absent, including those that could be confidently expected in extensive lesions of a frontal lobe. The mind, never highly cultivated, retained its functions during the formation of the cyst, notwithstanding the extensive destruction of white and cortical matter, until the last month or two, when intellection became dull and memory defective. There was no albumen or sugar in the urine, no loss of reflexes, no loss of weight or other interruption of the bodily functions.

The microscopic examination of the nerves and sheaths demonstrate the mechanical interference with the circulation in those structures from pressure and the consequent atrophy of the nerve fibers The fluid undoubtedly passed down to the eye from the brain in the sheaths and did not collect as the result of local inflammation of the nerve head from the presence of toxic elements in the fluid. The blindness was subsequent to the headache, and the changes seen by the ophthalmoscope kept pace with the presumed growth of the cyst and the persistence of a large amount of fluid in the sheaths.

A BRIEF STUDY OF THE OPHTHALMIC CONDITIONS IN A CASE OF CEREBELLAR TUMOR; AUTOPSY.*

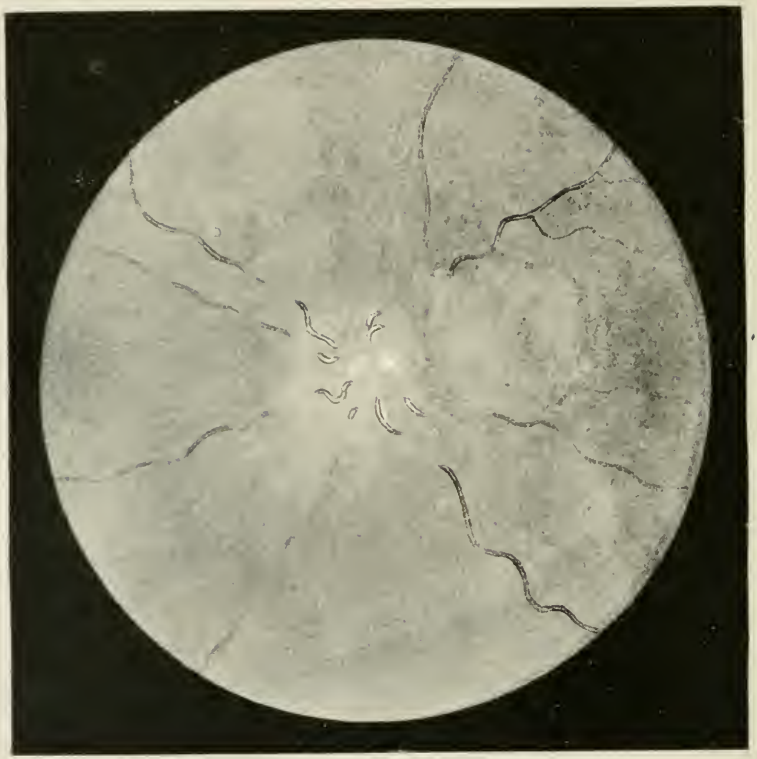
BY CHARLES A. OLIVER, A.M., M.D.,

PHILADELPHIA, PENN.

On the 20th of February of the present year, through the kindness of one of my colleagues at the Philadelphia Hospital, Dr. J. Hendrie Lloyd, I had the privilege of examining the

* An extended report of the case from a neurological standpoint, by Dr. Lloyd, appeared in the September, 1896, number of the *American Journal of the Medical Sciences.* The notes of the general conditions here given have, through the kindness of Dr. Lloyd, been abstracted from the manuscript of his paper.

Fig. 1.



Ophthalmoscopic appearance of left eye-ground.

ocular conditions of A. L., a thirty-eight-year-old married man, a brass polisher by occupation, who, bed-ridden in the nervous wards of the hospital, was suffering from undoubted cerebellar symptoms dependent upon a probable new growth.

There was a history of severe traumatism in the right occipital region seven years previously, this being followed by frequently recurrent and violent head-pains, which were especially marked in the occiput. In the latter part of December, 1895, the cephalagia became lancinating, his vision began to fail, and vertiginous attacks, but one of which was associated with gastric disturbance, appeared.

The patient, who was confessedly a syphilitic, could not give any family history of any relevant nature.

In the early part of February, 1896, when he was first admitted to the hospital wards, he was noticed to have both the gait and attitude that are typical of cerebellar disease. In addition, the head and the trunk were forcedly turned to the right side, this being increased when attempts were made to walk. Speech was hesitating, and cerebration was slow. Anesthesia, hemiplegia, and paraplegia were all absent. The patellar-tendon reflexes were exaggerated, and there was a slight ankle-clonus, which was rather excessive on the left side. Physical exploration failed to reveal any evidences of cardiac, pulmonary, or renal complication. The patient claimed that he had become almost blind, his pupils being markedly dilated.

When I first saw him, some three weeks after his admission to the hospital, the general condition was about the same as above given.

At this time I made as exhaustive and as careful an ophthalmic examination as I could under the circumstances.

The pupil of the right eye was five by six millimeters in size, with its long axis at forty-five degrees. The media were clear. There was a marked choked-disc, the extreme summit of which was situated down and in and extended forward into the vitreous to six diopters height from a two-diopter fundus. The retina in the vicinity of the disc was swollen. The retinal veins were small and carried dark blood. The retinal arteries

were very much reduced in size. The nerve swelling appeared solid, white, and compact, and stood out in prominent contrast with the swollen retina. Between the macula and the disc, and beneath the macula, there were a few points of commencing degeneration.

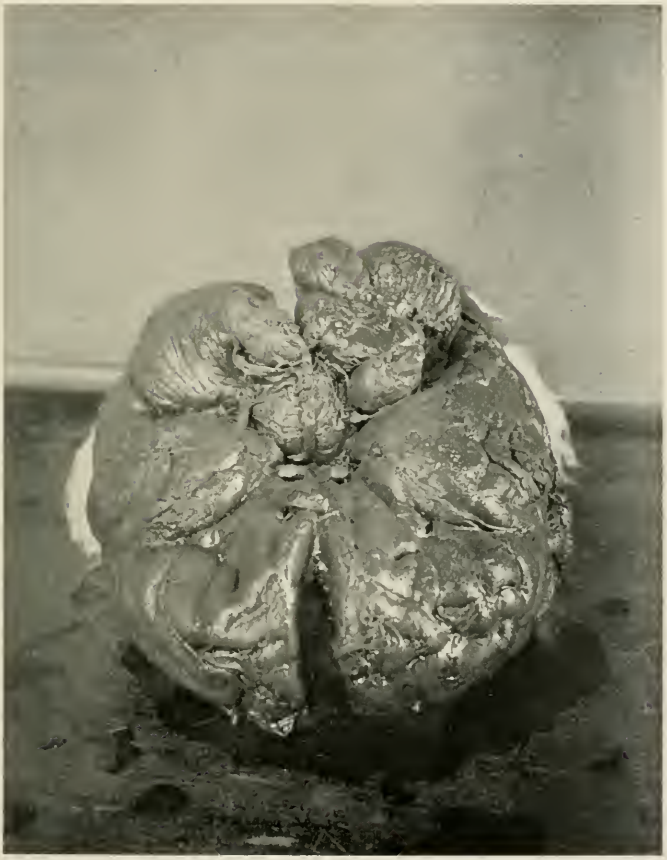
The pupil of the left eye was the same as that of the fellow-eye, except that its long axis was at one hundred degrees. The media were clear. There was a similar choking of the disc, the summit of the nerve-head extending seven diopters into the vitreous from a two-diopter level of the undisturbed portions of the fundus. The disc was diffusely swollen, its edges not being anywhere visible. The retinal veins were reduced in size, except at the summit of the disc, at which place they were engorged with dark-colored blood. In this position the lower temporal vein curved directly into the swollen tissues, and was surrounded by a congeries of fine swollen capillaries and minute capillary hemorrhages, distributed through which there were a number of brilliant crystalline masses. The retinal swelling was more extensive than it was in the other eye, and gradually shelved downward to the normal retinal plane far out in the periphery of the fundus. See phototype of ophthalmoscopic appearance.

Vision in the right eye seemed to be absolutely lost, while that of the left eye was reduced to the ability to see strong light-stimulus in a contracted and flattened field, embracing the fixation-point.

Careful examination of the irides showed that, with the exception of a slight response of the left iris to very strong light-stimulus, there was no reaction directly or consensually to light, accommodation, and convergence. The eyeballs were freely mobile in all directions, though when fixation was carried outwardly, either to the extreme right or to the extreme left, a series of horizontal oscillatory movements, that continued as long as the effort at fixation could be maintained, were constantly induced.

The symptoms remained unchanged until about a week later, when several slight attacks of vomiting appeared, and urinary incontinence — possibly mostly the result of deficient cerebration — ensued.

FIG. 2.



Base of brain, showing location of tumor.

The mental stupor increased, the head pains persisted, and mentation seemed somewhat disturbed. These symptoms became progressively worse, until, one month later, pulmonic oedema put an end to his life.

The *post-mortem* examination failed to evidence any disturbance of the trunkal viscera, except a slight interstitial nephritis with the appearance of a few small cysts upon the surface of the right kidney.

The calvarium was of its ordinary thickness, and there was a rather superficial exostosis in the external table of the occipital bone. The cerebral meninges were normal. Beneath the under surface of the cerebellum there was an oblong tumor about 5½ centimeters in length, and 2½ centimeters in breadth at its widest part. As can be seen in the accompanying reproduction made from a photograph taken by Dr. C. Y. White, one of my resident surgeons at the hospital, the growth sprang from the under and external surface of the middle cerebellar peduncle, and projected outwardly between the pons varolii, the medulla oblongata, and the right cerebellar lobe. The posterior portion of the neoplasm had become cystic. Across its projecting and solid surface several stretched and atrophied nerve-trunk strands coursed their way.

The inferior surface of the corresponding cerebellar lobe was excavated, and in the excavation there was a membranous cyst. The fourth ventricle was patulous and undisturbed.

The corpora striata and the optic thalami, as far as studied, were normal.

The spinal cord, which was edematous, gave evidences of degeneration of its lateral columns.

The tumor itself was a gliosarcoma that was undergoing cystic degeneration.

REMARKS. — This case, the type of which is represented in fully one-fourth of the total number of intracranial neoplasms is of interest, not only on account of the usual history of trauma and the characteristic general symptoms of cephalalgia, mostly in the region of the occiput, the vertigo, the ataxic gait with exaggerated patellar-tendon reflex, the tonic convulsive

movement of the head and trunk to the right, and the manner of death, but is of diagnostic importance when the ocular symptoms are considered alone.

Here the high grade of optic neuritis, its character, and its inequality with the associated relative disturbance of vision; the almost absolutely complete blindness which I have so often noticed as typical of subtentorial pressure; the shape and position of the field remnant in the left eye; the nearly total interior ophthalmoplegia, which was more marked on the right side; and the series of horizontal nystagmic movements — all make an ocular picture that is eminently of value in the determination of the situation of intracranial growths.

A CASE OF DOUBLE OPTIC NEURITIS SUPPOSED TO BE DUE TO AN ANEURISM, WITH RECOVERY.

BY DR. J. B. EMERSON,

NEW YORK CITY.

E. H., a well-developed young woman, sixteen years of age, was sent to Dr. Roosa, June 20, 1890 Her father had died two years previous of Bright's disease; her mother had been an inmate of a lunatic asylum since that date. Her general health had always been good, menstrual functions were irregular, and she was subject to nose bleeding. She had always been troubled with headache, blurring of vision, and dizziness when she used her eyes. For the past ten weeks the headaches had been much more severe, extending from her eyes back into her temples, and were accompanied with more or less photopsia, red, blue, and yellow in color, and at times some vertigo and nausea. For about a month she had noticed that her sight was gradually failing, that she could see better in the evening than she could in the morning, and that if an object was large she could not see it all at once. On examination there was a decided tendency to divergence of the optical axes, the pupils were dilated and sluggish. R. V., 10/200, L. V., 20/70. The

visual fields were contracted to inside of 10° circle. There was total color blindness. Ophthalmoscopic examination showed in the right eye that the outline of the nerve was very indistinct, the nasal side swollen about 3 D.; views were engorged and tortuous; there were numerous small, whitish spots in the retina, especially along the blood vessels. The left eye was in the same condition, except that the nerve was swollen uniformly to the extent of about 4 D. She was advised by Dr. Roosa to go to the Manhattan Eye and Ear Hospital for treatment, and came under my care in that institution four days later. An examination of the urine gave negative results. Temperature, 101; pulse, 120. A 20% oleate of mercury was used twice a day, and iodide of potash in increasing doses. On July 2d, the physiological effects of the mercury being apparent, it was discontinued, and tincture of chloride of iron ordered three times a day, and increasing doses of sulph. of strych. daily. Her temperature had varied since admission from 99½° to 101°; the pulse from 100 to 120. The patient was comfortable, and ate and slept well. On August 1st she complained of a headache in the morning, which passed off without treatment about midday; the pain was sharp in character, and was confined to the right side of the head. On August 5th the patient rested well until 4 o'clock A.M., when she called the nurse and complained of fearful headaches in her forehead and right temple. The nurse found that she had passed her urine in the bed, and that there was a lump on the side of her head as though it had been struck, but she was not conscious of having passed her urine or having hurt herself. Five drops of Magendie's sol. was given her, and relieved the pain. At 8 o'clock she became comatose with stertorous breathing — respiration, 12; pulse, 64 and irregular; temperature, 97; pupils contracted, with no reaction to the light. There were no convulsions. This lasted about thirty minutes, when the patient began gradually to recover, but was stupid for several hours, and had vomiting at intervals all day; phenacetine and digitalis were given.

August 21st, patient has entirely recovered from the attack. She informs us that she has had a buzzing noise in her head for some time, but it is now louder than ever before. Examinations

of the ears give negative results, as both ears are normal, but, on placing my ear against the side of her head, I hear a high-pitched, blowing murmur, synchronous with the radial pulse. This sound could be heard over the entire left side of the head, slightly through the right temple, but not audible over the vertex nor in the neck on either side. This noise could be stopped by pressure of the carotid arteries. Upon being closely questioned, she said that she had heard this murmur for two or three years, and at first it was only perceptible when she had a severe headache, but that for the last year it had been continuous, sometimes very faint. This was usually the case in the morning, but was louder in the afternoon and upon retiring at night.

September 3d. The patient has been out of the hospital for the past two weeks. The conditions were about the same, excepting more contraction of the visual fields.

From September 3d to October 14th she was in the hospital, treated with mercury, iodide of potash, and tonics alternating; at times had some headache, which was promptly relieved by 5 gr. phenacetine. The murmur could be heard at all times, but with varied degree of loudness, being increased in intensity when the patient had a headache. The urine was repeatedly examined with negative results. Temperature and respirations about normal. There were at no time sensory nor motor disturbances except those described. On October 14th she was shown before the New York Ophthalmological Society, and the advisability of modifying the circulation was recommended. On October 16th a collar was constructed with a pad to fit over each carotid artery. This the patient wore at intervals as long as she could endure the discomfort.

On November 12th she was discharged from the hospital. R. V., 3/200; L. V., 20/40; visual field contracted to about 5 degrees, more in the right eye than in the left.

February 6, 1891. Patient has been under the care of Dr. Abbott since she left the hospital. A letter from him says:

"On January 19th the patient had a convulsion which lasted 8 minutes and the unconsciousness lasted 35 minutes." The patient informs me that she has had several attacks of unconsciousness since she left the hospital. Has had severe head-

ache. The noise can still be heard, but is not so annoying as heretofore. R. V., 4/200; L. V., 20/40. She was advised by me to continue the compress.

September 19, 1891. Patient came to the hospital to-day and informed me she has not heard the buzzing for two months, and then it was when she had a headache, and it was quickly stopped by use of the compress; R. V., 13/200; L. V., 20/30; both fields much increased in size; the right nerve is slightly swollen, and left nerve is simply atrophic. General health and appetite good, and headache rare.

September 5, 1893. Patient's grandmother informs me that patient at intervals of about four months has had slight convulsions, which began with a buzzing noise in her head, followed by headache, and terminating in unconsciousness, lasting only a few minutes. R. V., 3/70; L. V., 20/50+; both nerves atrophic; visual field of right eye has increased to about 20 degrees, left eye to about 30 degrees, but both are irregular.

In June, 1896, Dr. Thompson saw patient's sister, who told him that the patient was in a hospital in Brooklyn undergoing treatment for some uterine trouble. She had had no further trouble with her eyes except an occasional headache, the buzzing having entirely disappeared. Patient's sister promised to send her to me to make an examination prior to making this report, which, I regret to say, she failed to do.

I have reported this case in brief, as it seems to me to be one of unusual interest, and it is the only case which has come under my observation where the visual field increased in size after the subsidence of a neuritis which had lasted over two years.

The patient was treated thoroughly with drugs; the results were entirely negative, and the improvement only began with the use of mechanical means.

THE USE OF MERCURY IN TRAUMATIC IRIDO-CHOROIDITIS.

BY CHARLES W. KOLLOCK, M.D.,

CHARLESTON, S. C.

I wish to place on record the histories of two cases of traumatic irido-choroiditis that were treated and held in abeyance, as it were, by the steady and persistent use of mercury administered by inunction. C. H. F., white male, 38 years of age, was struck in the left eye on the 24th of September, 1895, by a piece of belting. He consulted me on the 18th of October following. The wound had healed, but the location and extent of injury was easily seen, as the cornea had been torn across and the laceration had extended into the ciliary region. Both iris and lens had been injured, the former having been torn from its attachments, and the latter made cataractous and then partially absorbed. The cornea was flat, somewhat atrophied, and anterior chamber obliterated. The eye had a very angry appearance, being red, photophobic, and generally irritable. It was not specially painful. There was no pain in the fellow-eye, but it also was irritable and apparently in a state of sympathetic irritation. Vision was normal, the iris and media correct, but the disc was decidedly hyperemic. I advised enucleation, but he was adverse to this, and especially on account of an impending law suit for damages against the company. Finally I agreed to treat him, provided that if at any time the good eye showed further signs of trouble, the injured should at once be enucleated. Mercurial inunction was immediately commenced. The effect upon the injured eye was magical, within three or four days its appearance was wonderfully improved, the irritability disappeared, and the good eye became strong again. He was carefully watched, and the inunction continued, except at short intervals, until the latter part of April, 1896. He bore the treatment well, and at no time did his appearance show any ill effects from its prolonged

use. The law suit having been decided, I advised the removal of the eye, which was useless, and, of course, a menace to the safety of the other. This was done, and the other remained strong and useful as before.

CASE II. — W. McL., a mulatto boy of 15 years. He was shot in the right eye on Christmas day, and came to me on the 1st of February, 1896. The eye was slightly reddened, cornea clear, pupil round, iris not adherent, lens clear, and anterior portion of vitreous clear; but a white and glistening deposit covered the fundus and disc, and especially towards the outer side. Over this deposit was a large hemorrhage. The shot had entered at the upper corneo-scleral border. The other eye was normal. Enucleation was advised, but the parents declined to have it done. At their risk, then, he was treated. Mercurial inunction was advised; 3ss. of mercurial ointment twice a day. The eye at once cleared up externally, and the intraocular hemorrhage was absorbed within three or four days. The hyperemia of the disc in the good eye became less, but the lymph deposit slowly increased in the injured eye until it reached the lens, and by pressure rendered it opaque. The iris also became involved and adherent, but no active iritis was present. As the condition was becoming more and more serious, I finally prevailed upon the parents to have the eye removed; and this was done in the early part of May. The good eye has continued healthy since, and the vision is normal. The object of reporting these cases is to show how the disease was evidently held in check by the mercury, and to call attention to the fact that, though both of these patients, of different ages and color, took the drug for several months, no ill effects were experienced by either. It is well known that mercury is better borne in warm than cold climates, and I do not think there is any doubt but that the negro race can take it in larger quantities and for a longer time than the white. At least, such has been my experience in treating these people, and for some time past I have used mercury with them for nearly every disease of the eye, and found it, in most instances, more beneficial than any other remedy.

Just here it is well to call attention to the cases of sympa-

thetic uveitis reported by Rogman in the *Annales d'Oculistique* for August, 1895, and by Laqueur in the same journal for November, 1895. Rogman says: "An examination of the cases I have summarized shows that the time during which recovery was maintained was, respectively, three and a half years (Case II, my own), five years (Case III, my own), seven years (Case I, Schirmer), nine years (Case II, Schirmer), seven years (Case III, Schirmer), twelve years (Case of Hirschberg), and two years (Case of Laqueur). They are all, then, in a condition which may rightly be considered as definite." Rogman's treatment consisted in enucleation (when no vision was present) of the exciting eye, the employment of hot fomentations, atropine, mercurials, iodides, etc., and operative procedures, iridectomy and iridotomy, when necessary. He concludes: "The conclusion from this essay is that sympathetic uveitis is a disease of extreme gravity, the prognosis of which should be reserved for a long time, by reason of possible frequent recurrences. It is not right, however, to attribute to its development that character of desperate fatality with which certain modern classical authors endow it. Undoubtedly the only truly efficacious treatment is preventive treatment. The cases which I have reported, however, show that in its active period, especially at the beginning, the disease may yield to the treatment then used, provided it is employed energetically and with the necessary perseverance."

Laqueur, in the *Annales d'Oculistique* for November, 1895, reports five cases of sympathetic irido-choroiditis, all of whom recovered with sufficient vision to pursue their former occupations. He emphasizes the importance of enucleating all injured eyes (having no vision) after inflammation has commenced in the other eye. Even though this does not stop the disease, it eliminates the primary focus of trouble. He also regards the ages of patients as being of importance in the favorable termination of the disease, children and young persons, on account of their higher degree of nutrition, being better able to withstand it and recuperate than the old. He also thinks that the form of inflammation which commences with a rapid exudation into the pupillary area is much more formidable and fatal

than that beginning in the fundus and spreading slowly. "Treatment," he says, "should be both medical and surgical, beginning with the immediate removal of the injured eye when there is no sight. Then atropine and antiplastic and derivative treatment, consisting of the energetic employment of mercurial inunctions and pilocarpine, should commence at once. *General mercurial treatment is that in which the greatest confidence may be placed.*" (Italics mine.) It would seem, therefore, that in all eyes wounded in and about the dangerous zone, and in all cases of penetrating wounds, the strictest precautions should at once be taken to render the wound aseptic. In those eyes that are torn and otherwise badly injured strong solutions of bichloride can do no harm, should be employed freely, and even injected into the vitreous when that chamber has been opened. In cases of wounds made by small shot, which may often pass through the globe, mercurial and derivative treatment should begin at once, and be kept up steadily until the eye has become quiet, and should be resumed at intervals for some months to come.

To summarize: It seems most rational in all wounds of the eye of a dangerous nature that general mercurial treatment should at once be commenced, in order to prevent, if possible, the destructive inflammation and consequent exudation which so frequently cause blindness, not only in the injured but the good eye.

DISCUSSION.

DR. MYLES STANDISH, Boston. — In the course of my practice I have had two cases of sympathetic ophthalmia get well with vision of 1. One was a child, and the injured eye was nearly blind. The iris was torn and projecting through the cornea, so that I cut it off. The child was under observation continually, the eye continuing irritable, but nothing else appeared, except a slight iritis in the injured eye. This continued for several weeks, giving me considerable worry. The family contracted catarrhal conjunctivitis all round, including this child, which was not brought to me for several days. Then I discovered iritis in the other eye, so far developed that the iris was tagged down and irido-cyclitis beginning, if not already there. Vision in the second eye was reduced to 3/60. Al-

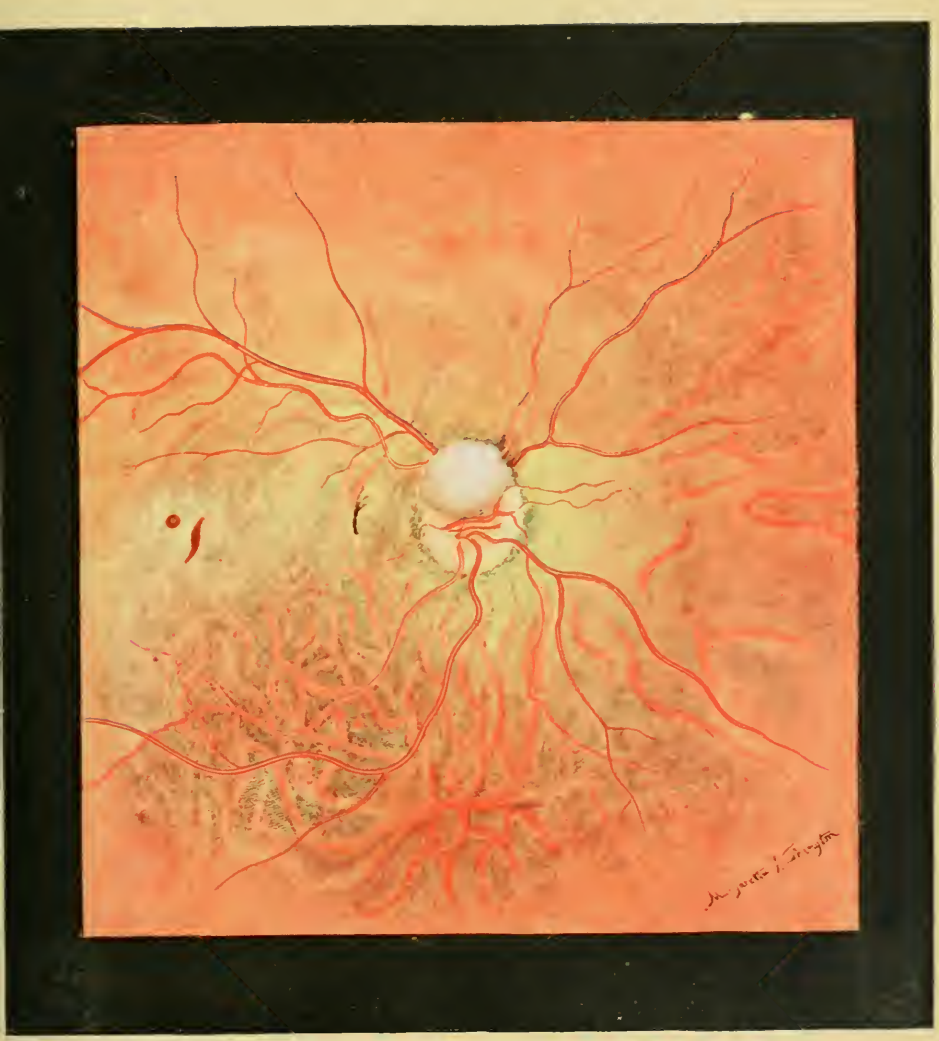
though there was some vision in the injured eye, it was thought best to enucleate. The child was then put upon mercurial inunctions, and nothing else, save a collyrium of atropine in the eye. The patient was kept in a dark room. The pupil dilated somewhat, and in the course of time most of the adhesions broke up. The child steadily improved, and subsequently the vision came up to 1. The other case occurred in a man of seventy, who received his injury from a piece of wire. Panophthalmitis ensued, and I did not expect sympathetic trouble. After a few days, however, I found plastic iritis and iridocyclitis well under way. The injured eye was removed and mercury given for months, when the vision, which had fallen to 5.60, came up to 1, and has continued so. I always attributed their recovery to the inunctions of mercury.

CYST OF THE RIGHT OPTIC DISC, CHOROIDITIS, MACULAR HEMORRHAGE.

By S. D. RISLEY, M.D.,

PHILADELPHIA, PENN.

Mrs. A. H., a Polish woman, aged 38, presented herself at the Philadelphia Polyclinic on October 24, 1895, complaining of impaired vision in both eyes and of violent temporo-occipital headache. The pain was constant, but greatly aggravated by exposure to bright light, or by any attempt to use the eyes, V. = 1/60 in each eye. The media were transparent, excepting a few opacities scattered along the border of both corneæ. The ophthalmoscopic picture presented in each eye is so well depicted in the accompanying sketch by Miss Washington that any extended description is unnecessary. The right eye-ground alone is here shown, but the left differed, so far as the general appearances are concerned, only in minute details. The macular hemorrhage and cyst, however, are absent in the left eye. The case is presented for permanent record in the annals of the society, not because of the retino-choroidal disease, examples of which are, unfortunately, only too common, but to record the presence of a peculiar cystoid body, situated on the



CYST OF THE OPTIC NERVE. *Risley.*

head of the optic nerve, the location, relative size, and general appearance of which are admirably shown in the colored drawing. There was, however, a delicate greenish-hue to the cyst, giving to the observer the impression of translucency which has been lost in the painting and its reproduction.

There was myopic astigmatism in both eyes so that −2 D. was required to study the details of the fundus. But the apex of the cyst could be distinctly seen with +3 D. or +3.50 D. Its projection, therefore, above the plane of the disc was approximately 2 mm. Directly below the cyst, but apparently not connected with it, was a short stub of a persistent hyaloid artery, shown on the surface of the disc, just below the central artery which skirts the lower border of the cyst.*

The precise nature and origin of this unique cyst must remain in uncertainty. I have not seen any similar appearance, and have found no case recorded. There seems no rational connection between the disease of the fundus oculi and this curious cyst on the nerve. A more probable relation exists between it and the persistent hyaloid; indeed, I was at first disposed to regard it as a cyst-like expansion of that vessel. The most careful study, however, failed to show any demonstrable connection between them, as was so obvious in the case presented by Mitvalsky.

DISCUSSION.

DR. B. ALEX. RANDALL of Philadelphia.— Cysts of the disk are always interesting. The ones I have seen usually are the small ones of the hyaloid artery, but this did not seem to be of that character, as the remains of the artery showed below. It was more like a bilateral case which I saw in Vienna with Dr. Dimmer, who published it in Dr. Knapp's Archives in 1884.

* The gray appearance of the remains of the hyaloid is lost in the lithographic reproduction.

A CASE OF SYMPATHETIC IRIDO-CYCLITIS?

BY B. L. MILLIKIN, M.D.,

CLEVELAND, OHIO.

In reporting the following case I have purposely put a question mark after the subject, as in my own mind there is a very grave question as to the sympathetic character of the difficulty. I do not believe that the theories of sympathetic inflammation or irritation, that have been propounded, explain all cases clinically observed; nor do I believe that either the infectious or ciliary nerve theories of sympathetic irritation account for the varying conditions that have been seen. It is, therefore, simply with a view of adding clinical observation that this case is reported, as I believe, that when a sufficient amount of data have been provided definite theories can be better suggested.

On the 11th of May, 1890, Dr. H. A. Z., about 32 years of age, a most intelligent physician, strong, and fairly robust from the standpoint of general health, gave me the following history. In 1882 he had been struck in the left eye with the branch of a thorn tree, one of the thorns having entered the eye on the upper portion, perforating the sclera, probably at the posterior portion of the ciliary body. The eye afterward was very greatly inflamed, with much pain, redness, general congestion, swelling of the lids, resulting in a very serious general inflammation, which lasted some weeks, eventually recovering, however, without loss of vision. Since then there have been several attacks of inflammation, varying in intensity, and lasting from two or three days to as many weeks. The last attack previous to my seeing him had been in 1888, two years prior to his visit. A few days before I saw him the left eye began to be slightly painful, with injection and tenderness over the point of the old injury. Before his visit atropia had been used, which had dilated the pupil ad maximum, there being no points of adhesion. At the old point of injury examination showed a scar of considerable magnitude, just about the posterior portion

of the ciliary body. Examination with the ophthalmoscope showed the media all clear, with the fundus comparatively normal, no positive indications of a retinal congestion. There was much external injection with tearing and marked swelling of the eyelids, and excoriations of the skin surfaces where the tears had run over the cheek. Atropia, heretofore used, had always produced much discomfort, and hence the pupil being well dilated duboisia was substituted, which acted much more kindly. The same day he returned home and continued doing some medical work for two or three days.

On May 15th he returned with the eye very much worse in every respect. Injection intense, eye very tender, excessive tearing, the whole showing a violent state of inflammation, the media somewhat hazy. He was put to bed, six leeches applied to the temples, hot applications, boracic acid and duboisia continued. Under this treatment the inflammation gradually subsided, and the attack completed its course in about three weeks. The inflammation subsided entirely leaving the media all clear, the fundus normal, and with the proper glasses vision normal.

Under homatropine, in November following, his refraction was found to be as follows:

O. D. + 0.75 D. cy. ax. 90°, V. = 6/6.

O. S. + 0.50 Ds. (°) 0.50 D. cy. ax. 90°, V. = 6/6.

He had an esophoria of 3°.

On June 29, '91, I again saw him in a similar attack, this going through exactly the same phases as the previous one. Under similar treatment the difficulty rapidly subsided, again leaving the eye in its normal condition. In the interval between these attacks he was able to do a large professional work without discomfort. A peculiarity in each attack was that the eye became sensitive and tender at the old point of injury in the upper ciliary region, and the inflammation gradually traveled around the ciliary body until this entire body was involved. The period of this extension was two to four days. In each attack it followed exactly the same course, the involvement passing from the upper portion toward the patient's temporal region until the circle of the ciliary body had been completed.

The eye also recovered fully after each attack, leaving no retinal disturbance or sensitiveness, either on pressure or from use of the eyes. There has been this characteristic, however, in connection with his attacks, that they have always come on after he has been excessively fatigued or run down as the result of over-work. This has been the history in every attack.

Now comes the most interesting feature of the case. There had been no attack of the left eye since June, 1891. In August, 1895, there occurred a similar severe attack of the right eye, lasting for three weeks. The initial place of involvement was at a point corresponding exactly with the old point of injury in the left eye. There was tenderness at this place, rapid development of inflammatory symptoms, involvement of the ciliary body, corresponding exactly to the mode of attack in the left eye and passing through identically the same phases. There was intense redness, much tenderness, severe throbbing pain, swelling of the eyelids, obscuration of vision and haziness of the vitreous, all the symptoms of the former attacks. During this there was no irritation whatever of the left eye. Under the same line of treatment the eye recovered fully, and has left no apparent disturbance or defect.

Examination, under homatropine some weeks later, showed the following refraction present:

O. D. + 1.25 D. cy. ax. 90°, V. = 6/6 + o.

O. S. + 0.50 Ds. (°) + 1.00 D. cy. ax. 90°, V. = 6/6 +.

Since then there has been no attack in either eye, and he has been able to continue his professional labors without discomfort.

The query arises, Was this attack of the second eye simply a coincidence, was it the result of some old infectious material, or was it the result of ciliary nerve irritation or possibly nerve habit? It seems to me no theory satisfactorily explains the case, but the nerve irritation, in my own mind, is much the more satisfactory. But why, after a period of nearly four years' quiet, the heretofore sound eye should be disturbed through ciliary irritation in the primarily affected eye, without any evidence of inflammation present in this, is a problem I am unable to settle satisfactorily in my own mind.

DISCUSSION.

DR. J. A. ANDREWS (exhibiting specimen).— I am not sure that this was a case of sympathetic irido-cyclitis, as the history was not perfect; but I made the drawing from an eye that was the seat of irido-cyclitis, the history given being that the fellow eye had been injured and lost several years previously, and that the other eye had become inflamed some time after the injury. The eye was removed because it was painful. As the drawing shows, the cornea was of a golden-yellow color. Under the microscope, you will see in the cornea hyaline degeneration, and a thick connective tissue membrane upon the anterior surface of the iris, stretching across the anterior chamber and blended with the atrophied iris.

A CASE OF SUPPURATIVE IRIDO-CHOROIDITIS OF OBSCURE ORIGIN, ENDING IN PANOPHTHALMITIS, IN AN INFANT OF NINE MONTHS.

BY ROBERT L. RANDOLPH, M.D.,

BALTIMORE, MD.

Suppurative inflammation of the uvea in children affected with cerebro-spinal meningitis is not such a rare condition, and it is found even with the exanthemata. The following case is interesting not only from the rather unusual course followed by the irido-choroiditis, which ended in panophthalmitis and rupture of the eyeball, but the case is interesting because there was absent throughout any well-marked symptoms of a constitutional disease. Last November I was asked to see a baby girl of nine months of age. A week previously the family physician was called in to treat the child for a cold and noticing that the eye was red, he had prescribed a boric-acid wash, and gave the eye affection no further thought. At the end of a week his attention was again called to the eye, and he noticed a whitish deposit in the pupillary area, and concluding that it was something more than conjunctivitis, requested me to see the child.

I found a strong, healthy-looking infant, seemingly in no pain, and easily diverted by its playthings. The child had no fever, but I noticed that there was a slight coryza showing itself in running at the nose, and some little catarrh of the upper portion of the bronchial tubes. Neither of these symptoms was what I should call marked. The affected eye (left) was somewhat uniformly congested. The cornea was perfectly clear. The pupil was much contracted, and its area was filled with a grayish exudate. There was also a deposit of this exudate on the floor of the anterior chamber. The tension of the eye was slightly below the normal, and the eyeball did not seem sensitive to the touch. There was no history of a blow. I regarded the condition as an irido-cyclitis suppurativa, probably of metastatic origin; and I told the attending physician that I had very little, if any, hope of saving the eye. The appearance of the eye closely resembled what I had seen several times in cerebro-spinal meningitis. Hot applications were used in the form of douches, and atropine was instilled every four hours. There was, however, not the slightest response on the part of the pupil to the action of the atropine, though on the third day I made three instillations myself of a solution of fifteen grains to the ounce.

On the morning of the fourth day the parents expressed the wish for a consultation, and Dr. Samuel Theobald was called in. Dr. Theobald agreed with me in the main, but thought that there was still hope, and suggested that the child be put on small doses of "gray powder," and that inunctions of mercury ointment be used. The infant at this time was a very restless sleeper, and Dr. Gamble was obliged to give an anodyne to enable her to rest. It would still take interest in its playthings and notice those in the room, and gave no evidence of actual suffering. The treatment suggested by Dr. Theobald was at once commenced and faithfully persisted in for three days, when it was discontinued, as Dr. Gamble thought that the child was weakening under it, and there was no improvement in the condition of the eye. The local treatment was, of course, carried on all this time.

On the evening of the fourteenth day from the onset of the

trouble I found the eye very hard to the touch, and on leaving the house with Dr. Gamble expressed the fear that panophthalmitis was setting in. The next morning I found the eye protruding and the lids very oedematous. From now on panophthalmitis prevailed in its most typical form, and at one time I had concluded to open the eyeball, so evident was the suffering: but on the evening of the seventeenth day — that is, three days after the beginning of the panophthalmitis — the ball ruptured at a point just between the cornea and the insertion of the external rectus muscle. The eyeball at present is two-thirds the size of its fellow.

My own idea of the case was that the child was suffering with a mild attack of influenza, and that an embolus infected with the bacteria of influenza had gotten into the circulation of the eye and hence the panophthalmitis. I must confess though that I was alone in this opinion.

A CLINICAL STUDY OF A CASE OF DOUBLE CHORIO-RETINITIS, IN THE MACULAR REGION, FOLLOWING A FLASH OF LIGHTNING AND A FLASH FROM BURNING LYCOPODIUM.

BY CHARLES A. OLIVER, A.M., M.D.,

PHILADELPHIA, PENN.

On the 27th of April, 1894, A. P., a twenty-year-old engraver and artist, came to my clinic at Wills' Eye Hospital, complaining of muscular and accommodative asthenopias. A week later the total error of refraction was most carefully and repeatedly obtained during several days' time by the use of atropine. Two weeks were allowed to elapse before the formula for glasses was given. During the intervening time medium smoked coquilles were constantly worn, and no manner of near work was attempted. The correction ordered, which was for a low grade of compound hyperopic astigmatism, gave an acuity of vision and a power of accommodation that were normal in each eye. Extra-ocular muscle balance for both far and near was restored from a slight esophoria to proper equilibrium.

Just after the patient left the hospital with the formula for his glasses, a violent electric- and rain-storm suddenly appeared. The details of what now happened cannot be better given than in the exact words of the patient's own intelligent account:

"On the 28th of May, after being at the hospital to have the glasses examined which were ordered by Dr. Prendergast of Dr. Oliver's clinic, I started home at 3.30 P.M. A heavy storm came up, and there was a great deal of lightning.

"While I was walking on Filbert Street, between 9th and 10th Streets, a flash of lightning which appeared like an electric arc light (that is, it was a blinding flash) passed from left to right in front of me.

"A queer sensation came over me, and I thought every bone in my body was being wrenched from its joints, and I staggered. A horse which was on the opposite side of the street fell, but regained his feet a moment later. For several moments I could not see; my eyesight came partially back first in the left eye only. Gradually, in a minute or more's time, the sight returned in the right eye. I walked home apparently all right.

"That evening, about half-past nine o'clock, I was exposed to a flash of light from lycopodium coming in contact with burning alcohol. I went to bed, and was so restless that I could not sleep.

"The following day I went to work, which is that of engraving. I noticed on my work or wherever I looked that there was a small grayish spot. In the center of this spot there was a second one, about the size of a pin's head, and which was of the brightness of the sun. The central bright spot was fixed, while the grayish boundary moved rapidly in the direction shown by the arrows in the sketch.* (Plate I, No. 1.)

"At noon on the second day the spot changed to the shape shown in No. 2. The central spot was still bright, but the boundary was darker. The same character of motion continued as in No. 1, but it occupied a different position, as shown by the arrows.

*"The spots are as I look at them, and are the exact size and shape. I have taken great pains in preparing these drawings, and they are correct."

(All of the succeeding subjective studies were made with the object situated at twelve or more meters' distance from the eyes.)

Right eye.

"During the evening of the same day No. 2 spot changed entirely. The central spot, which remained bright, divided into four parts that kept constantly revolving in and through each other. The outer area had become fainter, and seemed to be made up of radiations which rapidly moved from the center to the edge in radiary waves. Both varieties of motion moved with the same rapidity." (No. 3.)

The patient later stated that, during the time that these three figures were present, any series of narrow or closely placed vertical lines would appear unequally corrugated like broken waves. The lower extremity of each broken line seemed to vibrate both to the right and left and to the left and right in a similar manner to the movement of a pendulum of a clock. Each excursion was short, and the motion was very fast. The upper portions of the broken lines remained stationary.

On the afternoon of the 6th of June, just nine days after the accident, he came to me at the hospital, and I had my first opportunity of examining him. At this time he gave me the first seven sketches. He told me that the flash of lightning, which appeared purple, seemed to strike the pavement directly in front of him, and for several hours afterwards a grayish-colored area, which prevented him from seeing a man's head, persisted before each eye, and then gradually disappeared. The lycopodium flash did not seem to leave any immediate after-effects. As noted in his own account of the case, the central scotomatous- and irritation-area appeared on the following day and continued for seventy-two hours. For a period of three days he had very little if any trouble, although his employer had several times complained that his engraving was imperfectly done.

On the 3d of June, three days before I saw him, the irritation-scotoma again appeared before the right eye. As shown in No. 4, the patient stated that "the small brilliant spots had increased to seven, and the surrounding grayish area had become somewhat Maltese-cross shaped. The bright spots were constantly moving through one another like minute electric balls, without leaving any trail."

On the following day, "the large spot, as partly shown in No. 5, which still remained fixed, became darker, and the in-

cluded bright spots were changed into a great number of rapidly and irregularly moving hair-lines of brilliant light."

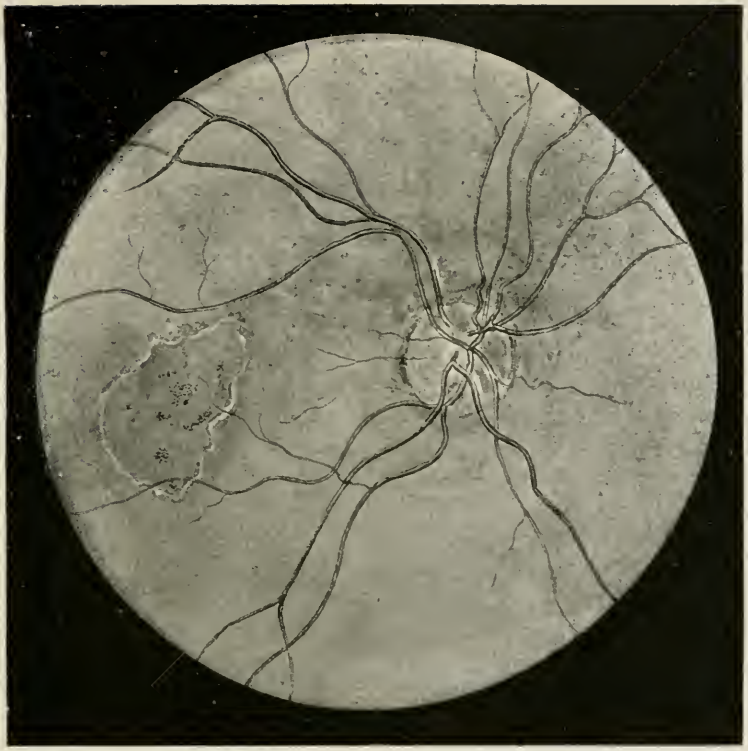
The succeeding day showed (No. 6) that a great change had taken place. The scotomatous area had become somewhat fainter, had increased in size, and had become stellate in form. The radii were massed into bundles that were situated upon different planes. The contained brilliantly-lighted lines were converted into eleven small spots of the same shape and size as the seven shown in No. 4. Like those in No. 4, the spots had become aggregated centrally and were undergoing the same character of inosculating motion.

Early in the morning of the day that I saw him, the remarkable change shown in No. 7 appeared. To quote from the patient's own written statement: "This change came suddenly. I had retired early the night previously, at which time the spot was like that shown in No. 6. I could not sleep much until towards morning. I arose at 7 o'clock, when, to my surprise, the spot was like that shown in No. 7. The slightly excentric light area was not brilliant, but had the appearance of frosted glass. The surrounding area was as black as ink. The large, faint peripheral area seemed to me like a fog. The entire mass was motionless."

He stated that any decided movement of the left eye produced a deep-seated pain in that organ.

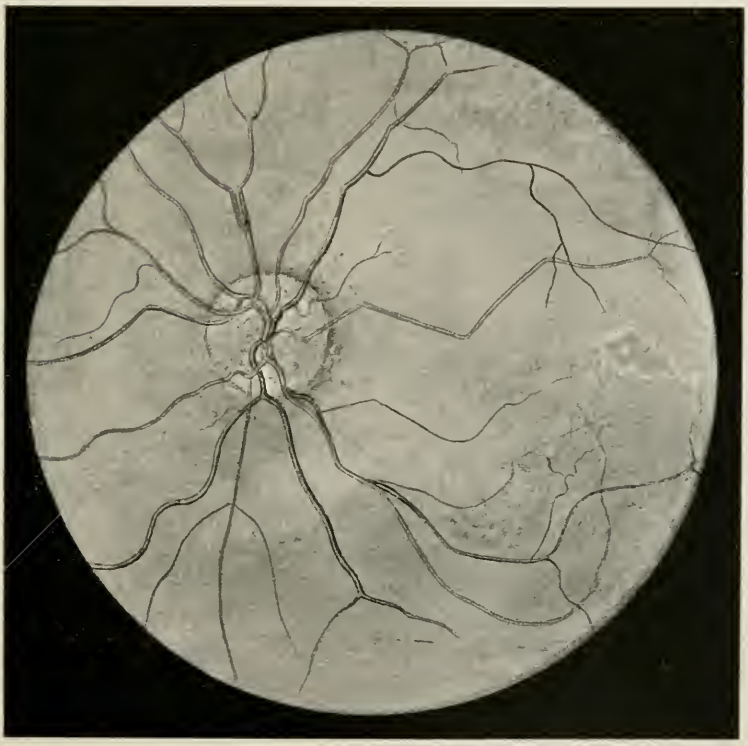
Central vision for form with the right eye was reduced to one-fortieth of normal. The field of vision, which was normal in size, gave marked evidences of a large irregular central scotoma that was absolute for both form and color. The pupil was the same size as that of the fellow apparently undisturbed eye, and the iris was as freely mobile to light-stimulus, accommodation, and convergence as its fellow. The left eye seemed normal in every respect. The ophthalmoscope revealed a most striking and never-to-be-forgotten picture in the right retina. Directly in the macular region the retinal tissue seemed to be slightly puffed into an irregularly flattened mass. The tissue itself did not appear to be discolored or opaque, but glistened in places as though the underlying material were composed of an extremely thin coating of cicatrizing almost transparent jelly. No hemor-

FIG. 1.



Ophthalmoscopic appearance of right eye-ground.

FIG. 2.



Ophthalmoscopic appearance of left eye-ground.

rhages of any character could be detected, and no signs of degeneration of any type, except that the nerve-head was a trifle hazy and gray, could be determined.

The retina of the left eye apparently was not affected in any way, except that here, too, the nerve-head was a trifle too gray for age, and was somewhat hazy.

The patient, who seemed strong and hearty, strenuously denied any syphilitic infection, and, after the most careful physical examination, failed to present any evidence of the disease. The only obtainable history of systemic disturbance was that of infrequent attacks of muscular rhematism.

In order to study the rapidly-changing symptoms, and to give his eyes a thorough rest, I admitted him into the hospital, put him to bed, and lightly though effectually bandaged his eyes so as to exclude all extraneous light from their interiors. I immemediately placed him upon the free use of alteratives, thoroughly purged him, and gave him light, nutritious diet.

The examinations were continued unremittingly each day, care being taken to give each eye a thorough rest before every new procedure.

On the second day of his stay in the hospital he observed that the scotomatous area had undergone a marked change for the better. This is shown in No. 8. In his own words: "There is some change in the general shape of the spot. The small white spot is a little larger, and the surrounding black area is a little lighter. The foggy appearance around the spot has disappeared." He complained that the eyeball pained him considerably. Both central and peripheral vision practically remained as before.

To his great dismay, he, for the first time since the primary momentary blinding at the time of the accident, noticed a central scotoma before the left eye.* (Plate V., Figure A.) He informed me that "it had appeared synchronously with the twisted, snake-like appearance before the right eye." To him it closely resembled drawing No. 3, seen with the right eye, and had the same characters of motion.

* In order to more readily differentiate the varying scotomata in the two eyes, all those that belong to the right eye have been numbered and all those that were seen by the left eye have been alphabetically arranged.

On the 11th of June, at my suggestion, he presented me with two very interesting sketches.

The scotomatous areas were studied in his ordinary way of projecting them against a distant white background, as, for example, the clouds, a white shutter, or a pane of ground glass, now gave him the peculiar appearance shown in No. 9. As he remarked in his report, "The color is the same as that in No. 8, but the light place in the center is larger, and I can see a very little through it." Acting upon this suggestion, I thought that I would try and see whether any increase in the distant illumination would make a change. To his great surprise, when I had him gaze at a large area of rather brilliant, orange-yellow light, obtained from ordinary illuminating gas, he found that the previous light central area in the scotoma became absolutely black, and the peripheral area, which was extremely black in the previous experiment, now became quite faint and "pearl colored." No. 10 shows very well what is meant. Several times during the experimentation, when the patient looked away from the flame, several brilliant triangular bodies, which were in rapid vibration, appeared in the scotomatous area.

A careful drawing of the appearance of the same series of vertical lines that he had experimented with before his admission into the wards of the hospital, gave the projection of a scotomatous area that was similarly shaped to No. 9 directly upon them. A peculiarity, however, that he noticed was that the lower extremity of every one of the lines above the scotoma was barbed upwardly and to the left, and the upper extremity of each of the lines below the scotoma was barbed downwardly and to the left.

On this day the general form of the scotoma before the left eye had changed to the area shown in Figure B. The six small brilliant spots kept moving in the same manner as the spots in No. 7.

At his own request, I discharged him from the wards to the dispensary service of the hospital, ordering him to take twenty grains of iodide of potassium three times daily.

On the next morning (the 12th of June) the scotoma presented the appearance shown in No. 11. As can be seen,

Right eye.

"the foggy atmosphere," as he was wont to call it, in which the scotoma had been situated, had disappeared. The central light area had greatly cleared, and the entire spot had become fainter, this being marked in measure by "a heavy dark vein" which ran through central portion of the larger dark area.

At 1 P.M. of the same day the patient made the sketch shown in Plate II., No. 12, and noted "there is some change in shape but not in color. There are two bright spots, like miniature suns, in the lower portion of the spot, and these, which are constantly vibrating, are exceedingly annoying. The eye pains me and seems quite inflamed."

Half an hour later, the sketch of No. 13 was made. In the patient's diary I find: "The dark spot is about the same shape, but it is lighter. One bright spot has disappeared. The remaining one, instead of vibrating, throws a light up across the light area beyond the scotomatous area, leaving a series of overlapping concentric rings somewhat like the tail of a comet."

At 5 P.M. of the same day he made the sketch for No. 14, writing: "This makes the fourth change in one day, the most that have taken place in one day. The bright spot has gone. I can see through the small central opening, but very dimly, as though it were covered with frosted glass. Everything seen through it, though not distorted, seems to be small and very far away."

The sketch of No. 15 was made at 10 o'clock the next morning. To use the patient's own language: "This morning another change has taken place, both in size and shape of the spot. It is larger, but is not any darker than that of the previous sketch. The whole area appears like a piece of isinglass, but I cannot trace the shape correctly. By closing the eye rapidly I can see the shape. The opening is a little clearer. All objects are very small and dim. The eight small spots outside appear as though they were broken-off particles of the large spot. They are fixed."

At 12.30, noon, he made another most interesting sketch, shown in No. 16, and wrote: "Another change, both in shape and size, has appeared. The light spots have lessened to six, and instead of one large opening in the central blind area,

there is a more irregular and dimmer somewhat central one, surrounded by six little ones, four of which are situated in the prolongations."

Two hours later sketch for No. 7 was made. Describing it, he said: "Another change, both in size and shape; all of the small areas have disappeared from the outside of the spot. The sieve-like openings in the large area have all, with the exception of the lower inner one, broadened into a large central light area partaking somewhat of the same general configuration of the large dimmed area."

During this day he made two very instructive sketches, one of which was practically No. 17 projected against a series of narrow vertical lines. Not only was the scotomatous area present, but the lines themselves in the region of the scotoma were smaller, finer, and more closely packed together, thus substantiating his assertions that all objects looked at through the spot were smaller.

A curious sketch showed that a vertically held string bulged forward and appeared somewhat attenuated in front of the scotomatous area. A drawing of a horizontally placed rectangle, made while looking at the object with the right eye, exhibited the same characteristic metamorphosia and micropsia. The ophthalmoscope showed that the macular region was surrounded by a most curiously irregular and shining rim, the enclosed area being markedly depressed in places and quite pallid, especially the fovea itself.

On the 18th of June the left scotoma, as shown in Figure C, appeared to be divided into four dull areas, "which are in constant motion. The six vibrating, brilliantly-lighted spots have disappeared."

Three days later (21st of June), at 4 P.M., the sketch shown in No. 18 came into existence. As the patient wrote, "This is the most peculiar shape and motion that I have had. It is about as dark as drawing No. 5. The small central clear spot, which is fixed, is about as bright as an electric arc light. The dark, comma-like area surrounding it moves around the light spot in the direction shown by the arrows at about the rate of two revolutions per second. In a dark room the small

Right eye.

central spot appears jet black, and the large surrounding area is pearl-white in tint. The same motion persists."

The appearance of the vertical lines at this time were so extraordinary that they are here reproduced in Plate III., No. 19.

At this visit it was found that vision in the right eye had tripled (3/40), while that of the left eye equaled full 5/5. Although there were some evidences of iodism, I continued the drug just as before.

On the following day (22d of June) the spot appeared as if split into two sections, and the bright area had gone. (No. 20.) The patient's notes state: "I cannot draw the shape of the spots unless I close the eye rapidly. They are in constant motion, like the one shown in drawing No. 3."

The vertical lines had undergone a marked change. They were not so broken, and the heavy, dense, horizontal thickenings were replaced by six broad, faint, horizontal smudges.

The right fundus in the macular region seemed to have regained its natural tint, though careful focussing revealed the presence of a few faint and almost imperceptible deeply-seated pigment-splotchings and aggregations.

On the 24th of June a most curious paresthetic area, represented in No. 21, appeared. Of this the patient wrote: "This shape stayed only for about one hour, fading to the shape shown in drawing No. 18. It has the appearance of waves of light composed of fixed radii which pass outwardly from the center. These waves elevate and depress themselves from the center just the same as if one threw a stone into the water — the waves flowing from where the stone struck the water — so here the spot is similar to the waves except that being water they are waves of light." Central vision with the right eye equaled 1½/40; excentrically it rose to 5/15.

On the 29th of June the sketch shown in No. 22 was made. The figure is that of a man smoking a cigar and carrying a cane as he is leaving the patient. "The white area represents the man as he appeared with the right eye while I was looking at the middle of his back. The surrounding shaded area shows him as I know what he should be."

Central vision directly ahead with left the eye equaled one-half of normal (5/10).

I did not see the patient again until the 2d of July. He said that he had taken the tri-daily dose of twenty grains of iodide of potassium faithfully and had not attempted to use his eyes in any way, being careful to wear his smoked glasses constantly.

At this visit he drew the sketches represented in Nos. 23 and 24. The scotomata had become fixed and all objects appeared "very small." His comments as to the sketch are as follows: "Now, you can see a great difference in the two areas in regard to shape and size and the dense dark spots over them. No. 23 has eight small black spots; No. 24 has eight also, but they cut across the whole area from left to right as a series of stripes. When these bands or stripes first appeared it seemed to me that the spots actually lengthened themselves out to become stripes."

Four days later I had him make a sketch of my card of test-types which was hanging on the wall at about two meters' distance. The result is shown in Plate IV., No. 25. The noting at the side of the drawing read: "This shows the appearance of Dr. Oliver's card while I am looking at the letter 'O' in the upper right-hand corner."

On the 8th of July he came back very much disturbed, saying that, although the size of the general area was diminished and the dense superimposed spots were reduced to five, yet these were in such a state of constant motion, just as they had been in No. 3, as to be annoying. The appearance of the fixed and superimposed mobile scotomata are shown in No. 26.

He voluntarily stated that during heavy thunder-storms where there is much lightning he gets demoralized and "must get into a dark room so as to prevent the right eyeball from jerking and twisting in its socket."

The next day, to his gratification, the five spots disappeared, but the gray area upon which they had seemed to rest had grown somewhat larger. No. 27 shows this very well.

Upon account of pronounced iodism I stopped the iodide, ordering him full doses of strychnia instead.

I missed him for another week, when he came back with the assertion that he had ignored the strychnia and had unremittingly continued his tri-daily dose of twenty grains of iodide of

Right eye.

potassium. In spite of the marked iodism I persisted in the use of the drug.

The bright mobile spots had once more come to trouble him. The morning of his visit he had the appearance shown in No. 28.

He said that while sketching the scotomatous boundary "several bright spots shot in towards the center from the outer edge like roman candles; in fact, they resembled them very much. After striking the center they disappeared. This phenomenon lasted for about one minute."

Some hours after this he accidentally found that while gazing down upon a white marble floor and drawing the scotomatous area, two excentrically situated and fixed bright areas of light, just as "when the sun shines through the slat-work of a shutter," were projected upon the floor. The position of these light areas and the central scotomatous area are shown in No. 29.

Notwithstanding the scotoma, the excentric vision up and in the right eye had increased to about two-thirds of normal ($5/7\frac{1}{2}$).

On the succeeding second and third days the central dim area, which stayed fixed, became larger. The excentric light area first noticed on the 16th of the month, remained equally bright, but had become a trifle smaller. At the upper border of the large dim area a brilliant and serrated worm-like mass kept in constant motion. This can be seen in No. 30.

"During the afternoon of the third day the two bright spots in the lower right-hand corner disappeared," and immediately the dense black stroke, shown in No. 31, came on, they first being 'lightish' and gradually becoming 'darker.' By the 18th of the month the four faint scotomatous areas before the left eye had practically gone. I found, however, by reference to his notes, these words: "While lying in bed on the night of this date, and being unable to sleep, and very restless, I looked up at the moon, when, slightly down and out from it, there were two somewhat luminous objects in the sky. These were stretched out vertically, quite close to each other, and moved around the moon as I moved my head in the same direction."

One week later the spot before the left eye again came into

evidence. At this time all objects immediately below the fixation-point were obscured. A drawing of a man's face in profile, made while he was looking at the top of the model's nose, placed the mouth and chin in the scotomatous area. Figure D, showing the appearance of my card of distant test-type when the patient was looking at E. O. on the top-line, will explain very well what is meant.

On the 30th of the month he told me that the objects seen through the comparatively clear areas were much larger and more nearly what they should be than before.

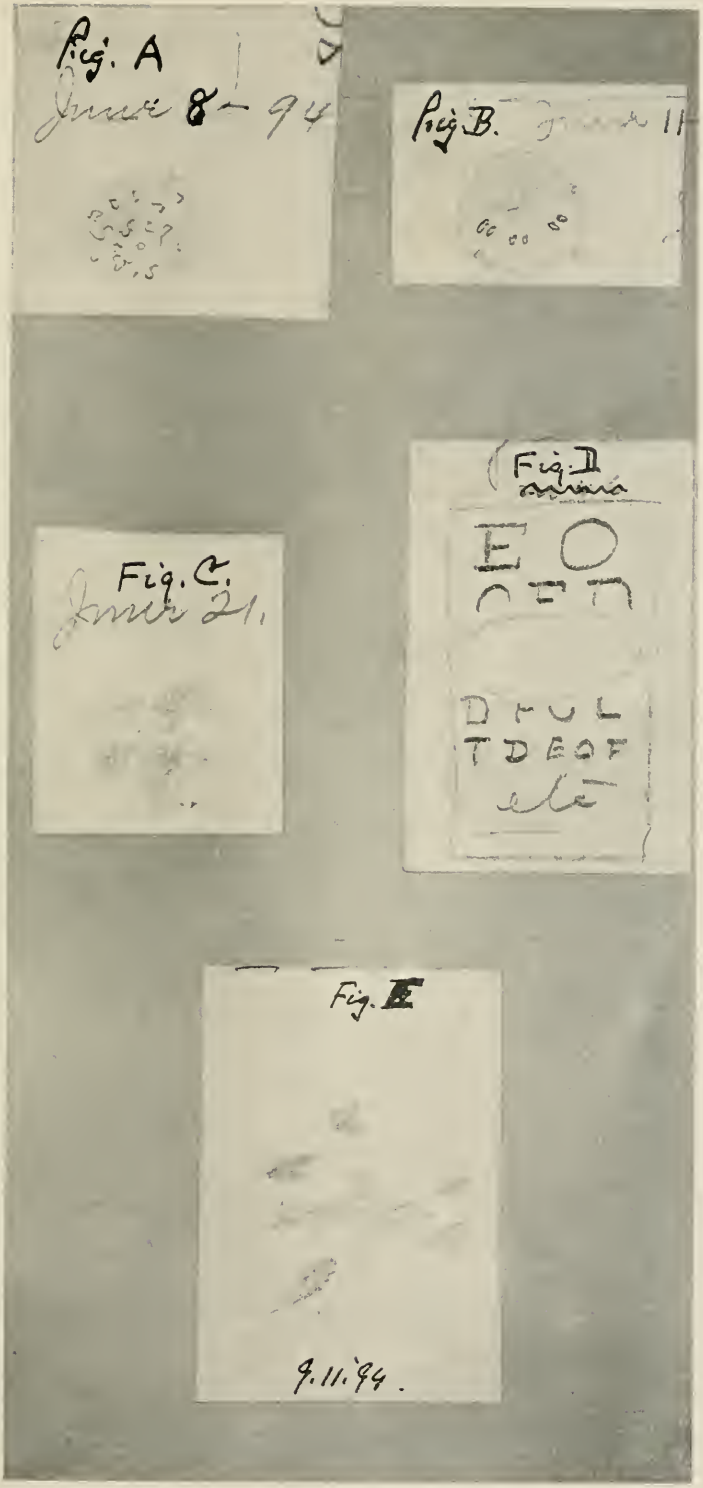
The notes of the 5th of September state that he was taking eighty grains of iodide of potassium daily with impunity, he having a good appetite. Nothing noteworthy was apparent until this date, when a minute fresh hemorrhage with its convexity directed upwards could be seen just below the left fovea, between the retina and the chorioid. The macular region of the right retina was faintly granular, and slightly pigmented.

He stated that the left eye had become painful during the previous night, and when he had gotten up and lit the gas, he found that there was a dense black spot in the center of its field of vision.

On the 10th of September he noticed that the left scotoma had become reduced. In his own words he said, "to a lot of faint spots which, as near as I can explain, look like drops of water slowly flowing down a pane of glass, one trying to beat the other."

On the same day, without warning, a dim representation of No. 21, seen on the 24th of June, appeared before the right eye and lasted for about twenty-four hours.

On the following morning he noticed that the large, dim scotoma before the right eye, which had been so persistent and fixed during the summer months, recurred; but, curiously, its edges seemed broken away and lost. Through this area, and in no other position in the field of fixation, was there any complaint of micropsia. The scotoma gradually became faintly mottled, and at last decreased in density, until a drawing, made on the 9th of October, showed that the area was barely discernible.



Left eye.

At this visit he brought a sketch of figure E, which, as he said, showed "the shape, size, and shade of the spots in the left eye. There is no motion whatever."

After a most rigorous examination, no cardiac or renal lesion could be determined. Vision in the right eye had risen to one-half of normal, while that in the left eye was normal. When the patient regarded any object fixedly with the left eye, the image of the object became alternately larger and smaller, and seemed distorted upon its edges just "as though it were viewed through a convex lens which is successively elevated and depressed." The subretinal hemorrhage in the left eye was beginning to manifest evidences of beginning absorption.

Two weeks later the ophthalmoscope showed that there were a few faint pigment-spots in the right retina, and that the minute hemorrhage in the left subretinal tissue was nearly gone, the retina in the macular region being elevated and depressed into several almost imperceptible striæ. He stated that he had not used any alterative for more than a week. He was told to discontinue its use.

On the 17th of October he returned with the statement that the day before he had attempted to resume his work, but found that he was compelled to desist upon account of the annoying distortion and dimness of objects. A careful correction of his minor degree of astigmatism obtained both with and without the employment of a mydriatic, failed to relieve the condition in any way.

During the month of November he returned several times. On the 26th of the month he made some sketches showing the contracting effects upon long, narrow rectangular forms placed at different angles in the scotomatous areas. These, which were most numerous and ingenious, will be reserved for another paper upon a related subject.

In January of 1895, the scotoma in the right eye could be just seen. He then wrote: "vertical lines are not broken or drawn together, and objects seem very little distorted." The accompanying reproductions of two faithful water-color sketches (Figs. I. and II.) by Miss Margaretta Washington of this city were secured about this time. The relative conditions seen

are so self-evident that written description is rendered unnecessary. The iodide of potassium was persistently continued in, as much as possible,—attacks of iodism coming on very quickly and persistently, requiring constant counter-medication.

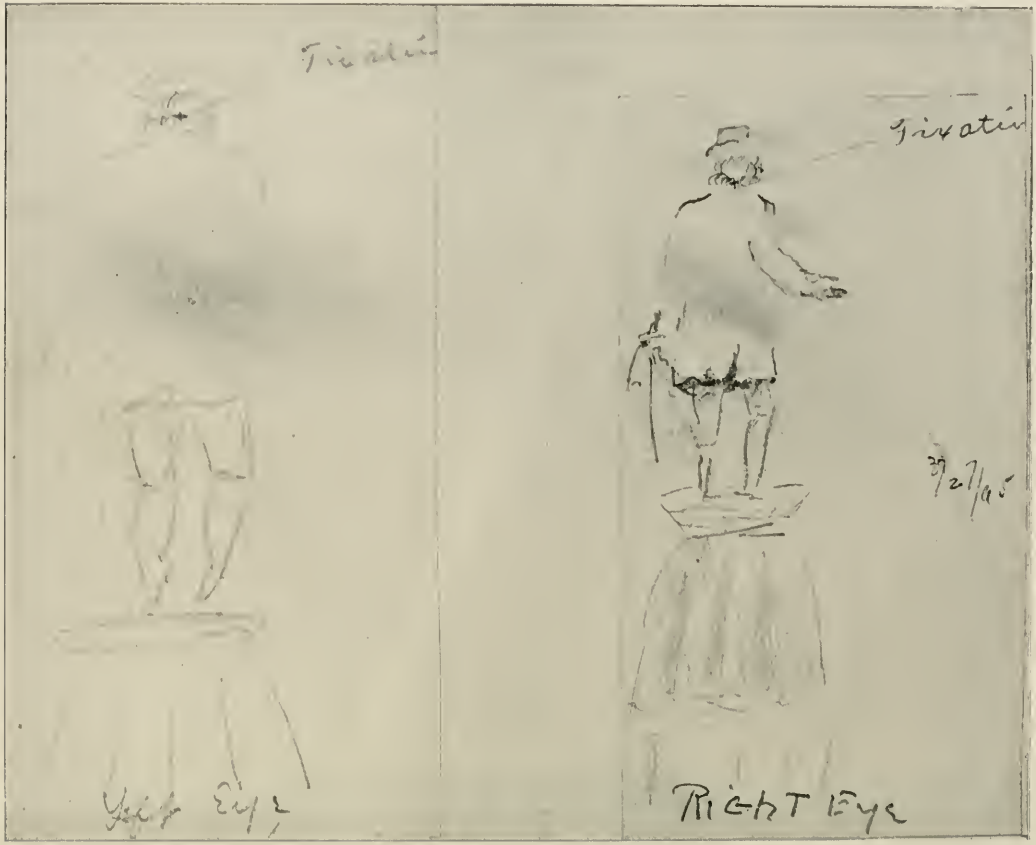
Once in February he returned with a slight, though temporary increase in dimness in the right scotoma. At this visit he told me that the left one "had preserved the same shape and shade, but that the smaller spots were plainer (darker), and seemed to be increased in number.

His statement that at times there was some supra-orbital neuralgia, and that frequently an irregular and vibrating meshwork was thrown between the left eye and the object looked at, induced me to make a most careful, though fruitless, examination of the media and muscular apparatus of the organ. Central vision with the right eye had steadily risen to one-fourth of normal ($\frac{5}{20}$), while that of the left eye was practically normal.

The dose of iodide of potassium, which was now being taken with more or less regularity, was reduced to five grains three times daily.

On March 27th of last year, in order that I should better realize the relative difference between the two sights, he gave me two rough sketches of the same object studied from the same objective point nearly four blocks away (the statue of William Penn upon the City Hall of Philadelphia). When study is made of these, which are reproduced in the full-page phototype (Plate VI.), it will be instantly noticed that (with the same minor degree of refractive error) the image of the right eye is much the smaller, thus substantiating in another and most graphic way his constantly repeated assertions of micropsia. The projections of the faint scotomatous areas against the head and back of the figure, and the large size of the left scotoma, are all most interesting and instructive.

In September, 1895, he returned for the removal of some dirt that had been blown into his left conjunctival cul-de-sac. At that visit I embraced the opportunity of restudying his case. His vision, which was central in each eye, had risen to two-thirds of normal in the right eye and to full acuity in the left. Accommodative power and play were equally good in each eye.


Right Eye
RIGHT EYE

He considered his right eye well. At times, water-like globules would appear in the center of the left field of vision. Careful focussing with the ophthalmoscope revealed the faintest traces of the macular changes shown in Miss Washington's sketches.

An extended re-examination the beginning of this month (July 1896), gave practically the same findings as were noted ten months previously. A final series of characteristic sketches of geometrical forms in which the distance between any two parallel lines (especially the horizontal ones), was made very small, showed minor degrees of bulging just at the fixation point with the right eye, and rather more marked elevation and depression of the entire widths between the two lines away from the fixation point with the left eye. He is now unable to project any scotoma, "any mark, blur, or spot" with the right eye, "except by looking up at a clear sky, and then only a very faint outline of the old spots appears."

With the left eye he can project a few extremely attenuated and almost invisible grayish scotomata around and especially above the macular region, these in the carefully taken corresponding field of vision being evidenced by the faintest dim areas for color and form. The field of vision of the right eye fails to show any scotomata but in a small area about three degrees above the fixation point, extremely minute and circular test objects appear elongated into a vertical oval.

The fields of vision, which were frequently repeated during these studies, at no time evidenced any contraction in the peripheral boundaries, the central scotoma, which were constantly absolute for color, and, at times, negative for form, always agreeing with those that the patient made in the sketches from which the figures were taken.[1]

Remarks: — The present case is here given in its minutest detail in order that an almost unique instance of intelligent

[1] The writer here desires to express his obligation to the patient himself for his untiring aid and conscientious study of the constantly varying symptoms without which help much of the interest and value of the paper would have been lost. To the writer's general clinical assistants, especially Dr. Wm. Campbell Posey, his official assistant, much credit must be given for their skillful and careful clinical handling of the case.

subjective study in combination with a fairly well-made series of clinical researches and an exact graphic reproduction of the intra-ocular lesion found, might be made of use by others in their studies upon such comparatively rare and quickly evanescent symptom—groupings. Uncomplicated, having been seen but a few minutes before the accident, studied carefully and watched most incessantly, the case assumes a certainty that entitles it to consideration.

Although the literature upon the subject has been well searched over and much that has been done by others has not been attempted here, yet with the latter shortcoming, this clinical study is given to the literature of the ophthalmic world in the hope that it may not be altogether fruitless and useless.

SOME BACTERIOLOGICAL EXPERIMENTS BEARING UPON THE STERILIZATION OF INSTRUMENTS USED IN CATARACT EXTRACTION.

BY SAMUEL THEOBALD, M.D.,

BALTIMORE, MD.

The question of the best method of sterilizing surgical instruments is one of great practical importance. Heat furnishes the most certain means of destroying pathogenic organisms, but its effect upon cutting instruments, and particularly upon the delicate instruments used in eye surgery, is most deleterious, especially if they be subjected to its action for a considerable length of time. I have seen, for example, a pair of strabismus scissors so tarnished and dulled by a single exposure to the action of a steam sterilizer that they could not be used again with any satisfaction, without being re-polished and re-sharpened.

Influenced by what Dr. Knapp told us some years since (TRANSACTIONS AMERICAN OPHTHALMOLOGICAL SOCIETY, 1886) as to the practicability of removing pathogenic organisms from cataract knives and similar smooth instruments by the simple

mechanical process of washing and wiping, and at the same time wishing to avoid the blunting effect of long exposure to heat, I have been in the habit for a number of years of cleaning my eye instruments previous to operating by giving them a brief *washing* in boiling water. This is accomplished by the aid of fixation forceps and a pledget of absorbent cotton, which has been boiled for some minutes, the cotton held by the forceps being used to wash off the blade of the cataract or iridectomy knife, the cystotome, etc., while these are immersed for a few moments in boiling water.

The efficacy of this method of sterilization seems to have been shown by the clinical results obtained, but recently it occurred to me to put its efficiency to the test of bacteriological experiment, and, further, to endeavor to discover how far the sterilization was due to the comparatively brief action of the heat, and how far to the mechanical effect of the washing. With these ends in view, the following experiments, which were made in the Pathological Laboratory of the Johns Hopkins Hospital, and with the efficient aid of Dr. Berwick B. Lanier, one of the workers in the laboratory, were undertaken:

The blades and teeth of a pair of iris forceps were contaminated with a pure culture of the staphylococcus pyogenes aureus. The blades of the forceps were then washed in boiling water, in the manner above described, and were then introduced into a culture tube containing bouillon. No growth resulted, showing that the sterilization of the forceps had been effectual.*

A cystotome was treated in like manner, and with the same negative result — the culture medium remained sterile.

The experiment with the iris forceps was varied by substituting the streptococcus pyogenes for the staphylococcus aureus. The result was the same — no growth.

The forceps and cystotome were chosen for these experiments rather than a cataract knife, in order to make the test more crucial.

A cataract knife was contaminated with the staphylococcus

* This experiment was subsequently repeated by Dr. Lanier and myself thirty times, the culture medium remaining sterile in every instance.

aureus, and, after being washed in boiling water, was exposed to the air of the laboratory for eight minutes. The culture tube again showed no growth. An open Petrie dish exposed near the knife for the same length of time showed only one colony of an air organism.

The iris forceps, after having been contaminated with staphylococcus aureus, were washed in water which had been sterilized by boiling, but had been allowed to stand until it had become lukewarm. The washing was done with the fixation forceps and cotton, as in the other experiments. The bouillon gave a growth of staphylococcus aureus.

The same forceps were contaminated with streptococcus pyogenes, and were washed in the same vessel of sterilized water. The culture tube showed growths of both streptococcus and staphylococcus aureus.

A cataract knife contaminated with staphylococcus aureus was washed under the water spigot, with sterilized absorbent cotton held in the fixation forceps. The culture tube gave staphylococcus aureus, and also water bacteria.

These experiments seemed to show that bacteria are not removed by simple washing, even from the smooth surface of a cataract knife. Subsequently, however, three experiments were made with a cataract knife and one with a cystotome, the staphylococcus aureus being used to contaminate them, and the washing being done under the spigot, but in a more thorough way — the absorbent cotton being held between the thumb and fingers — and in all of these the washing proved effectual, and no growth whatever was observed in the culture tubes.

What they show more positively, however — and this is a point of greater practical importance — is that, so far as the ordinary pyogenic organisms are concerned, a very brief *washing* in boiling water, which is not likely to appreciably blunt their cutting edges, suffices to sterilize effectually such instruments as are commonly used in eye surgery.

ABSOLUTE ALCOHOL AS A DISINFECTANT FOR INSTRUMENTS. A BACTERIOLOGICAL STUDY.*

BY ROBERT L. RANDOLPH, M.D.

For the past eight years I have employed absolute alcohol as a disinfectant for all cutting instruments used in operations upon the eye; and recently I instituted a series of bacteriological experiments to test the value of this agent as a practical disinfectant. The cataract operation demands a keener knife probably than any other operation in surgery, and the peculiar objections to heat for sterilizing cutting instruments led me to adopt the use of absolute alcohol as the best substitute for heat. I have satisfied myself again and again that not only does moist heat but even dry heat dull the edge of instruments, and this I understand has been the experience of many surgeons. In making this contribution to our knowledge of alcohol it is not with the idea that I am introducing a new disinfectant, for I am well aware that there are not a few ophthalmologists who use it as an agent for sterilizing instruments. No matter though how well satisfied we may be with aseptic measures we can not understand why they are satisfactory or, in other words, how much they contribute to our success, until these measures have been subjected to bacteriological tests, and so far as I know, no exhaustive series of tests of absolute alcohol as a disinfectant for instruments has been made.

The experiments of Koch go to show that alcohol possesses inferior germicidal qualities in so far as its action upon the spores of the anthrax bacillus is concerned, the spores retaining their vitality after a submersion of one hundred and ten days in alcohol. This power of resisting the action of germicides exists in a marked degree in the case of the spore-producing organisms, as is shown among others by the works of Globig,†

* Read at the thirty-second annual meeting of the American Ophthalmological Society, New London, Conn., July, 1896.

† Ueber einen Kartoffelbacillus mit ungewöhnlich widerstandsfähigen Sporen. Zeitschr. f. Hygiene, Bd. III, 1888, S. 322.

and of Reinicke.* It is evident that in the case of the spores of the anthrax bacillus at least, absolute alcohol is practically useless as a germicide, but the negative results of Koch should not be taken as an evidence that absolute alcohol has no value whatever as a disinfectant. This is true only in so far as one organism is concerned; and that, too, an organism which we know surpasses nearly all other bacteria in its vitality. It does not seem practical then to take Koch's results as a criterion for the germicidal value of absolute alcohol.

My experiments were undertaken at first to control, as it were, and to throw light from a bacteriological point of view upon the method which I employ for sterilizing instruments in operations on the eye. These experiments were not intended to demonstrate the effect of alcohol upon any special organism but to ascertain the value of this agent as a disinfectant for every-day conditions in eye-surgery. The question arises, why not determine the effect of absolute alcohol upon some one or more of the commonly met with pathogenic organisms, for instance the so-called pus organisms, and be guided in my conclusions by results reached in this manner. We know for certain that the pyogenic bacteria are concerned in the production of many serious affections of the eye and its appendages, and that in those cases of sloughing cornea, following the operation for cataract, to say nothing of panophthalmitis, one or more varieties of pyogenic cocci have been often found present in the affected tissues. No doubt many a staphylococcus and streptococcus infection has been conveyed to the eye by the instruments. There are practical reasons though for not approaching the subject from this point of view. The line between pathogenic and non-pathogenic organisms is not sharply drawn. Organisms which ten years ago were regarded as harmless have been since shown to possess, under certain conditions, distinct and intense pathogenic properties. Take, for instance, the bacillus coli communis, the bacillus prodigiosus, and the aspergillus fumigatus. Any one of these bacteria I have found when introduced into the eye will call forth the

* Bacteriologische Untersuchungen ueber die Desinfection der Hände. Archiv fur Gynaekologie, Bd. 49, S. 515–553.

most intense inflammation. The investigations of de Schweinitz, Haab, Poplawska, and of myself go to show that other than the so-called pyogenic cocci are met with which are capable of producing the most intense panophthalmitis. However valuable observations conducted on these lines might be they would not tell us whether alcohol protects us from a host of other bacteria which, under certain circumstances, are just as pathogenic as the staphylococci or streptococci. These were my main reasons for not selecting a special organism to test the efficacy of absolute alcohol as a germicide.

Fürbringer * first called attention to the value of alcohol as a disinfectant for the hands. His work has been gone over by Reinicke (loc. cit.) who has added a long series of most exhaustive experiments bearing upon this question of hand disinfection, and he agrees with Fürbringer in attributing valuable qualities to alcohol as a disinfectant for the hands. Reinicke employed in his experiments permanganate of potash and oxalic acid, sublimate soap, carbolic acid, lysol, and trikresol, and compared the results obtained with these agents with the results obtained by disinfecting the hands with alcohol, and his conclusions were as follows: After first washing the hands for five minutes in hot water, using soap and a nail-brush, then following this by scrubbing them from three to five minutes with 90 per cent. alcohol, he found them almost always absolutely free of germs. He says finally that the quickest disinfection that can be relied upon is scrubbing the hands for five minutes in alcohol. His results were confirmed in the main by Krönig,† Ahlfeld,‡ and Schaefer,§ though these observers differed in some points as to the exact action of alcohol.

Reinicke thinks that the alcohol in taking up the fat takes up the bacteria which are on the hands, and thus the bacteria can readily be washed away (*abgespült*).

Krönig is of the opinion that alcohol from its dehydrating

* Untersuchungen und Vorschriften über die Desinfection der Hände des Arztes nebst Bemerkungen über den bakteriolog. Charakter des Nagelschmutzes. Wiesbaden, 1888.

† Centralblatt fur Gynäkologie, 1894.

‡ Monatschrift für Geburtshülfe und Gynäkologie, 1895, Heft 3.

§ Therapeutische Monatshefte, Juli, 1895.

and astringent power changes the skin so that the bacteria are held fast in the shriveled epidermis and in this manner that they are rendered inactive.

Ahlfeld, however, believes in the germicidal power of alcohol and submits this test: thirteen people were made to wash one of their hands for three minutes in hot water, using soap and a brush, at the same time the fingernails were trimmed and cleaned. The hands were then rinsed in sterile water. Ahlfeld then removed some of the dirt beneath the fingernails with a small splinter of wood and dropped the latter into bouillon. Another fingernail was treated in the same manner and the piece of wood was dropped into a small glass containing 1/2 ccm. of alcohol. The piece of wood was always small enough to be completely covered by the alcohol. The same individuals were then required to repeat the cleansing process with the other hand, but instead of using soap and water the hand was scrubbed for one minute in alcohol, and inoculations were made from the fingernails in the same manner as in the first series. The results were as follows: In those cases where the cultures were made from fingernails, which had been washed in soap and water, colonies were present in every instance but two, while in those cases where the alcohol was employed as the cleansing agent the tubes remained sterile. In the twelve cases where the infected particle of wood was allowed to remain in the 1/2 ccm. of alcohol for two days after evaporating the alcohol and filling the vessels with bouillon the latter were found to be sterile after a certain length of time. These tests certainly indicate that alcohol possesses germicidal power.

Schill and Fischer* found that when tuberculous sputum was mixed with alcohol, in the proportion of five parts of the latter to one of the former, the bacilli were rendered inactive as was shown by inoculation experiments. Yersin† found that pure cultures of the tubercle bacilli were destroyed by five minutes' exposure to the action of absolute alcohol. I might add that Green of Birmingham, Eng., has recently repeated the experiments of Reinicke and failed to confirm them, but his

* Mittheilungen aus K. Gesundsheitsamte, Bd. II, 1884.

† Ann. de l' Institut Pasteur, t. II, 1888, p. 60.

experiments are very few in number, and his work is not yet completed. His communication appeared in the Deutsche Med. Wochenschrift for June 4th. As I remarked before, I have been unable to find any experiments bearing upon the efficacy of alcohol as a disinfectant for instruments.

The scheme followed by me in these experiments was as follows: A porcelain-lined tray, ten inches long, two inches deep, and five inches wide, was first sterilized by dry heat. The instruments were then taken from the case and laid in the tray. Squibb's absolute (98% to 99%) alcohol was poured on the instruments till they were completely covered, and then the tray was covered with a sterilized top. The instruments were allowed to remain in from a period ranging from fifteen to forty minutes. Only once, though, did they remain in the extreme limit; this was in the first series where a great many instruments were sterilized at one time, and necessarily the last instruments taken from the alcohol had been immersed for a much longer period, namely, forty minutes. Agar tubes were used for the inoculating medium. Each instrument was taken from the alcohol with a pair of long forceps (which had been sterilized by holding them in a flame) and after being plunged once in sterilized water it was then pushed down into the agar. I may say here that each tube was stabbed at least three times, and the majority of tubes were stabbed five or six times, so that every portion of the instrument, which would be likely to come in contact with the eye in an operation was rubbed against the culture medium. The instrument remained in contact with the agar from 20 to 30 seconds, which is longer than the knife remains in contact with the eye in the operation for cataract. The tubes were then placed in the thermostat, at the temperature of the human body, and allowed to remain for at least three days. Fresh alcohol was of course used at every sterilization of the instruments. I have divided these experiments into three series. The first series consisted in the inoculation of one hundred tubes with eye instruments which had been sterilized in the way described. The following instruments were sterilized:

Graefe's cataract knives,	7
Fixation forceps,	6
Iris forceps,	4
Iris knives,	4
Liebreich's forceps,	1
Desmarre's pincette,	1
Canaliculus knives,	5
Scalpels and bistouries used in lid operations,	12
Strabismus hooks,	6
Lid retractors,	4
Foreign body needles,	4
Iridotomy scissors,	2
Discission needles,	4
Cystotomes,	4
Scoops,	2
Hooks for tearing capsule,	3
Beer's cataract knives,	6

And to these seventy-five instruments were added twenty-five nails. These nails were three and one-half inches long, and one-eighth of an inch thick. It may be said that the nails had been lying for nearly a year in an open box about twenty feet from where all the autopsies of the Johns Hopkins Hospital are made, and it is almost certain that they were in consequence infected, and doubtless many of them with pathogenic bacteria.

Out of one hundred tubes inoculated in this manner there were five infections. It matters little as to the nature of these infections, for as I have said, the probabilities are that almost any, if not all, bacteria, when introduced into the eyeball will cause inflammation, so that I did not concern myself as to the properties of the bacteria found in the five infected tubes further than that three of the growths looked as though they were air-bacteria, from the fact that they were, more or less, colored, and cover-slips showed that they were very gross. One of the organisms somewhat resembled the staphylococcus albus, but I am of the opinion that it was too large.

I confess that I was surprised at the result, for I thought that I would get more air infections, and also that the bacteria

present on the nails at least would withstand the action of the alcohol.

Another more crucial test was then made; seventy-five other nails were taken from the same box, and, as in the first instance, they were sterilized by allowing them to remain from fifteen to thirty minutes in absolute alcohol. Instead, though, of simply stabbing the agar the nails were pushed into the agar as far as they would go and allowed to remain there. The tubes were then placed in the thermostat for three days. Nine infections resulted, or, in other words, nine tubes had growths in them. Five of these growths were almost certainly the result of infections which occurred after the nails had left the alcohol, two of these five were mold.

It is proper to say that all these experiments were made in the Pathological Institute; and, furthermore, in two rooms adjoining the autopsy amphitheatre. The conditions then for obtaining sterile tubes, or rather the conditions for testing the disinfectant properties of alcohol, were not favorable. It is not improbable that had these experiments been made in a room freer from chances of accidental infection from the air that I would almost surely have gotten a greater number of sterile tubes. As it was, the results were surprising, especially in the case of the nails, and for reasons stated above.

I have often heard the remark made that eye instruments, from the manner in which they are kept, are not so apt as are other instruments to be unclean. This is probably so, but it is no excuse for relaxing antiseptic precautions in eye operations. In order to ascertain how many instruments in a given number were clean, that is to say bacteriologically clean, I made the following test with fifty instruments taken at random from my own case of instruments and from the hospital case. Some of the instruments had been used the day before, and others not for a week previously. After use, the instruments are usually dipped in warm water and then wiped with a soft linen rag, and returned to the case. Instruments which had been treated in this way were taken at random from the case and plunged several times into agar tubes. Fifty experiments were made in this series, and in sixteen cases the tubes remained sterile. It is certainly surprising that so many sterile

tubes followed these inoculations, and while this series shows that the measures we adopt for cleaning our instruments immediately after an operation possess decided advantages, it also goes to show that the majority of instruments even when treated with our usual care are infected. I made no examination of the infected tubes.

Thinking that a fitting conclusion to this work would be to ascertain the effect of absolute alcohol upon the pyogenic bacteria, I made the following experiments, fifty in number. Fifty eye-instruments were first sterilized by heat, and then infected with a pure culture of the staphylococcus albus in the following manner. A platinum loop was passed into the tube containing the growth of the staphylococcus albus, and gently drawn across the latter and withdrawn, and rubbed over that part of the instrument which is brought into contact with the eye. The instruments were then placed in a tray (which had been sterilized by heat) and one-half a pint of absolute alcohol was poured over them. Twenty minutes were allowed to elapse, and each instrument was taken out with sterilized forceps, and that part which had been infected was plunged several times into an agar tube. The results were as follows: Forty-three tubes contained pure cultures of the staphylococcus albus. As to the seven tubes: one was sterile, one was infected with a large micrococcus, one contained a mold, another the bacillus subtilis, and the other three tubes contained bacilli which were characterized by their very large size and by the luxuriance of their growth, and probably were air bacteria.

These results, to say the least, would seem contradictory when compared with the results of the experiments recorded in the first part of this paper, experiments which pointed to the undoubted value of alcohol as a disinfecting agent. We must consider this fact, though, in this connection; that when we infect an instrument with an organism in pure culture the infection is exceptionally and, I might say, unnaturally virulent; or, in other words, that no instrument, which has been infected accidentally by exposure to the various conditions surrounding us in every-day life could be so septic as the instrument infected artificially or infected in the manner described in the last series of experiments. The organisms are present in far greater num-

bers, and they exist in their purity. Such a condition is practically never met with. The chance infection which happens to everything which is exposed for any length of time to the air is of the mildest character, even when the organisms are pathogenic, as compared to the infection with an organism in pure culture.

It is not unlikely that in the first and second series of experiments some of the instruments were infected with pyogenic bacteria; but these bacteria were present in too small numbers, and under conditions too unfavorable to withstand the action of alcohol. It is evident that the alcohol in the first and second series was adequate for disinfecting purposes, but it is equally true that alcohol is totally inadequate for disinfecting instruments which have been infected with the staphylococcuc albus in pure culture, and this might contraindicate our relying upon absolute alcohol for disinfecting instruments which had been employed in an operation where the pyogenic organisms are usually present in large numbers, as for instance in panophthalmitis.

CONCLUSIONS.

1st. That in a given number of eye-instruments, by far the majority are infected by exposure to the air.

2d. That absolute alcohol would seem a valable disinfectant for instruments infected under the conditions which ordinarily surround us in every day life. This conclusion seems warranted by the results obtained in the first and second series of experiments. Attention may be called to the fact, too, that in the second series the nails were all without a doubt infected; and it might be said that they had been exposed to conditions which, to say the least, were extraordinarily favorable for infection, so that this series I think is strongly suggestive that alcohol possesses disinfectant properties of no little value.

3d. That the septic character of instruments infected with a pure culture of staphylococcus albus is not altered by exposure for twenty minutes to the action of absolute alcohol.

I may add that the alcohol employed in these experiments was Squibb's absolute alcohol, which is supposed to have a strength varying from $98\frac{1}{8}\%$ to $99\frac{9}{10}\%$. This is the grade of alcohol which I use in operations.

RUPTURE OF THE IRIS, AT THE PUPILLARY MARGIN AND IN CONTINUITY, FROM CONTUSION OF THE EYEBALL.

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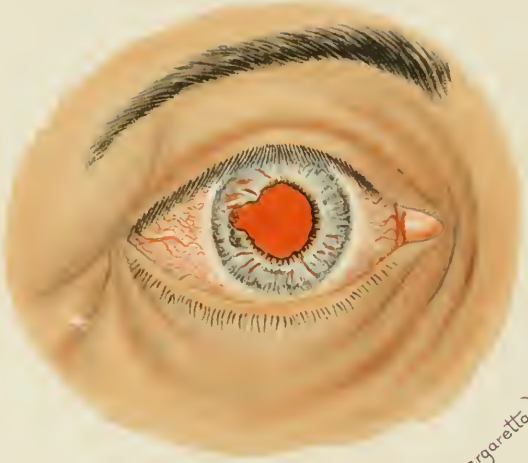
Though separation of the iris from its ciliary attachment as a result of a blow upon the eye is an accident of comparatively frequent occurrence, rupture of its pupillary border is much more rare, rupture in the continuity of the membrane is rarer still, and I have not been able to find any record of a case of the radiating form of the latter. I have thought, therefore, that it might be worth while to submit a brief report of the following cases which furnish six instances of pupillary rupture, and two of radiating rupture in the continuity of the iris.

CASE I. A. P. H., 51 years of age, was struck violently on the brow and eye with a chair, February 28, 1896. He was stunned by the blow and remained unconscious for a time. When seen at the Pennsylvania Hospital, twenty hours afterwards, there was a horizontal contused wound 3 cm. long above the outer half of the eyebrow, and partially absorbed extravasation of blood beneath the skin of the brow, temple, and lids, and also beneath the conjunctiva, chiefly on the temporal side. There was no blood in the anterior chamber. The pupil was irregularly dilated and immovable. Its long axis at an inclination of about 165 degrees, measured 7 mm. and the short axis $4\frac{1}{2}$ mm. There was a notch in its temporal border, a little above the horizontal meridian, which extended to within 3 mm. of the periphery of the iris. When examined by focal illumination the apex of this notch was seen to be a ragged angle crossed by a network of fine thread-like fibres which seemed to be a part of the iris stroma which had resisted the force that ruptured the muscle and vessels. There were also numerous minute serrations in the margin of the pupil, noticeable only by the use of a lens. By means of transmitted light with the mirror and a strong convex eye piece a number of narrow


Margaretta Washington

radiating streaks of red fundus reflex could be seen on the surface of the iris, those on the inner and nasal portion being situated about midway between the free and the attached margins of the iris and those above being near the edge of the notch. Thirteen of these minute ruptures could be counted, but they could not all be seen at the same time as they could be detected only when brought into proper relation with the source of light and the eye of the observer. This picture (Fig. 1) shows the notched and serrated pupil and the small radial slits in the iris as they appeared when examined with the mirror and a 4 D. lens. Careful inspection with focal illumination showed a slight peripheral trembling of the iris. As there was no other indication of disturbance of the lens, it seems possible that this may have been due to the shattered and relaxed condition of the membrane rather than to loss of support. The fundus was normal, and vision, with correction of a compound myopic astigmatism of about the same degree as existed in the other eye (— 2 — .75ᶜ130), equaled 20/20 (?).

The pupil was reduced in size to the extent of 1 mm. by the application of eserine continued for a week but promptly resumed its former width when the eserine was discontinued.

Nearly three months later, the condition of the eye remained the same. There had been no iritis. There was still no pupillary reflex. The accommodation equaled 1/60, as compared to 1/18 in the other eye,— a difference of 1/25 which, at 51 years of age, might be accounted for by the dilated pupil.

CASE II. An Italian, thirty years of age, was struck on the right eye by a piece of stone while quarrying, ten days before he was seen at the Pennsylvania Hospital (April 12, 1895). There was no other sign of injury than an irregularly dilated pupil, the long diameter of which, at 110 degrees, measured 8 mm. and the shorter diameter 6 mm. Oblique illumination showed a number of minute serrations in the pupillary margin.

The man was illiterate and stupid and vision could not be accurately measured, but it seemed to be the same as in the other eye. Accommodation, measured by the shadow test, was about 1 D. less. A gr. ii solution of eserine acted very slowly, but at the end of an hour the pupil was much contracted,

though still wider than that of the other eye, and irregular. This patient did not appear again, and could not be found.

CASE III. N. V., a boy, fourteen years of age, was struck on the left eye with a corncob thrown violently by a playmate (April 7, 1896). Four hours afterward there were slight pain and good deal of photophobia, ecchymosis, and swelling of lids, serous chemosis of conjunctiva and haziness of cornea. No blood in the anterior chamber, and no oscillation of the iris. Fundus indistinct, but otherwise normal. Pupil widely dilated and fixed. Iced cloths applied.

Two days later the pupil was rather ess dilated — 6½ mm.; vertical diameter rather longer than horizontal; just perceptible reaction. V. equaled 6/7.5, and with —.50 6/6 (?). Oblique illumination showed three small but decided notches in the lower margin of the pupil, involving the muscle, and a number of minute serrations extending only through the uvea.

A week after the injury V. equaled 6/6 without glass, and accommodation was the same as in the other eye. A gr. ii solution of eserine produced very little effect in half an hour. After the application of gr. ½ twice daily for a week, the pupil measured 3 mm. by 3½ mm., but resumed its former size when the eserine was discontinued.

Four weeks after the injury there was no change, except a rather more decided reaction confined to the upper and lateral margins of the pupil, the lower margin where the ruptures existed remaining as motionless as if adherent. There had been no iritis.

For the opportunity to see three other cases I am indebted to Dr. Charles A. Oliver, who has furnished me with the following notes:

CASE IV. On the 15th of November, 1893, H. P., an eight-year-old schoolboy, came to the clinic at Wills' Eye Hospital with a history that four days previous the right eye was struck with a small piece of wood. Vision was immediately reduced to light perception. Pain was not complained of at any time. No local treatment had been employed except the use of water with a wash of boracic acid.

Examination showed marked congestion of both the tarsal

and bulbar conjunctivæ, there being numerous small ecchymoses in the sub-mucous tissues of the eyeball. The upper lid was swollen. The cornea was hazy throughout its superficial layers, and there was loss of epithelium in a space corresponding with the pupillary area. The anterior chamber was deep with a hypemia three millimetres in height in its most dependent portion. The pupil was dilated. The iris was discolored, indrawn, and did not react to light. Tension was slightly reduced. No view of the eyeground could be obtained. Vision had fallen to the ability to see hand movements at fifty centimetres distance.

The left eye was normal.

After the absorption of the intraocular hemorrhage, the eyeground could be plainly seen. Slightly up and out from the fovea there was a black-bordered rupture of the choroid, which was concentric with the outer edge of the disc.

During the succeeding two months, vision gradually increased until it had risen to 5/20, without the use of any correcting glass. Re-examination at various intervals, averaging about two months apart, showed that the pupil remained the same size throughout the entire period of examination, and that there were two minute breaks in the lower portion of the pupillary edge of the iris, these extending about half a millimetre into the inner circle.

In July, 1894, a faint whitish reflex in the anterior cortical substance of the lens, slightly up and out, could be dimly seen; this has never increased in size.

In May of this year, the eye and its vision were found to have remained the same. The appearance of the pupil and the broken portion of the pupillary edge of the iris, as shown in the accompanying sketch (Fig. 2), were as before. Application of eserine produced a very slight contraction.

CASE V. On the 22d of June, 1896, R. J., a sixty-two-year-old farmer, applied to my clinic at Wills' Eye Hospital for a glass to correct a high degree of myopia in his left eye. He stated that the vision of the right eye had been bad for the past three years, dating from an accident in which the eye had been struck with a piece of kindling wood.

Examination showed that there were two tears in the circular fibres of the iris, slightly down and out, between which positions the inner circle of the iris was inverted. The lens

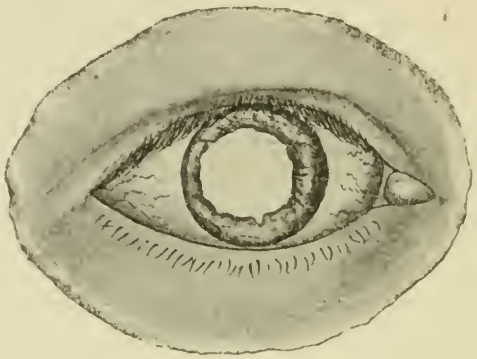


FIG. 2.

was slightly hazy, and there were numerous floating opacities in the vitreous. Vision was reduced to the ability to see to count fingers at 43 cm.

CASE VI. C. R., twenty-six years of age, was a patient at the Wills' Eye Hospital clinic. Three years previously he had been struck on the right eye with a piece of thick cardboard. He had experienced no trouble but diminution of vision. V. equaled 5/15; accommodation the same as in the other eye. There were a slight corneal nebula, a localized lenticular opacity down and out, and a rupture of the choroid concentric with the outer edge of the disc. The pupil was slightly dilated and oval, with its long axis at 90 degrees, and responded to light except at its lower margin, which was fixed, and in this position oblique illumination showed two shallow notches. Examination with a mirror and a + 16 D. glass revealed eight small radiary ruptures of the iris, beyond the sphincter, seen as minute red streaks of fundus reflex,—six down and in, one down and out, and one up and in. There was just perceptible oscillation of the iris.

Franke* has collected thirteen cases of rupture of the sphincter, including one reported to this Society by Dr. Vermyne in 1878, but not including two others to which Vermyne referred as having been observed by Drs. Williams and Wadsworth;

* Graefe's Archiv. f. Ophtalmologie, 1886, Abth. ii, p. 261.

and the following three cases of rupture in continuity. He attributes the accident to stretching of the iris from flattening of the ball, and at the same time spasmodic contraction of the sphincter.

CASE I. The well-known case of Lawson, which is frequently referred to as unique. The eye was struck by a rebounding rifle ball. There were two distinct pupils; the upper separated from the lower by a bridge of iris, and not reaching above to the cilliary margin. The margin of the new pupil was irregular and ragged. Lawson thought it was a rent in the iris which had opened out and formed a new pupil.

CASE II. A case by Amédéé of Paris also presented the appearance of two pupils. The natural one occupied its normal position, while the "accidental pupil," which was above, had the form of a triangle, the apex of which touched the corneal limbus, and its base was separated from the natural pupil by a bridge of iris.

CASE III. Case by Bünger. Contusion of the ball from a blow with a chain. There was an artificial pupil which could be distinguished from an iridectomy only by the fact that a band of iris remained at the ciliary margin. From an illustration accompanying the report it is evident that there was an extensive vertical rent of the nasal segment of the iris, and at the same time also a rupture of the sphincter which united the new opening with the normal pupil.

CASE IV. To these may be added a case reported by Dr. Clark of Columbus, O., in 1889.* The eye was struck by a rebounding rifle ball. There was an irregularly oval opening, about 1 mm. by 1½ mm. in diameter, in the upper and nasal quadrant of the iris, with a delicate web-like membrane stretched across its upper border.

In all cases of rupture beyond the sphincter primarily recorded the rupture has been across the direction of the radiating fibres, which have caused the wound to open out and form a rounded perforation somewhat resembling an additional pupil. In a case reported by Reber† of a linear tear in the tem-

* Archives of Ophthalmology, Vol. XVIII, p. 12.

† Archives of Ophthalmology, April, 1896.

poral segment, 4 mm. in length and nearly vertical in direction, — perpendicular to the radiating fibres — a rupture could not have involved the whole thickness of the iris, as, if that had happened, the wound would inevitably have gaped. This view is confirmed by the fact that four days after the accident all trace of the rupture had disappeared.

In the two cases of rupture in continuity just reported the edges of the small radial slits parallel to the iris fibres tend to approximate, which makes them much more difficult to detect. They can be seen only by transmitted light; oblique illumination does not discover them.

As would be expected from the nature of the accident, when the iris is ruptured by contusion the eye usually suffers some other injury, such as more or less extensive intraocular hemorrhage, injury or dislocation of the lens, or, most frequently, rupture of the choroid; but the cases that I have reported, not including Dr. Oliver's, were remarkably free from serious complication. There was no blood in the anterior chamber, the acuteness of vision was not materially affected, and there was no iritis.

In the five cases remaining under observation four weeks, six weeks, three months, two years, and three years after the injury — the mydriasis is permanent.

In two cases the accommodation was the same as in the sound eye, and in two it was only partially suspended. In the others it was not practicable to estimate it. Of the cases in literature I can find only four in which the accommodation is noted. In Vermyne's case the near point of the injured eye was 8″ and of the sound eye 3½″. In Clark's the accommodation was reduced one-half as compared to the other eye, but atropia had been used freely ten days before and its effect may not have passed off completely. In a case of Hirschberg's* there was no limitation of accommodation; and Meyhöfer records one in which there was accommodative spasm. In Meyhöfer's case,† which was one of multiple rupture of the sphincter, a myopia of 1/18 promptly gave place to emmetropia

* Klin. Beobachtungen aus der Augenheilanstalt, 1874, 33–38.

† Zehender's Klin. Mon. f. A XV. p. 66.

under the use of atropine. More than a year afterwards the pupil was still widely dilated.

It is probable that ruptures of the iris from contusion, particularly small multiple ruptures of the sphincter, are much more common than is usually supposed, and that, as Hirschberg suggests, they would be found if carefully searched for in all cases in which the mydriasis is permanent. No doubt they have been the cause of the mydriasis in many cases that have been looked upon as paralytic. I believe, however, that the paralytic form does occur as a result of contusion — a kind of peripheral stunning of the nerve fibres which affects the accommodation equally with the pupil. These cases yield quickly to the action of eserine, and would probably end in recovery in a little longer time without medication. I reported two such cases some years ago.* In one the pupil was widely dilated and the accommodation was completely suspended. The patient was seen immediately after the accident, and no application had been made to the eye. With the correction of a low degree of hypermetropia, V. equaled 20/20. Twenty minutes after a few drops of a solution of extract of calabar were applied, the pupil was myotic and the far point was 8″. This patient probably had no further trouble and he never presented himself again.

The other case was that of an assistant surgeon in the navy who, while in a Boston street car one evening, received a violent blow on the eye from the elbow of a fellow passenger who was attempting to close the sliding door. He suffered a good deal of pain at the time but it soon subsided and he slept as usual. On arising in the morning he was horrified to find that the power of near vision had gone from the eye and that the iris also had nearly disappeared. He went at once to Dr. Williams, who treated the eye with calabar and, after several applications repeated at intervals of two or three days, both the iris and ciliary muscle regained their power. When I saw him a few months later there was absolutely no difference between the eyes.

Hirschberg† has reported the case of a child, eight years of

* Am. Journ. Med. Sci., CXXI, p. 139.

† Loc. cit.

age, in which as the result of a contusion of the ball there were wide mydriasis and paralysis of the accommodation, both of which disappeared entirely in two days; and in a case reported by Eales,* in which fixed dilation of the pupil and loss of accommodation without impairment of distant vision resulted from a fall upon the head, the accommodation was completely restored in four days, and the pupil action in five days, after the accident.

When the mydriasis is accompanied with loss of accommodation, the possibility of rupture of the ciliary muscle, or injury of the lens or of its suspensory ligament, must be considered; but this does not seem a probable condition in cases like those just cited in which complete recovery was so prompt.

DISCUSSION.

DR. J. A. ANDREWS, New York.—Will Dr. Harlan tell us how soon after the injury these pictures were made?

DR. HARLAN.—Fig. 1 was made a few days after the accident. Fig. 2 two and a half years after.

DR. ANDREWS.—The picture which I pass around was made 28 hours after an injury to the eye produced by the blow from a cork discharged from a ginger-ale bottle. The subject was a woman, æt. 60 years. The iris was separated from its attachment for more than one-third of its circumference. The dependent portion of the iris was torn across its middle. There was a small hemorrhage into the anterior chamber, but there appeared to be no reaction. The sclerotic was perfectly white. The media were clear. I could not discover that the lens was injured. It seemed remarkable that a blow which had sufficient force to detach the iris, should not have dislocated the lens also, in a person 60 years of age; but I could not make out that the lens or its suspensory ligament had been injured. A week after the injury the eye presented every appearance of acute inflammatory glaucoma. The lens was very much swollen. It appears, therefore, that the lens capsule had been injured by the blow, although careful inspection at the time failed to detect it. I excised the dependent portion of the iris, and the tension became normal and the pain disappeared, but the lens at this time, one month after the injury, shows an opacification of its capsule.

DR. W. B. JOHNSON, Paterson, N. J.—I wish to mention here a case which I think is worth a report in this connection.

* Torquay Med. Soc'y, Dec. 19, 1894.

It occurred in this manner. The patient received a perforating wound of the cornea and went to a physician in the country who observed the prolapsed iris as a black substance which he thought was a foreign body. He took hold of it and drew it out. In his efforts he drew out the entire iris. The patient came to me for other troubles and this condition was only incidentally noticed. He had absolutely no iris left. His vision was about normal.

DR. CALLAN, New York.—In class of cases referred to by Dr. Andrews, viz.: increased tension—I attributed the glaucomatous condition to the fluttering iris, against lens and ciliary body. Therefore I excise that part of the iris which is the cause of the trouble—with happy results.

DR. OLIVER, Philadelphia.—I had the opportunity of seeing some of the cases that Dr. Harlan mentions in his paper, a type which is very seldom spoken of in ophthalmic literature. The ruptures which penetrate through the entire substance allowing the fundus reflex to be seen through them, are as a rule extremely minute, requiring a strong convex lens (generally a sixteen diopter lens) to be placed in the sight hole of an ophthalmoscope before they can be discovered.

The breaks when in the radial fibres of the iris are generally tangential, while those in the inner zone consist in small irregular splits in the pupillary border. I feel sure that should they be looked for more persistently in cases of traumatism, that they would be more frequently found, this assumption being based upon the fact that since Dr. Harlan called my attention to them some four or five weeks ago, I have had four undoubted cases (a couple of which are mentioned in his paper), appear in the ordinary routine of my clinic at Wills' Hospital. Most of my cases have been associated with minute ruptures in the posterior pole of the eye.

DR. EDWARD JACKSON, Philadelphia.—As to the frequency of these cases and our failure to recognize them, this case occurs to me. A man was recently brought into the hospital and was said when first seen by the resident to have rupture of the iris. There was some blood in the anterior chamber. I examined the case carefully five or six hours after his entrance. There was then no trace of blood in the chamber and the examination both by ophthalmoscope and oblique illumination showed no break in the iris at any point. At this time the pupil was widely dilated with atropine. Two days later the pupil contracted and there was bleeding into the anterior chamber which covered up the rupture. In the dilation of the pupil a fold of the iris had completely hidden the rupture from view.

ANGIOID STREAKS IN THE RETINA.

BY G. E. DESCHWEINITZ, M.D.,

PHILADELPHIA, PENN.

Four years ago Plange * called attention to certain pigment striæ with secondary changes in the retina after hemorrhage. His communication was followed by a paper by Dr. Knapp,† who gave the name "angioid streaks" to this affection. A similar condition is described by Sydney Stephenson, ‡ characacterized "by the presence of dark, reddish-brown anastomosing bands lying beneath the retinal vessels, and extending over a large area of the fundus." Ward Holden § contributes an article on the probable hemorrhagic origin of the striated affections of the retina, and concludes that "it would seem warrantable to assume as a hypothesis, to be verified by future observation, that the affection called retinitis striata, like that called angioid streaks, arises through the elements of peripheric hemorrhages being diffused in a linear manner in the deep layers of the retina, and undergoing various sorts of metamorphoses." Recently, B. Walser, ‖ in Vienna, has contributed three similar examples to the literature of the subject.

To this series of cases I desire to add another, at present under my observation.

Josiah Deily, aged 47, born in Pennsylvania, married, carpenter, consulted me May 16, 1895, with the hope of obtaining relief for failing vision.

History.— With the exception of small-pox in 1885, and the usual fevers of childhood, the patient has been a healthy man. He denies venereal disease of any type; he has not smoked for many years, but chews one ounce of tobacco per diem; he is not accustomed to drink liquor; his parents are alive and well; he has seven healthy children, and his wife has had no miscarriages.

* "Archives of Ophthalmology," 1892, XXI, p. 282.

† Ibid., p. 289.

‡ "Trans. Ophth. Soc., U. K.," 1892, Vol. XII, p. 140.

§ "Archives of Ophthalmology," 1895, XXIV, p. 147.

‖ "Archiv. f. Augenheilkunde."

In April, 1894, the vision of the left eye began to fail, and one month later the right eye suddenly lost its sight. These visual disturbances were unassociated with ocular pains, but at times he has suffered from starting pains in the head.

Examination.— The patient is a medium-sized, apparently healthy man, with slightly pallid countenance and typically amaurotic expression. The pulse is rather soft, 72 to the minute, and regular in rhythm; the area of cardiac dullness is normal, and there is no murmur. The specific gravity of the urine is 1012; it contains neither albumin nor sugar.

Eyes.— V. of R. E. equals counting fingers at 1.5 metres; of L. E., counting fingers at 1 metre. Each visual field (form and colors) is normal. The pupils are semi-dilated (6 mm.), and the iris movements to light and accommodation are preserved, but are somewhat sluggish.

One year ago the lesions in the background of the eyes were as follows: *R. E.* — The optic disc was somewhat discolored, and there was greenish broadening of the scleral ring on the temporal side. Directly in the macular region was a patch of whitish exudation, and below it and between it and the disc were large, sheet-like hemorrhages, while above it was a patch of pigment equal in size to the surface of the papilla. Several smaller hemorrhages were visible in the lower and inner quadrant of the retina. Covering a large area of the fundus, especially on the nasal side, were numerous branching and anastomosing lines, or streaks, of somewhat granular appearance, lying beneath the retinal vessels, partly brownish-black and partly reddish in color. They resembled a system of obliterated vessels, were slightly elevated, and might be compared to diminutive ridges, not unlike those made by a mole when he burrows beneath the surface of the ground. Some of them terminated near the margin of the disc, while others reached entirely to the edge of the papilla. *L. E.*—The appearances were almost exactly similar to those just described, except that the macular degeneration was more extensive, and the streaks broader and more pigmented. (Figure 1.)

More than one year has elapsed since this description was written, and as the patient has been under continual observa-

tion in the meantime, it is now interesting to compare these two water colors which I exhibit — the first one having been prepared by Miss Margaretta Washington in June, 1895, and the second one in June, 1896.

Examination of the second sketch shows practically the same arrangement of the angioid streaks on the nasal and upper side of the retina, although their hemorrhagic nature is now less marked, owing to the admixture of finely granular pigment.

A study of the temporal side of the eyeground is most instructive. The large dark mass which lay beneath the upper temporal vessels has almost entirely disappeared, while the diffuse hemorrhagic extravasation between the disc and the macula has nearly subsided, and in its place have developed a number of short, dark ridges, or streaks, which are evidently the outcome of its metamorphosis. (Figure 2.) In connection with the large hemorrhage which was situated below the macula region, there has developed a broad, somewhat pigmented streak — also, unquestionably, a part of the process of transformation.

The interesting point in connection with these two sketches is that they demonstrate, from the ophthalmoscopic standpoint, at least, the undoubted hemorrhagic nature of the lesions, which may be traced from their origin in the hemorrhagic metamorphosis, through the stage in which the formed striæ, still partly hemorrhagic in nature, are disposed in characteristic and branching lines, to their later development into true pigment streaks and ridges.

In the cases thus far observed there has been some difference in the description of the striæ. Thus, in the right eye of Plange's patient the striæ were of a dull brown color, and were included in broader light stripes, probably a later development of the affection. In Knapp's case the streaks were dark brown or black, radiating from the neighborhood of the optic disc in every direction. There was no direct connection with hemorrhage, although in a few places the dark streaks had red portions. Stephenson's description, as well as his plate, shows that the anastomosing bands were of a dark reddish

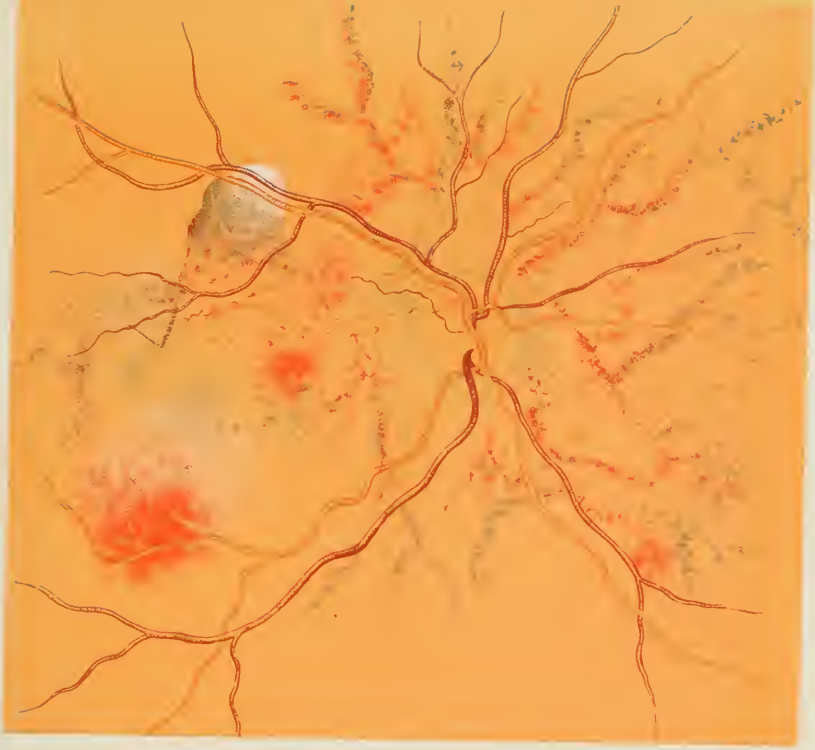
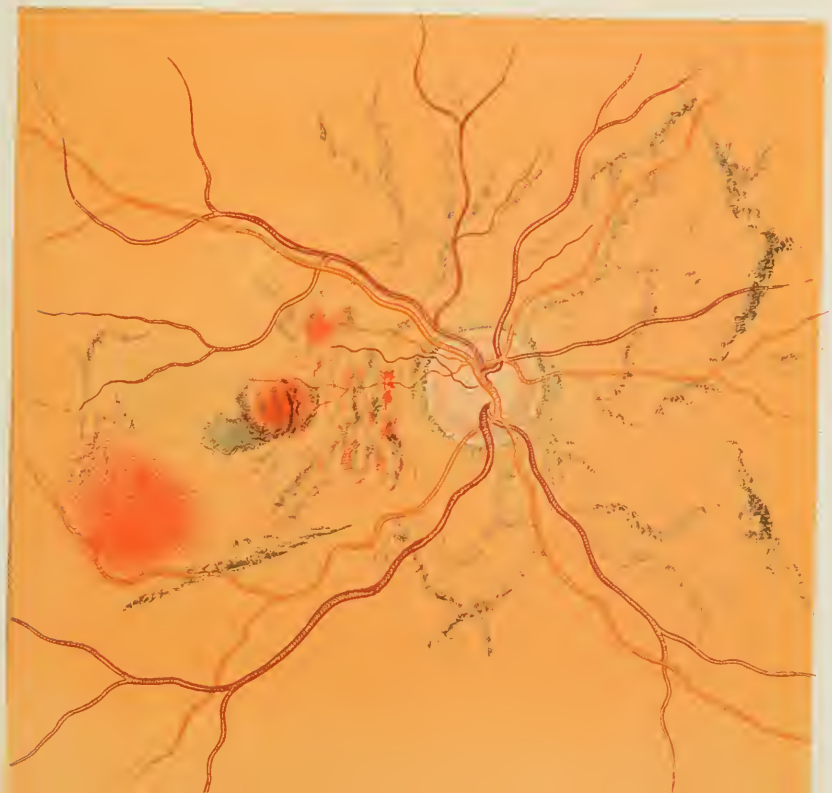


FIGURE II



brown color, and were occasionally bordered by cicatricial-looking lines of a glistening gray aspect. In Ward Holden's case, studied in the practice of Dr. Knapp, the angioid streaks closely resembled those of previous cases. He also was able to notice their direct connection with a hemorrhage — in fact, he practically observed the gradual development of the streaks while the hemorrhage was undergoing absorption. In my own case it will be noted that in the first drawing there is no bordering of white tissue, as has been described, the streaks being composed of a stippling of brown or reddish tissue. In the later stages, however, as represented in the drawing made one year after the original observation, in addition to the increase in the brown pigment and the decrease in the reddish color, an irregular whitish border begins to appear, especially along those streaks which probably are oldest in point of origin. In the reports of some of the cases it has been stated that the streaks lose themselves gradually near the papilla, or stop short in the neighborhood of its margin. Certainly in the case which I present today many of the striæ pass entirely to the margin of the disc — in fact, they become united with the pigment disturbance in its immediate environment. The mechanism of the development of these striæ has already been discussed by Plange, by Holden, and by Knapp, and need not be referred to in further detail.

It would be a matter of interest to determine the reason of the retinal hemorrhages in this case, and one naturally turns to an examination of the blood to furnish etiological clues, inasmuch as the urine is normal, and there is no history of bodily-dyscrasia which would satisfactorily explain those ophthalmoscopic extravasations. To this end, I have secured a very careful examination of the patient's blood, and am indebted to Dr. Alonzo E. Taylor of the Pepper Laboratory of Clinical Research for the following study of the blood:

Haemoglobin, . . .	80 per cent.
Red corpuscles, . . .	4,750,000.
Leucocytes, ...	4,200.

The red cells are in all respects normal. A differential count of the leucocytes gives the following result:

Neutrophilic polynuclear leucocytes,	68	per cent.
Oxyphilic polynuclear leucocytes,	4	per cent.
Mononuclear and transitional forms, not granulated,	13.6	per cent.
Lymphocytes,	14.4	per cent.

The percentage of mononuclear cells is higher than usual, but, morphologically, the cells are normal. The amount of fibrin is approximately normal. The resistance of the red cells is also approximately normal. It is, therefore, almost absolutely certain (assuming that his blood has been in the same condition that it now is) that the retinal hemorrhages are not the result of any general blood dyscrasia.

HISTOLOGICAL EXAMINATION OF THE EYES FROM A CASE OF PERNICIOUS ANÆMIA.

By G. E. DE SCHWEINITZ, M.D.,

PHILADELPHIA, PENN.

The following case of pernicious anæmia occurred in the wards of the Philadelphia Hospital in the service of Dr. F. P. Henry, to whose courtesy I am indebted for the privilege of examining the eyes.

Dr. Charles W. Burr* has reported the case, so far as the lesions of the spinal cord are concerned, and from his paper I abstract the following history:

James Mullaney, male, 64 years of age, a laborer, was admitted to the Philadelphia Hospital, April 26, 1894. He had been slowly growing weaker for several years and complained of slight dyspnœa upon exertion. During his entire stay in the hospital his only complaint was a progressive weakness.

There was a soft systolic murmur at the apex and a more distinct systolic murmur at the aortic cartilage, transmitted to the vessels of the neck.

At the first examination of the blood made by Dr. Henry

* University Medical Magazine, April, 1895.

there were 1,275,000 red blood corpuscles to the cubic millimetre. At a later examination made by Dr. Daland, the hæmatokrit being used, there were 25 per cent. of the normal number of red blood corpuscles. Fleischl's hæmoglobinometer gave 20 per cent. of hæmoglobin.

The knee-jerks were abolished. The urine contained neither sugar nor albumin. Examination of the liver, lungs, spleen, and kidneys, failed to develop signs of disease. The skin was exceedingly pale, and there was a freckle-like pigmentation over the entire body, except on the palms and soles.

When I examined the eyes, two days before death, the usual ophthalmoscopic appearances of intense anæmia were present, namely, rather narrow arteries, broad, pale veins, intense pallor of the fundus, over portions of which, chiefly in the periphery, there was a faint, fog-like œdema, and hemorrhages somewhat flame-shaped, but also irregular and splotchy, only in the neighborhood of the papilla. A few of the hemorrhages contained a whitish center, and here and there throughout the eye-ground there were small white or yellowish-white spots. The optic discs, with the exception of being exceedingly pallid, were unchanged. The examination was made when the man was too weak to be raised in the sitting posture, and was necessarily less prolonged than was desirable.

The post-mortem examination was made twenty-four hours after death, and the findings were largely negative. There was only a small amount of intensely yellow subcutaneous fat; the tibial marrow was slightly tinged with red. The lesions of croupous pneumonia and an old endocarditis were visible.

The only tissues submitted to microscopic examination were the spinal cord and the eyes. As already stated, the spinal cord has been described by Dr. Burr, who found at the lowest level of the crossing pyramids degeneration of the posterior columns, but not extending to the border of the gray matter. In the lateral columns there was a small area of degeneration at the periphery, just outside of the posterior horns. In the cervical swelling there was a patchy degeneration affecting the whole transverse area of the posterior columns, and much more pronounced in some fields than others. In the lateral tracts

there was a wedge-shaped area of degeneration just external to the posterior horns. The same condition obtained in the dorsal region. The lumbar cord was not examined. The gray matter and the posterior peripheral roots were not affected.

The eyes were hardened in Müller's fluid, imbedded in paraffine, and cut in serial sections.* As the conditions were practically the same in each eye, a record of one will be sufficient.

The optic nerve entrance is slightly cupped, the nerve bundles viewed in longitudinal section have a yellowish tint, and there is some increase in the number of nuclei. Cross sections of the optic nerve stained by the Weigert-Pal method do not exhibit degenerative change or atrophy. An attempt to develop the Deiter cells by the Golgi-Cajal method gave negative results, probably owing to the fact that the preservation of the specimens had been in Müller's fluid, although Berkley's modification of Golgi's method, which is suited to Müller-fluid-hardened specimens, yielded equally negative results.

The cornea, iris, ciliary body, and choroid are normal, the lesions being confined entirely to the retinal elements.

Anterior to the equator of the eyeball there are no hemorrhages, but the retinal elements are somewhat indistinct and show a tendency to separate one from the other. As the ora serrata is approached, this tendency develops into the lesions of a marked œdema, the tissue between the inner nuclear layer and outer limiting membrane containing large oval empty spaces, so sharply marked in some instances as to present appearances analogous to the so-called cystic degeneration. This œdema apparently begins in the outer reticular layer and gradually involves the outer granule layer, until the tissue between the internal nuclear layer and the outer limiting membrane becomes occupied, if I may so express myself, with a series of oval cavities separated by thickened bundles of fibres in which may be seen imbedded the remains of the nuclei. (Figure I.)†

Posterior to the equator and in the neighborhood of the optic entrance are the hemorrhages, appearing as extravasations of

* I am indebted to Dr. J. Dutton Steele for the preparation of the sections.

† The drawings illustrating this paper were made by Mr. E. F. Faber of Philadelphia.

blood corpuscles disposed in various positions in the retinal layers. The chief extravasations are found in the nerve fibre layer and among the ganglion cells; hemorrhages also appear in the outer and inner reticular layers. For the most part the retinal vessels, especially the veins, are stuffed with corpuscles. In a few places, both veins and arteries are empty. (Figure II.)

In addition to the lesions thus far described, there are great thickening of the nerve fibre layer and varicose enlargement of the fibres. A typical diseased area of this character presents itself as a round or slightly oval mass which springs from the nerve fibre layer and pushes outward, pressing the overlying retinal layers until it almost obliterates the internal reticular layer, practically causing the internal and external granule layers to come in contact, inasmuch as they are separated only by a thin stratum of compressed external reticular tissue. In some places this lesion is capped with a layer of blood cells which occupies the position of the ganglion and internal granule layers. In others there is absence of hemorrhagic exudation. The center of a focus of pathological change of this character is composed of variously shaped but chiefly roundish and globular bodies of homogeneous structure. These bodies do not stain with the ordinary pigments used in microscopic work,—carmine and hæmatoxylin. Instead of large masses, smaller ones also exist, lying directly in the center of the nerve fibre layer, and crossed above and below with intact fibres. In some places the varicosities are more isolated, that is to say, there is no conglomerate collection; in fact, the bodies do not look unlike badly-stained ganglion cells, a comparison which has already been made by Uhthoff, to whose research I shall presently refer. (Figure III.)

In summary, I may say that the histological changes found in this case of pernicious anæmia were: (*a*) hemorrhages in the various strata of the retina, but most marked in the nerve fibre layer; (*b*) varicose hypertrophy of the fibres of the nerve fibre layer, existing either as an isolated lesion or sometimes gathered in a conglomerate mass; and (*c*) exquisite œdema of the retina, especially in its periphery, an œdema beginning in the outer reticular layer and gradually involving the outer granule layer,

until the space between the internal nuclear layer and the outer limiting membrane becomes riddled with a series of oval cavities.

These microscopic findings correspond closely with the ophthalmoscopic picture: (*a*) flame-shaped and irregular hemorrhages in the neighborhood of the papilla; (*b*) hemorrhagic areas containing a yellowish center, or isolated yellowish-white spots which probably correspond to the hypertrophied and degenerated nerve fibres which have been described; and (*c*) a cloud-like œdema, which was most marked in the retinal periphery.

Uhthoff* in a description of the pathological retinal changes in progressive pernicious anæmia, based upon the examination of three cases, summarizes his findings in a very analogous manner, namely, hemorrhages in the various retinal layers, varicose hypertrophy of the non-medullated nerve fibres, and glistening colloid masses of varying size and shape in the internuclear layer.

Uhthoff was unable to find collections of round cells in the center of the hemorrhages, as they have been described by Litten, nor did he detect in the midst of the hemorrhages collections of round colorless cells enclosed in capsules, which Manz† believed to be the wall of a capillary dilatation. Neither are these lesions present in my case. I was unable to find the glistening colloid bodies in the internuclear layer which Uhthoff has described. These bodies, however, were present in only one of his cases. In Uhthoff's sections the collections of diseased fibres were confined chiefly to the inner portion of the nerve fibre layer, and usually protruded into the vitreous; occasionally they were situated in the middle of the nerve stratum, and normal fibres crossed them above and below: rarely the thickening pressed outward and the overlying retinal layers were flattened. As already described, the last-named condition is the rule in my specimen; in no portion of the sections is there a protrusion of any of the masses into the vitreous.

Ophthalmoscopically, Quincke has observed œdema of the

* Klin. Monatsbl. f. Augenheilk., 1880, XVIII, page 513.

† Centralbl. f. die med. Wissenschaften, Berlin, 1875, page 675.

Figure I.

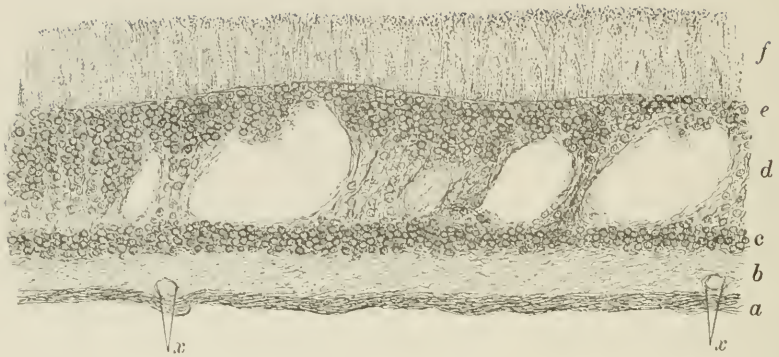
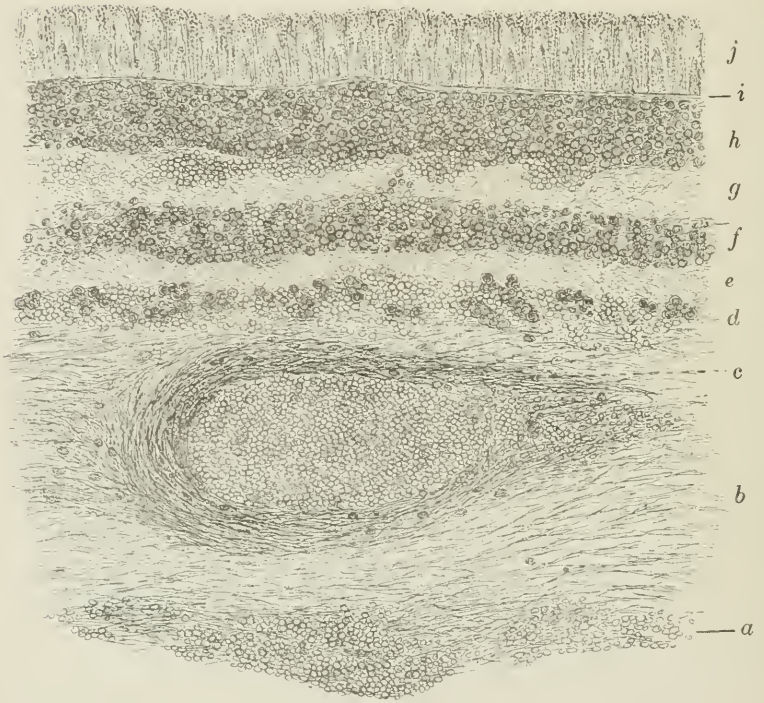


Figure II.



retina, just as I did, an œdema which is further demonstrable by the microscopic examination. Writing on profound affections of the eyes in pernicious anæmia, Dr. Elizabeth Sargeant,† in addition to extensive retinal hemorrhages and detachment, describes extensive œdema of the retina near the equator, while in the immediate neighborhood of the papilla the granular layers were stretched by the œdema into reticular tissue, cystic degeneration being present in the ora serrata. She ascribes the changes in the eyes to œdema and extravasation caused by the general lowered vitality of the vascular system, inflammatory symptoms being secondary and circumscribed.

Natanson† has had the opportunity of examining three cases of the so-called anæmia perniciosa helminthiatica, and found ophthalmoscopically and microscopically practically the same conditions which have been described in essential pernicious anæmia. He also observed a delicate œdema of the retina.

Uhthoff believes, on the ground of the pathologico-anatomical changes which he has found, that we are justified, as in leucæmia, in describing the retinal changes of pernicious anæmia as a true retinitis. At all events, to quote his sentence, pernicious anæmia appears to serve as the foundation for that essential process which has been described as varicose hypertrophy of the nerve fibres. Other than this condition, which was present also in my sections, inflammatory symptoms are entirely lacking. Inflammatory symptoms were not demonstrable in Natanson's cases, and this author believes that the retinal hemorrhages have a not unimportant diagnostic and prognostic significance as to the morphological changes in the blood, inasmuch as we may expect any patient suffering from micro- or poikilo-cytosis to have retinal hemorrhages and the reverse. Therefore, if these hemorrhages are found, morphological changes in the blood may be certainly inferred, even without microscopic examination of this fluid.

* Archives of Ophthalmology, XXI, 1892, page 39.

† Abstract in Nagel's Jahresbericht der Ophthalmologie, XXV, 1895, page 528.

EXPLANATION OF FIGURES.

Figure I.—Retina with Œdema. Pernicious Anæmia.

a, *b*, Fibre layer and inner reticular layer; *c*, compressed inner nuclear layer; *d*, tissue of the outer reticular and outer nuclear layer, confluent and containing large empty spaces; *e*, outer limiting membrane; *f*, rod and cones; *x*, blood vessels. (Zeiss. Compens-ocular, 4; obj. 4.0 mm., apert., 0.95.)

Figure II.—Retinal Hemorrhages. Pernicious Anæmia.

a, Hemorrhagic extravasation at inner portion of fibre layer bulging toward vitreous; *b*, thickened fibre layer, with large artery; *c*, distended with corpuscles; *d*, ganglion layer infiltrated with blood corpuscles; *e*, inner reticular layer, comparatively normal; *f*, inner nuclear layer, slightly involved in hemorrhagic process; *g*, outer reticular layer, markedly infiltrated with blood corpuscles which encroach on *h*, the outer nuclear layer; *i*, outer limiting membrane; *g*, rod and cones. (Ampl. ditto.)

Figure III.—Varicose Hypertrophy of the Nerve Fibres. Pernicious Anæmia.

a, Conglomerate mass of varicose nerve fibres, occupying entire width of fibre layer; *b*, hemorrhage capping thickened fibres lying partly in ganglion layer—inner reticular layer not distinguishable; *c*, inner nuclear layer somewhat compressed; *d*, outer reticular layer; *e*, outer nuclear layer; *f*, outer limiting membrane; *g*, rods and cones. (Ampl. ditto.)

DISCUSSION.

DR. E. KNAPP. My attention was attracted to the angioid streaks many years ago, and sometimes the picture is very peculiar. Here are the pictures of some cases that are interesting. I may point to a picture I saw many years ago which has until lately been mysterious to me, and which I think suffers no other explanation than this. I will draw it upon the blackboard (drawing). There is, I think, such a picture in Jaeger's Atlas. The background is normal, except that it is pervaded by long lines crossing the retinal vessels all over the fundus. They are nearly parallel or slightly curved. I am convinced that they are the result of hemorrhages. If we follow hemorrhages for years, we can find almost every change. After a hemorrhage I think the blood corpuscles lie more or less loose in the retina, and are by the tissue currents collected in lines or irregular figures, such as we see in the sand at the seashore. After hemorrhages all kinds of transient forms can be noticed, from the lines shown by Dr. de Schweinitz to the end stage, where, with a more or less normal fundus, we have before us a system of figures which at first appears utterly mysterious.

Figure III.

TWO CASES OF "A RARE AND FATAL DISEASE OF INFANCY, WITH SYMMETRICAL CHANGES IN THE MACULA LUTEA" (KINGDON).

BY CARL KOLLER, M.D.,

NEW YORK CITY.

I wish to present to you two cases of a rare and generally fatal disease or degeneration in infancy, associated with early blindness and characteristic retinal changes. The credit for having first observed and accurately described such a case belongs to Waren Tay, who in 1881 presented the case before a meeting of the Ophthalmological Society of the United Kingdom. Tay's report of the case, admirable for its simplicity and completeness, reads as follows:

"Mrs. L—— brought her infant, aged twelve months, to the London Hospital, March 7, 1881. When the baby was a fortnight or three weeks old, it was noticed to have little power of holding its head up or moving its limbs. Since that time the weakness has become more and more pronounced. The mother brought the child to the hospital in the hope that something might be done to strengthen it. I could find nothing more than weakness, no absolute paralysis of any part. It seemed to me that its cerebral development was probably deficient, and I was induced to examine the eyes with the ophthalmoscope to ascertain whether there was any affection of the optic nerve. The mother had not suspected there was anything the matter with the sight, though when questioned closely she admitted she did not think the baby took as much notice as other babies. I found the optic discs apparently quite healthy, but in the region of the yellow spot in each eye there was a conspicuous, tolerably well-defined, large white patch, more or less circular in outline, and showing at its center a brownish-red, nearly circular spot, contrasting strongly with the white patch surrounding it. This central spot did not look at all like a

hemorrhage nor as if due to pigment, but seemed a gap in the white patch, through which one saw healthy structure. In fact, the appearances may be most suitably compared with those we are familiar with in cases of embolism of the central artery of the retina. I am quite unable to arrive at any conclusion as to the exact nature of the disease. I believe the changes to be situated in the retina, at any rate chiefly so. They may possibly be congenital. The family history throws no light on the possibilities of the case. This is the first child. There have been no miscarriages. There is no history of phthisis in the family. The parents have been married two years and were not related before marriage. Dr. Hughlings Jackson kindly saw the child with me, and said there seemed no evidence of any definite cerebral affection. He could only say the baby seemed very weak. He agreed as to the local conditions present; so also did Mr. Huchinson and others who have examined the child.—April 7, 1881.

"P. S. July 30th. — The baby has remained in much the same state as when first seen. There is still no definite sign of localized mischief, but the child lies almost helpless in its mother's arms. It is generally cheerful or else asleep; it is rarely cross. There is an important alteration in one respect, however: the discs are now undoubtedly becoming atropic. The changes in the region of the macula are apparently precisely the same as before."

This child died at the age of one year and eight months. Two more cases of exactly the same kind occurred in this family and were described by Tay. Since Tay's first publication in 1881 a number of other cases have been brought to light by different observers — Magnus, Goldzieher, Knapp, Sachs, Wadsworth, Hirschberg, Kingdon, Carter — altogether nineteen (my own two cases included) that have been ophthalmoscopically examined and identified as belonging to the same group. To this list must be added a number of others that, according to the histories of the parents, have occurred in the same families and have closely resembled the cases examined, which brings the number of known cases up to something over twenty-five. Recently, Kingdon and B. Sachs, both of whom had the chance

of observing a comparatively large number of the cases known, have collected and reviewed all the cases in literature. They are also the only ones who have made autopsies and microscopical examinations.

In reading through the histories of all the cases, one is struck by their uniformity. The children are born of healthy parents with no history of syphilis; most of them, if not all, are Eastern Jews, with their well-known tendency to neurotic degeneration. Up to the third or fifth month of age the children develop well; nothing unusual is noticed, unless a former case in the same family directs the attention to the ocular symptoms, which, in fact, seem to precede the others. Between the third and eighth month, sometimes sooner, a peculiar weakness of the muscles shows itself. The children are unable to hold the head up, the back is weak, the muscles are flabby, the reflexes are present. The further development is retrograde, both as to body and mind. The children do not learn to walk, present the picture of idiocy, and fall into a condition of marasmus, to which they succumb at the age of about two years.

The eye symptons, although not always first noticed, seem to be the very first and seem to appear in the first weeks or months of the child's life. It is not likely that the retinal changes are congenital, as some observers assume. The ophthalmoscopic picture is of striking uniformity, and according to all observers very similar to the changes found in embolism of the central artery of the retina. The yellow-spot region is the site of a whitish opacity, the center of which shows a cherry-red spot. The discs are mostly yellowish or grayish discolored, but otherwise appear normal and well defined; later on, atrophy develops. Pupils react sluggishly; in most cases, at least before the stage of complete atrophy, perception of light is present. In some cases there is oscillatory nystagmus.

The variations from this general picture are only slight. In many of the cases I find hyperacuity noted; in some of them convulsive seizures.

The affection is a family disease; two, three, and even four cases having been observed to occur in the same family. The nineteen cases reported and tabulated by Sachs occurred in ten

families. All observers are agreed that syphilis plays no part in the etiology.

So far only three autopsies have been performed — two by Sachs of two children belonging to one family, and one by Kingdon. Both found changes in the layer of the large pyramidal cells in the cortex of the brain, and they interpret these changes as arrested development. Kingdon found descending degeneration in the cervical part of the cord. Sachs states expressly that no changes in any of the blood-vessels of the cortex were found. No satisfactory examination of the eyes has been obtained. Treacher Collins made sections of the eyes of Kingdon's patient, "but the result was unsatisfactory, as there was a fold of the retina in each eye at the macular region."

The history of my own cases is this:

Mary L——, then two years old, was brought to my dispensary service on June 18, 1894. The child had been born healthy and had developed well, until at the age of five months it was noticed that she did not use her eyes as other children of that age do. Nystagmus of the vibratory kind was present, which, according to the history, had developed in the first few months of the child's life. The ophthalmoscopic examination was very difficult on account of the nystagmus, and showed the discs in a congested state; besides, I find in my record the entry that apparently there was perception of light. There was nothing that struck me as unusual in the general condition of the child. The case was considered by me one of optic neuritis from an unknown cause. A second examination was intended, but the child was lost sight of until two years later, when an almost identical condition in an infant sister came under my observation, excited my interest, and led to the re-examination of the first child. She was now nearly four years old, but far behind others of that age in mental development. The latter had been retrogressive rather than progressive. At the age of one year she had been able to stand up, but she had never learned to walk. She was weak in her limbs and could not stand upright. At present she crawls and finds her way in the rooms of the institution (Montefiore Home for Chronic Invalids) into which she has been admitted. At the age of two years she had begun to

speak a few words, but she forgot them. She knows her parents. She is very uncleanly in her habits, very irascible, and subject to fits of rage, in which she screams and scratches herself, unless she has her own way and is taken in the arms of her nurse, whereupon she becomes perfectly quiet. Altogether, she gives the impression of being an idiot. The condition of nutrition is very poor; several times it has seemed as if marasmus made quick progress and would soon terminate life, but with good care she has rallied again. Her muscles are weak and flabby; reflexes are present. There is hyperacuity and she starts at sudden noises. The eyes outwardly present nothing peculiar; occasionally there is a little nystagmus, but this is very much less marked than it was two years ago. The iris is bluish-gray; the pupils are of medium size; they have no prompt reaction, but become slowly narrower when exposed to light. After dilatation of the pupils with atropine the ophthalmoscopic examination is easy, the nystagmus being only occasional. The discs are sharply outlined, atrophic, yellowish discolored, and present the appearance found in cases of retinitis pigmentosa. The retina is atrophic. The choroidal vessels are visible, as in individuals having the same color of iris. In the region of the macula there is a slight, veil-like, milky-bluish haze, gradually fading into the color of the surrounding retina; in the center of this opacity, at the site of the fovea centralis, is a cherry-red patch, not very dark, a little smaller than the disc, with well defined outlines.

The second child, Hattie L——, was seen for the first time on January 8, 1896, at the age of two months. When the child was three or four weeks old, the mother, forewarned by the experience with the first child, noticed that it had nystagmus and did not seem to see. I found the eyes of normal external appearance, oscillatory nystagmus, and pupils of sluggish reaction. With the ophthalmoscope the media are found clear; the discs are sharply outlined, yellowish discolored, but otherwise appear normal. The retina exhibits the bright reflexes usually found in young individuals. The ophthalmoscopic examination is very difficult, on account of the strong nystagmus. Since the beginning of January I have examined the child six times, but

have not found any unusual appearance of the fundus, except the yellowish coloring of the discs. In the left eye, however, there is at the site of the fovea a rather indistinct brownish patch; there is none of the white opacity in the yellow-spot region. The child begins to exhibit the signs of muscular weakness, and in every way, as the mother avers, behaves like her older sister.

The examination of the parents did not furnish anything of especial interest. They are both of the Jewish race and appear healthy; the mother is twenty-seven and one-half years old and the father twenty-six and one-half years. There is no history nor are there any symptoms of syphilis. Inquiry into their family history elicited nothing that could bear on the subject. They have been married six years. Ten months after marriage a boy was born, who is healthy. Nineteen months later a second child appeared, the girl that figures as my first case. During the seventh or eighth month of pregnancy with this child, the mother suffered a violent shock, her husband being brought home on a stretcher, on account of some sudden illness. Eighteen months after the birth of the second child, a third one was born — a girl, who is in good health. Eighteen months later the fourth child appeared, which is the second subject, as related above.

These two cases differ only in some minor points from the other cases described. As to the first child, which exhibits all the characteristic symptoms of the affection, she has reached the age of four years, whereas all the others died when about two years old. From the condition of the nutrition it appears very unlikely that the child can live much longer; in fact, her end has seemed near several times, but she has unexpectedly rallied each time. She has also reached a comparatively higher degree of development than the other subjects (being able to stand and to speak a few words), so that we may conclude that the affection in her case is of a milder form than in the others. In the younger child, although she has developed all the other symptoms of the affection, the characteristic retinal changes are missing, which proves that they are not congenital. In this connection it is remarkable that in Kingdon's second patient,

who was seen at the age of three months (sister of a former patient) and in whom muscular weakness was just then beginning, the fundus oculi was normal. When the child was five months old a suspicious haze appeared at each macula; when she was eight months old the eyes exhibited the usual appearance.

It is to be hoped that this rare and interesting affection of the nervous system will be cleared up by pathological investigation with modern methods, especially with reference to possible changes in the vascular system. Until this has taken place, we can only state as our opinion that the anatomical substratum of the affection is most likely a degenerative process in the cortex of the brain and in the retina. From the clinical course of the disease, the original healthy condition of the children, and the consequent development of the marasmus and the characteristic changes in the eyes, we must conclude that we have to deal less with a condition of arrested development than with a progressive morbid process in the nervous system. The clinical picture of this affection in infancy is one that bears some resemblance to general paresis; general muscular debility without outspoken paralysis, physical and mental decay, and fatal issue being common to both.

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DISCUSSION.

DR. H. KNAPP.— This disease is so rare that when I saw the first well-developed case I looked it up and found only two cases reported. Since that time I have never omitted to examine a child's macula if brought to me for nerve trouble or defect of sight. I have only seen three cases. In all that I know of their nationality has been Hebrew.

DR. B. ALEX. RANDALL, Philadelphia. — I have the material in my hands to make an autopsy report on one of these cases, but I have not yet worked it up. Some day I will report it.

DR. O. T. WADSWORTH, Boston. — I have never seen any other case than the one I reported, nor have I seen any other infant with the same general symptoms. They are peculiar and typical.

DR. C. A. OLIVER, Philadelphia. — Several years ago, through the kindness of Dr. Kerlin, of the Pennsylvania Institution for Feeble-Minded Children, I had the opportunity of examining about one hundred and fifty cases of various grades of imbeciles and idiots, a portion of this work having been presented to the society at one of the previous meetings. Nearly all of the studies to determine the changes in the fundus were made while the pupil of the eye was dilated by mydriatics. Throughout the whole series I did not see any case at all similar to that spoken of by Dr. Koller this afternoon.

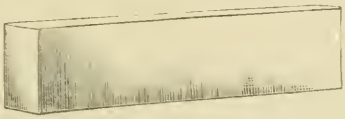
DR. S. D. RISLEY, Philadelphia. — I have examined three or four hundred of these children, and, while I have discovered all sorts of curious things in the eyes, I have not met one of these cases. They may occur in the lower grades. As yet I have only examined the higher grade children in this institution.

OPHTHALMOSCOPIC REPRESENTATION OF A CASE OF TRAUMATIC RUPTURE OF THE INFERIOR TEMPORAL VEIN OF THE RIGHT RETINA.

BY CHARLES A. OLIVER, A.M., M.D.,

PHILADELPHIA, PA.

On the 18th of March, 1896, at 7.30 A. M., a fourteen-year-old apprentice in a machine shop was struck in the left eye with a piece of steel, the actual size of which is shown in the accompanying woodcut. The missile was thrown with but a



slight degree of force by a fellow-workman, who was standing at some twenty-five meter's distance. Numerous brilliant stellate phosphenes were noticed at the time that the eye was struck. These were followed by a temporary obscuration of vision. Upon account of severe ocular pain provoked by movements of the globe, tea-leaf poultices, which gave much relief, were applied by the patient. Previous to the accident the eye was as good as its normal fellow.

Fifty hours after the accident I saw him at my clinical service at Wills' Eye Hospital. The lids of the left eye were red, and there was slight tarsal and ciliary congestion. There was a small area of slight superficial haze in the center of the left cornea. The pupil, which was two millimeters in diameter, was one-half a millimeter smaller than that of the other eye. Both irides, which were intact and uninjured, were equally and freely mobile to light-stimulus, accommodation, and convergence. The left iris was slightly hyperemic, and there was some ciliary tenderness. Intraocular tension in each eye was normal. Vision in the injured eye was reduced to one-fifth of normal ($\frac{5}{25}$).

The power of accommodation in the left eye was as good as its fellow (8 cm.), but the region of accommodation was markedly lessened (50 cm. into 30 cm).

The ophthalmoscope revealed an extraordinary picture, which was immediately sketched in water colors by Miss Margaretta Washington of this city. As can be seen in the accompanying reproduction, there was a dense irregular subhyaloid hemorrhage, which had escaped, and was escaping at the time of examination, as a series of slow oozes, seemingly independent of cardiac action from a rupture in the inferior temporal vein at an upward angle just beyond its inferior bifurcation. The blood was disposed in irregularly-situated clots and layers, the densest massings being those which were the furtherest down and out. In the macular region there was a stellate and irregularly-shaped area, enclosing the fovea centralis at its lower inner part. This area was similar to that which, at times, is seen in cases where there have been slight, though rapidly given, contusions to the eyeball by blunt instruments. No other gross change in the eyeground could be determined.

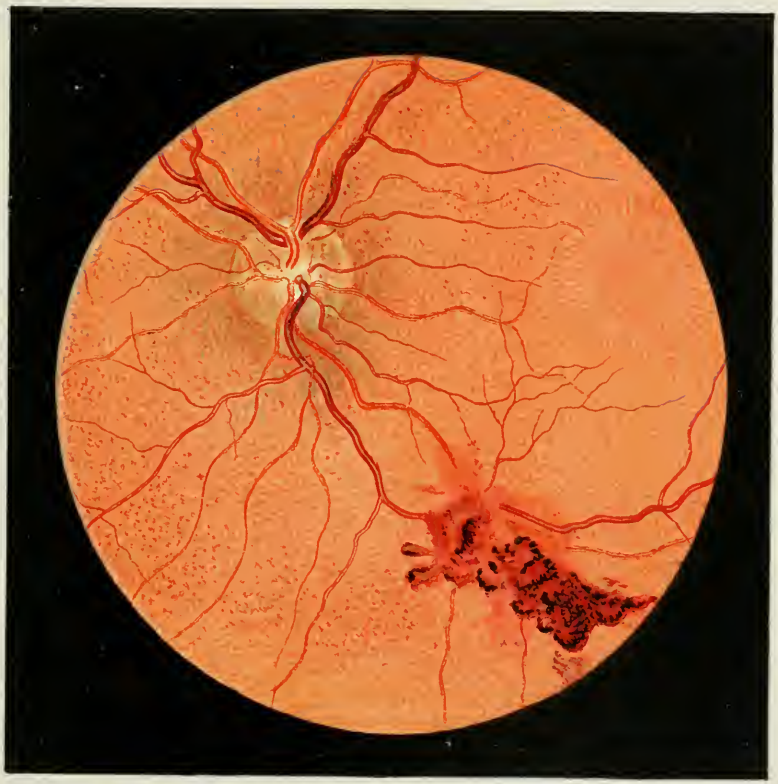
The field of vision, beside evidencing an absolute scotoma for both form and color that coincided in relative position with the hemorrhagic extravasation, was concentrically contracted to about one-half of its normal size.

No family or personal history of hemophilia or any dyscrasia could be obtained. The patient was strong and vigorous for his age, and had always been healthy and sturdy.

Atropine was locally, the emunctories were freely opened, and alteratives were given.

In seven days' time the vision had risen to 5-7½. The pupil was two-thirds and evenly dilated, and the ciliary tenderness had disappeared. The atropine was gradually reduced in strength and frequency until one month had elapsed, when hardly any traces of the break in the venous wall and the resultant hemorrhage remained. At this visit all medication was ordered to be stopped.

At present writing, vision has risen to full acuity, the same as that with the fellow eye, and the accommodative power is normal. All signs of inflammation in the anterior segment of the globe have disappeared. The visual fields, carefully taken by one of my assistants, Dr. William C. Krauss, fail to give evidence of any scotoma in the left eye, except possibly a doubt-



Ophthalmoscopic appearance of traumatic rupture of the inferior temporal vein.

ful lessening of saturation of color in the position previously occupied by the absolute blind area. The extent of the left fields, however, as compared with those of the right eye, still manifest a slight concentric reduction. The ophthalmoscope shows that the subhyaloid extravasations has gone. The vessel-wall in this situation seems thicker and irregularly opaque. The underlying retinal tissue is dragged into a series of striæ, which run mostly at an angle of about seventy-five degrees. In other words, with the exception of these almost indiscernible sequelæ, the eye is as perfect as its normal fellow.

THE PUPIL REFLEX IN ABSOLUTE BLINDNESS.

By GEORGE C. HARLAN, M.D.,

PHILADELPHIA, PENN.

The pupil is dilated and fixed in so large a proportion of cases of absolute blindness, in which the ball is sound and the media are clear, that the impression is quite general among those whose attention has not been particularly called to the subject, that reflex pupillary action is not compatible with loss of light perception. This is less to be wondered at when we consider that few of the ophthalmological text-books contain anything to correct this misapprehension, and that many of the neurological works do not bring the point out clearly. These considerations may justify the report of the following cases :

W. G., a bright and well-developed boy, sixteen years of age, recently admitted as a pupil to the Pennsylvania Institution for the Instruction of the Blind, had good health until about a year ago. He then had a severe illness which his attending physicians attributed to intracranial tumor, and during which his vision failed, and at the end of three months was entirely lost. This was all that could be learned of the history of his case. He

was represented as in good health at the time of his admission to the institution, but it was soon found that he was unequal to any mental exertion, and had frequent headaches with occasional attacks of vomiting, and that it was necessary to return him to his home in a distant town.

There was entire absence of light perception in both eyes; repeated testing and close watching left no doubt on this point. The pupils were dilated — about 7 mm. — and the eyes had the vacant stare and objectless movements of blindness, but the external appearances were otherwise normal. The pupils responded sluggishly and partially, though very evidently, to diffused daylight from a northern window, but promptly and completely to direct sunlight. The ophthalmoscope showed typical post-neuritic atrophy of both discs, which, in the absence of other probable cause, might have been considered sufficient to account for the blindness.

Of course, a moment's reflection shows that there is nothing in the behavior of the pupil in this case that does not admit of ready explanation, and that it is rather remarkable that such cases are not more frequently observed. If the well-known path of reflex pupillary action — from the retina through the optic nerve, optic tract, corpora quadrigemina and Meynert's fibres, to the center for pupillary contraction in the aqueduct of Sylvius, and thence returning to the iris through the fibres of the third nerve — be unimpaired, there is no reason why a lesion situated in the cortical visual center, or in the fibres connecting this center with the corpora quadrigemina, should necessarily interfere with the movements of the pupil. Ferrier states that a flash of light before the eyes will cause the pupils to contract in animals deprived of their cerebral hemispheres. Perhaps the reason why pupil reaction in absolute blindness is so rare is that a bilateral lesion would be required to cause complete cortical blindness, even in one eye (bilateral hemianopsia), and that so extensive a disease would be likely to involve other portions of the visual apparatus. As in the case just reported, the optic atrophy, evidently consecutive to neuritis, observed with the ophthalmoscope, would appear to be sufficient of itself to obstruct light stimulus, but has done so only

partially; the pupils acting sluggishly and incompletely to diffused daylight, though promptly and fully to direct sunlight. The Wernicke symptom, hemianopic pupil reaction, has been much discussed of late as a means of locating unilateral lesions; and in the Argyll Robertson pupil we have loss of reflex without loss of sight.

I expected to find a number of cases for the observation of the pupil in absolute blindness in the Pennsylvania Institution for the Blind, and, with the assistance of Dr. George Cross, made a search there for such cases; but among the 175 inmates we could find only 3 with sound balls and clear media who were entirely without the perception of light. Those who were conscious of direct sunlight were excluded.

A. W., a girl, eighteen years of age, in excellent health, blind for two and a half years after cerebro-spinal meningitis; complete optic atrophy. Discs bluish-white and somewhat stippled, with margins not sharply defined, and slight choroidal changes about them; retinal arteries slightly contracted; no nystagmus; pupils regular, and 7 mm. in diameter; no reaction to diffused light, but decided, though slow, contraction when exposed to direct sunlight; more noticeable after prolonged shading, which, however, did not cause increased dilatation.

J. V., a healthy man, twenty years old, lost sight at seven years of age, also from cerebro-spinal meningitis. Complete white optic atrophy. Discs stippled and margins sharply defined; no decided choroidal changes; nystagmus; pupils 5.5 mm.; no reaction by usual tests, but after the eyes had been bandaged for half an hour the pupils were found to have dilated to 8 mm., from which they gradually and imperceptibly returned to their former size. They contracted decidedly, though slowly, on exposure to direct sunlight.

J. McK., aged fifteen, a well-developed, muscular boy, large for his age, and of fair intelligence, has never seen; is not conscious of the shadow of the hand, or of a black screen passed before the eyes in direct sunlight. No history of blindness in any of his relatives, except a brother who was born blind. He has two sisters with perfect vision. The brother was an inmate of the institution some years ago, and

the cause of his blindness is recorded as "congenital, probably optic atrophy." There is constant nystagmus; a rather slow movement of the balls, chiefly horizontal, but occasionally slightly oblique. Ophthalmoscopic examination of the right eye shows a hypermetropia of 7 or 8 D. The disc is scarcely distinguishable, except by the emergence of the retinal vessels, which are somewhat narrow. It is a little raised above the level of the fundus, and its margin is obscured by coarse striations. In the left eye the disc margins are less obscure. There is no suggestion in either of the usual picture of optic atrophy. The constant nystagmus makes a satisfactory examination impossible.

The pupil in each eye, in the diffused light of a room, is regular, and 4.5 mm. in diameter. There is perceptible variation with the movements of the ball, particularly with that down and in, but no response to the light from a northern window. When, however, the eyes are bandaged for awhile, the pupils dilate a little more than a millimetre; and when again exposed to light, though no motion is perceptible, they return to their former size in a few seconds. When exposed to direct sunlight, even without previous occlusion, the pupils contract down to 2 mm., with a movement that is easily perceptible, but deliberate and very different from the prompt action of a normal iris.

None of these pupils responded to artificial light from the ophthalmoscopic mirror.

It is probable that in these cases there is complete cortical blindness with slow and very imperfect transmission of light excitation to the center for pupil contraction. In the congenital case we may suppose absence of cortical visual centers and imperfect development of the optic nerve, or, perhaps, intrauterine cerebral disease. It is remarkable that two members of a family should be thus affected, without heredity or other recognizable cause. Dr. Gould* has reported a case of complete white optic atrophy, consecutive to a neuritis occurring in connection with obscure spinal and cerebral disease, in which the dilated pupils, although they failed to respond to the usual tests, contracted gradually and imperceptibly to the normal size

*Eighth International Ophthalmological Congress.

when the patient was seated before a window. They would probably dilate if the eyes were bandaged and contract visibly if exposed to direct sunlight.

I commenced to suspect that direct sunlight might cause contraction in all cases, and that perhaps the heat might have some effect on the iris; but Dr. Risley has removed all doubt on that point by showing me a patient whose pupils are absolutely indifferent to sunlight. There is wide mydriasis and absolute optic atrophy of unknown cause. Her optic nerves have completely lost their function, or there is lesion in some other part of the reflex path.

In all these cases the pupil contracted with a forced effort to close the lids. Gifford,* who has recently called attention to this reaction, thinks that it is a result of an overflow of stimulus from the orbicularis center to the center for pupil contraction, and Jackson suggests that it may be "due to an inhibition of the action of the dilator of the pupil accompanying an inhibition of the palpebral muscle of Müller, which acts in opposition to the orbicularis." A simpler explanation, and I believe the true one, is that the sphincter pupillæ acts in association with the superior rectus, which always contracts when a forcible effort is made to close the lids. This association is well-known to obtain during sleep.

Some interest attaches to the condition of the pupil in hysterical blindness as indicating the probable seat of the morbid process. Gowers thinks that this morbid process is in the cortex, and says that the pupil action should decide. Leber also maintains that there is a central disturbance and retains the expression "retinal anæsthesia," not as implying that the retina is necessarily involved, but merely as a convenient name for a condition that is not understood.

Priestly Smith,† on the other hand, thinks that "hysterical amblyopia, neurasthenic amblyopia, and sympathetic amblyopia are conditions of peripheral anæsthesia, due to reflex contraction of the vessels which nourish the retina," and maintains his view chiefly by a study of the visual fields. He does not

* Archives of Ophthalmology, July, 1895.

† Ophthalmic Review, Vol. III, No. 31.

mention the pupil. I have usually found the pupil normal in cases of hysterical blindness, of which I have chanced to meet with a considerable number, and believe that this is the rule ; but in one case of complete monocular blindness in a typically hysterical subject that I reported to the society a few years ago,* a pupil dilated ad maximum and absolutely fixed was promptly restored to normal size and complete mobility by mental impression (the application of a wooden imitation of a magnet). My own observation, therefore, would seem to indicate, so far as the evidence of the pupil is concerned, that the morbid process in hysterical blindness may be either central or peripheral, or both, but that it is more frequently central. It must be remembered, however, that the mydriasis in the case just referred to, may not have been due to any obstruction in the reflex path of pupillary contraction, but that it may have been, and in all probability was, the result of excitation of the pupil-dilating center in the medulla, which is known to be influenced by the emotions. In other words, there is very little doubt that it was not a paralytic but an irritation mydriasis, such as is met with in, for instance, the psychical excitement of acute mania,—a mydriasis which is more easily referred to muscular action than to elastic contraction, as simple elasticity can act only by relaxation of its opponent.

This case of hysterical monocular blindness has seemed to me to be of special interest because it was not merely a more or less dubious subjective phenomenon, but presented the definite objective symptom of a dilated and immobile pupil. It gives little encouragement, however, to localization of the morbid process, if even that term is not too materialistic to be applied to such cases as this, which perhaps, in the present state of our knowledge, can scarcely be rescued from the domain of metaphysics. Still, it is easier to conceive of a retinal cause, though the ophthalmoscope may show no sign of it, than to understand how one acting in the cortex, or anywhere behind the commissure, could account for complete blindness in one eye, the other remaining unaffected, without doing violence to what is known of the anatomy and physiology of the brain.

* TRANS. AMER. OPHTH. SOC., Vol. III, p. 649.

DISCUSSION.

DR. MYLES STANDISH of Boston. — I had a patient who insisted that he was not blind because his friends told him that his pupils reacted to light. He had white atrophic nerves, and was blind. When taken into the dark room and left there for a few minutes the pupil became twice as large as it was in the light. When taken to a window where the sunlight fell upon him the motion of the pupil was clearly seen.

DR. O. F. WADSWORTH of Boston.— I recall the case of a child who had wholly lost the sight from double optic neuritis. The pupils, even with the same light, varied at times rapidly, but not always, at least in response to light.

DR. G. E. DE SCHWEINITZ of Philadelphia. — I have seen two cases of blindness in which the ordinary light stimulus failed to produce the slightest movement in the irides; but when the eyes were exposed to sunlight there was contraction. One of these cases was a boy, aged about sixteen, with complete atrophy of each disc following meningitis. Indeed, I fancy it is one of the cases described by Dr. Harlan, as after I had seen this boy in the Jefferson College Hospital, I advised him to go to the blind asylum. The second case was one of choked disc in a man about twenty years of age, whom I saw in consultation with Dr. Reuling of Baltimore. The papillitis was caused by a large brain tumor occupying the left frontal lobe, which had been removed by Dr. W. W. Keen. The optic neuritis was subsiding when I saw him. In the right eye there was no light perception. In the left eye there was qualitative light perception excentrically. Both pupils were widely dilated, and the irides perfectly immobile under ordinary examination, but reacting promptly to the direct rays of the sunlight. I have a vague impression that somewhat similar cases have been described by von Graefe, but have been unable to find the reference, and may perhaps be mistaken. No doubt Dr. Knapp can enlighten us on this subject.

A CASE OF BILATERAL NECROSIS OF THE SKIN OF THE EYELIDS.

BY CHARLES J. KIPP, M.D.,

NEWARK, N. J.

Michael Nagel, white, 48 years, single, was brought into City hospital at Newark, N. J., 4 A. M., June 16, 1891, with the history that he had been drinking heavily for two weeks, and developing delirium from alcohol, had walked out a second-story window, falling to the brick pavement below. The fall was about 15 feet, and the surface fallen on was entirely brick. By the fall, patient sustained an injury to the left arm and left leg. Examination showed a simple fracture of the left humerus, about the middle third; also a simple comminuted fracture of the left femur in the middle third, the bone where fractured having several fragments.

Physical Examination:—Patient is a large, well-built man, fairly nourished, and in seeming good health. Has been drinking, and is now well under the influence of alcohol, but appears rational, and answers all questions without hesitation. He is covered with filth and vermin, and has blotches over his entire body which appear like those following the scratch of lice-bites. The free edges of the eyelids were covered with dry, yellowish crust, but the lids were not swollen, and the skin of the lids was of normal color. The patient stated that he had had a discharge from his eyes for years, and that it never troubled him except some mornings when the eyelids were stuck together more than usually. He was found to have a chronic catarrhal conjunctivitis of both eyes. His sight is good, his appetite is good, and the bowels are regular. The examination of the heart and lungs fails to show disease of these organs. He denies having had syphilis, and has no discharge from his urethra. The broken arm was set in side-splints, and the broken leg put up in a Buck's extension apparatus with about 25 pounds weight. His lids were washed with a solution of boric acid every three hours, and a compress wet with the same solution

kept on his lids. Pulse, 120°; temperature, 101°; respiration, 36°. In the evening of same day: Pulse, 128°; temperature, 101.4°; respiration, 32°.

January 17th. Patient has been fairly quiet all day, but removes the compresses whenever he can. Bowels moved once; defecation normal.

January 18th. Patient developed marked delirium early today, and shouted or talked incessantly. He became violent, and was restrained by the harness or "straight-jacket," used in such cases, his arms being bandaged securely to his body.

In the morning of this day was noticed, for the first time, a dark-colored spot of about the size of a pea in the skin of the upper-lid of the right eye, below the outer-half of the brow; and in the evening a similar discolored spot was found in the skin of the upper lid of the left eye, below the middle of the brow.

He received ten grains of chloral every three hours, and the compresses wet with solution of boric acid were continued. Pulse, 118°; temperature, 98.4°; respiration, 26°.

January 19th. The dark-colored spots in the skin of both upper lids have increased in size, and are now almost black. The conjunctivitis as before. There is now a slight roughness of the epithelial layer of the cornea in both eyes. The compresses were continued, and a drop of a half per cent. solution of the sulphate of atropine was instilled in both eyes three times daily. He received whisky and small doses of strychnine, and it was found necessary to give him 15 grs. of chloral every two hours in order to keep him quiet. For food, patient was given egg-nogg, chicken soup, beef tea, and milk. He takes all food greedily, and often snaps at the food like an animal.

An analysis of his urine showed its specific gravity, 1020; it was of alkaline reaction, contained some mucus, but no sugar and no albumen. The microscope showed oxalate of lime and triple phosphate crystals, but no casts. During the day the patient passed fæces and urine in the bed. Late in the evening he became much quieter than he had been heretofore, and slept so soundly in the night that he had to be roused for his food and medicine which he continued to take greedily. In the

evening it was noticed that the skin of both upper lids was of a very dark color from their free borders to the margins of the orbits, and that there were also dark-colored spots in the skin of both lower lids. The lids were now so stiff that it was impossible to separate them for the purpose of inspecting the eyes.

January 20th, A. M. Temp., 101°; pulse, 120°, good. The skin of the lower lids is now of a dark color from their free edges to the margins of the orbits. The discoloration of the skin of the upper lids has not extended since yesterday. Patient was very quiet all day, and has taken a great deal of nourishment; 8 P. M., temp., 102°; pulse, 120°, good.

January 22d. The patient has been quiet since last report, and the necrosis of the skin of the lid has not extended beyond the margins of the orbits. A distinct line of demarkation is now seen, corresponding to the orbital margin on both sides.

January 25th. The necrosed skin of the upper lid of right eye came away to-day exposing the orbicularis muscle.

January 26th. The separation of the necrosed skin from the tissue beneath has continued since last report, and to-day the orbicularis muscle of both sides is entirely deprived of its covering. The patient has failed steadily for several days, but up to to-day has taken all nourishment given him. Pulse, 98°; temp., 101.4°; res., 26°.

January 27th. During the last night patient failed more rapidly, and before morning began to have difficulty in swallowing. By noon he was unable to take food, and at 6.45 P. M., he died.

The autopsy was made soon after death by Dr. E. W. Peet, the house surgeon, to whom I am also indebted for the notes of this case. The brain and its meninges were carefully examined, but no gross lesion could be found. The thoracic and abdominal organs were found healthy. A cause of death was not discovered. The eyelids were removed for microscopic examination, but unfortunately were lost.

A somewhat extended search for similar cases in the textbooks and journals has been nearly fruitless. J. MITWALSKY, *in Zehender's klinische Monatsblätter f. Augenheilkunde, January,*

1893, reports two typical cases of bilateral gangrene of the skin of the lids. The first was caused by primary facial erysipelas; the patient lived. The second, he regards as due to a metastatic process in a septic organism; the patient died. He believes the gangrene to be caused by mycotic emboli in the arterioles, springing from the arcus tarsei. The patient was a woman suffering from purulent endo-metritis; pyogenic strepto cocci were found in the subcutaneous tissue of the lids, and also in the form of emboli in the capillaries of the liver.

A. ELSCHNIG, *in the same journal, June*, 1893, in reviewing the above cases, says that in all the reported cases, the gangrene of the skin of the lids presented only a symptom or a peculiar ending of an inflammatory process, originally located either in the skin itself (as malignant oedema, gangrenous erysipelas), or in the subcutaneous tissue (as abscess after erysipelas simple, primary and metastatic phlegmons of the lids), and that an idiopathic gangrene or necrosis of the lids, such as is seen in the lower extremities of old people as the result of marasmic thrombosi (as so-called senile gangrene), or in certain toxic and nervous affections as spastic ischæmic gangrene (vasomotor gangrene) of the fingers, has not, thus far, been observed in the lids.

HIMLY, *Die Krankheiten und Missbildungen des menschlichen Auges, etc.*, 1843, *p.* 210, says: "Occasionally there is also seen an erysipelas which is limited to the eyelids and in which the face is not affected. This appears in very severe cases of typhus at the time of the crisis, and is not rarely the forerunner of death. The eyelids, and perhaps also the nose, become red, and in a few hours later, livid and gangrenous, whereby the whole lids are destroyed. I saw such a case of typhus in the military hospital, at Frankfort in 1794."

In my case the necrosis was not preceded by an inflammation of the skin nor of the subcutaneous tissue, and there was no disease of the skin in any part of the face. My patient had a conjunctivitis with much mucous secretion, and was treated with compresses wet with boric acid. I cannot believe that either the conjunctivitis or the treatment caused the necrosis of the skin. No one so far as I know has ever observed necrosis of

the skin in connection with a conjunctivitis, or as a consequence of the long continued use of compresses to the lids. My patient suffered from chronic alcoholism, and had a fracture of an arm and a thigh, and it seems to me most probable that the bilateral necrosis of the skin was due to some change in the nerve centres, brought about by the alcoholism.

DESCRIPTION OF A SUCCESSFUL OPERATION FOR BLEPHAROPLASTY EMBRACING THE OUTER HALVES OF BOTH THE UPPER AND THE LOWER LIDS BY SINGLE SPLIT-FLAP TAKEN FROM THE FOREHEAD, FOR EPITHELIOMA.

BY CHARLES A. OLIVER, A.M., M.D.,

PHILADELPHIA, PA.

During my fall 1895 term of service in the eye-wards at the Philadelphia Hospital, A. K., a sixty-six-year-old hostler, was admitted. He gave the following history: In May, 1864, during the last day of the battle of the Wilderness in Virginia, between the Federal and Confederate forces, he was struck at the outer angle of the right eye by a small piece of shell. From this wound, that never entirely healed, a growth, which slowly but steadily increased in size until both of the lids became involved, developed. This finally assumed a malignant type, and presented exuberant granulations which were painful, irregular in outline, and showed no tendency to heal.

The family history was negative. For the past three years the patient has had a chronic diarrhœa, the stools being thin and liquid, and averaging from six to twenty a day.

The growth, which was epitheliomatous, in character, occupied the outer halves of both the upper and the lower lids, and extended laterally to some six or seven millimeters beyond the supposed position of the external canthus. Its oldest and densest portion seemed to be to the outer side. It bridged across the palpebral fissure without apparently reducing the commissural width. A

Fig. 1.

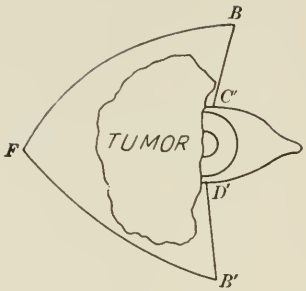


Diagram showing relative size and position of tumor and eye (slightly reduced from normal).

Fig. 2.

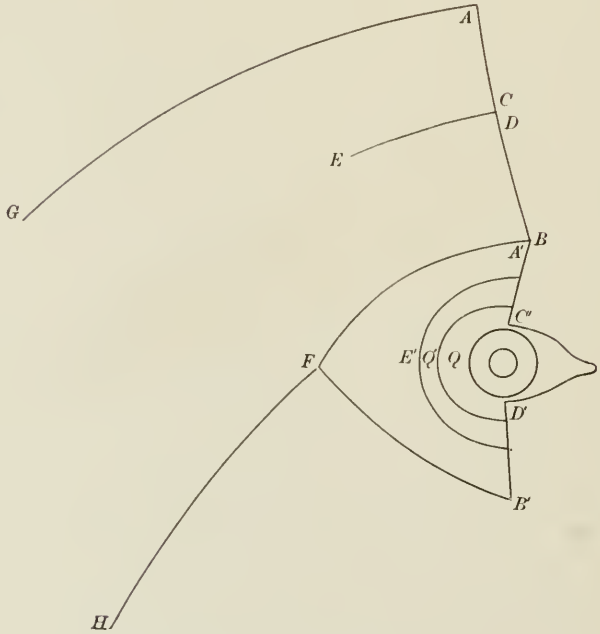


Diagram illustrating method of operation.

probe could be readily passed beneath the growth into the conjunctival cul-de-sac, showing that the mucous membrane was untouched. The eyeball itself, which was uninjured in any way, performed its functions normally for age and refractive condition.

There being no contraindication, on the 10th of October, 1895, while the patient was under the general anæsthetic effects of ether, and with the kind assistance of my friend, Dr. George C. Harlan, and my resident surgeon, Wm. H. King, and in the presence of my colleague, Dr. Geo. E. deSchweinitz, I made the following operation for the removal of the growth and the filling in of the bared surface with the adjacent sound skin.

As shown in the accompanying outline sketch (Number 1) the area "Tumor" which represents the position and the size of the growth was excised in the triangle F B C′ D′ B′. During this procedure care was taken to save every portion of the underlying conjunctiva. This was accomplished by dissecting the mucous membrance free from the inner edge of the ciliary border of the outer halves of the lids by a series of carefully made incisions carried along the junction of the mucous membrane and the skin of the lids.

This done, the large, irregular, triangular area, as shown in the second sketch (F B C′ D′ B′), was obtained. Embraced in the central portion of the inner thirds of this area there was a large quadrate flap of conjunctiva (Q Q′) which represented the entire mucous membrane surface of both the globe and the lids to the temporal side of the cornea, the bulbar portion (Q) being still adherent to the submucous tissues of the globe.

The bared surface was thoroughly freed from all shreds of tissue and masses of fat. The capillary oozing was checked by the moderate employment of hot stupes.

A large single flap made of a height at its inner aspect equal to the base of the denuded triangular area was formed at G A A′ F H (second sketch). This was dissected loose, leaving the broad and well-nourished base G H. The tissues beneath H F B′ were next dissected sufficiently to make the overlying area freely mobile. The large upper flap was slid into position and the border F B was attached to F B′ by a series of

sutures which were so inclined as to bring the two edges neatly together. The slit C E D was cut and the lower border E D was stitched to the conjunctival flap, which now ran from E′ to D′, thus making a ciliary border in the new outer half of the lower lid. The external canthus was next formed by a similar stitch placed in the new external angle E′. The ciliary border of the new half of the upper lid was formed in a similar way by attaching the upper border of the split E C in the flap to the conjunctival border E′ C′. The rest of the large flap was set into position and the open triangular area in the forehead was reduced to a minimum by a number of fine superficial sutures. The tissues beneath the forehead were loosened so as to allow the skin of the forehead in the region of the operation to cover as much of the exposed surface as possible. The second phototype will show the position and size of the surface that was left to heal by granulation.

The field of operation was cleaned and dusted with powdered iodoform, covered with a large square of antiseptic gauze, and protected by several turns of a narrow gauze bandage.

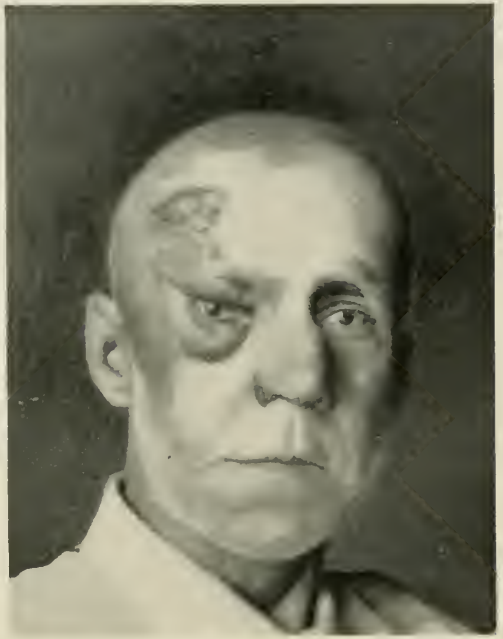
The first dressing, which was done in two days' time, consisted as follows, in sopping off the gauze with sterile water; in thoroughly irrigating the whole operation area with warm sterile water; in spraying the cicatrizing area and the stitch wounds with a one-third strength solution of peroxide of hydrogen in water; in drenching the conjunctival sac with a warm saturated solution of boracic acid; and in dusting the cicatrization area with powdered acetanilid.

In four days nearly all of the superficial stitches in the broadest portion of the flap were gently removed. The outer sutures were gradually gotten rid of, until on the 28th of the month the last were cut out, these being those that joined the lower border of the conjunctiva to the adjacent skin.

On the fifth day, at the suggestion of my resident surgeon, Dr. Wm. H. King, the granulation area was dressed as is sometimes done with chronic ulcerative conditions in the lower extremities. The exposed surface was dusted with acetanilid. The sound skin around the free space was covered with several layers of gauze with a central perforation equal in size to the

Fig. 3.

Fig. 4.



Appearance of growth before operation, and slanting situation of palpebral fissure immediately after operation.

granulation area itself, thus affording a bandage which was protective without producing any pressure upon the delicate granulation tissue.

On the same day a slight bagging of the lower outer portion of the base of the flap induced me to cut a quadrangular trap-door between two or three of the stitches. In this opening I had Dr. King spray the one-third strength solution of the peroxide of hydrogen daily in such a way as to force the material well beneath the flaps without producing any manifest damage to the parts. A few drops of pus upon the first two or three trials showed the wisdom of the procedure.

On the 28th of the month, but eighteen days after the procedure the field of operation was permanently exposed to the air. Two days before, photograph of No. 11 phototype showing the first result of the operation was taken by my friend, Dr. Frank Savary Pearce. When compared with the condition seen four days before the operation, as imperfectly shown in phototype No. 1, the difference between the two is plainly manifest.

In April, 1896, more than half a year after the operation the external canthus was not dragged so much up and out. The eyeball was freely mobile; the patient was well able to cover the eye. The frontal cicatrix could barely be seen, and there was not the slightest vestige of the growth remaining.*

Temperature, pulse, and respiration remained normal throughout the after-treatment. The almost constant diarrhœa, with its necessary uncleanliness, was one of the most important things that was successfully combated.

REMARKS. — This case is reported fully as the method of operation is most certainly a novel and a useful one. The patient, who was almost absolutely bald in the fronto-temporal region, seemed to present in this peculiarity an opportunity that was particularly appropriate for the form of operative procedure that was adopted.

The restoration of fully one-half of the lid area by an ordinary, single-split skin-flap; the accurate coaptation of the mucous and skin surfaces so as to form a new lid border; the mak-

*A later photograph taken just before the patient's death a few months ago, unfortunately was a failure.

ing of an artificial external canthus; the almost total disappearance of any of the disfigurements that were first noticeable; the thorough excision of the growth; the full movement of the globe in its various directions: all are but a few of the interesting factors in the permanent results of the case.

The full and generous excision of the malignant mass; the single split flap, totally different from that of Hasner for the restoration of an external canthus; the broad base of the large flap with its full and free vascularity; the method of formation of a ciliary border and a properly-shaped and deeply-set conjunctival cul-de-sac which is almost if not quite as extensive as its fellow; the nearly infinitesimal loss of mucous membrane; the method of preparing and setting the flap; and the plan of superficial sutures, are all of interest, and seem to be of value in the technique of the operation.

The bringing down of a second upper flap so as to take away the cicatrizing tissue from near the eyelid; the production of an upward external dragging of the palpebral fissures, which, if it had not sufficiently fallen into proper place, I would have remedied by the placing of a second cicatricial area down and out from the external canthus just below the outer lower angle of the malar bone; and the redundance of tissue introduced into the lids, which, at present writing, was greatly lessened, may all seem to have been conditions brought into existence that should be avoided in such cases. The facts, however, that the late results fail to evidence any such early indiscrepancies, seem to show that under ordinary circumstances they make but little difference in the question.

The form of protective dressing adopted for the granulation-area; the simple methods for cleanliness and the endeavors to obtain as near asepsis as possible in a broken-down, unhealthy, and unclean subject; the avoidance of any dangerous and even ruinous pus-bearing channels, by the little operative device and the faithful use of peroxide of hydrogen; the care and order in which first the superficial and later the deep stitches were removed; and the ingenious well of gauze in which the granulation-area was enclosed: are but a few of what seemed to be of interest in the after-treatment of such cases.

The one curious feature in the case was the manner in which at first the orbicularis palpebraum acted. The upper outer fibers, which were situated upon the lower part of the cicatrix at times dragged the outer half of the lower eyelid up and out during the earlier stages of the healing process, and gave the patient a most quizzical expression.

DISCUSSION.

DR. F. BULLER, Montreal. — I notice that Dr. Oliver speaks of having left a large area to heal by granulation. Of course that might have been covered by flaps brought from above, but another method is to immediately graft the surface by Theirsch's methods. This greatly simplifies the matter, and I have never had any trouble to get such grafts to grow under similar conditions.

DR. S. B. ST. JOHN, Hartford. — I remember many years ago hearing Dr. E. Loring speak of this method of slitting the flap, and think he referred to it as the Italian method of blepharoplasty.

THE TREATMENT OF DERMOID TUMORS OF THE ORBIT.

BY F. BULLER, M.D.,

MONTREAL, CAN.

Some six years ago, my attention was sharply directed to the treatment of dermoid cysts of the orbit, by two cases which came under my notice, separated by but a short interval of time.

The first taught me a lesson I shall not forget. The second established a principle which I hope others will remember, viz.: that even the most formidable of these cysts can be removed without dissection of the surrounding tissues.

I suppose most ophthalmic surgeons have, at some period of their career, depended largely on text-books for information concerning the various morbid conditions they are likely to meet with in ophthalmic practice, and at all times we are apt to be guided more or less by what we read in the works of well-known authorities.

Now, dermoid tumors of the orbit are so common that one

would suppose any person writing a treatise on the eye would be sure to give all the information on this subject that might be required in order to deal with these growths in a satisfactory manner. This is my excuse for quoting briefly from a number of well-known authors.

I have nothing to add to what is already well known regarding the genesis morbid anatomy, and clinical history of these tumors, but in the matter of treatment I cannot agree with any one of the authors whose writings I have searched. Some do not mention dermoid tumors at all; others treat of them quite elaborately, but not one advocates any principle of treatment that can be safely followed in all cases. I will ask your indulgence for a brief *résumé* of what they have to say in the matter of treatment.

BERLIN, in "Gräfe-Saemisch Handbŭch der gesammten Aŭgenheilkŭnde," discusses the subject of dermoid cysts of the orbit very fully, and closes the discussion in the following words: "After all, I believe total extirpation is the only reliable method of treatment. It is true that a perfect cure has been known to follow simple puncture or incision of the cyst, but such a result must be regarded as exceptional, and the probability of obtaining such a result is very slight."

SOELBERG WELLS (edited by Bull) says that if the contents of the cyst are dense, and it does not reach very far back, it should be dissected out; if the contents are fluid, it should be punctured, if necessary, several times, and allowed to heal by adhesive inflammation, but the use of any means of effecting adhesive inflammation he considers dangerous if the cyst extends deeply into the orbit, as the inflammation might extend to the membranes of the brain. The reader is left in darkness as to how he should deal with deep-seated cysts with non-fluid contents. Inferentially, he may be allowed to choose between the devil and the deep sea.

DR. DE SCHWEINITZ:—"Sebaceous cysts occur in the eyelids, most frequently in the outer part, and also in the eyebrow. In the latter situation they are sometimes deeply-seated, lightly adherent to the periosteum, and may extend some distance into the orbit. Their removal by an ordinary dissection is usually unattended with difficulty."

NETTLESHIP, under the heading "Tumors of the Orbit,—Dermoid Tumors (Cystic)," ignores the fact that they sometimes extend deeply into the orbit, and says they should be removed by incision, "the thin cyst wall being carefully and completely removed."

FUCHS says of dermoid cysts of the orbit:—"On account of their superficial situation they do not displace the eyeball, but push forwards the skin of the lids, through which they can readily be felt, as round movable tumors of the size of a bean or walnut. . . . The only harm that the dermoid cysts produce is the disfigurement caused by them, and this, moreover, is the only reason for the rather frequent attempts that are made to extirpate them. In doing this we must go to work very carefully to dissect out the cyst, as far as may be, unopened. If the wall of the cyst, which is often thin, breaks prematurely, a part may be easily left behind and give rise to recurrences."

ROOSA does not mention dermoid cysts of the orbit.

NOYES barely mentions the subject.

JULER recommends excision by a large opening, and enjoins great care not to rupture the thin walls of the cyst. He also mentions that these cysts sometimes extend deeply into the orbit; this, of course, implies an extensive dissection within the orbit.

MEYER recommends partial excision of the deep-lying cysts in the orbit, with the hope that the fistulous wound remaining may ultimately heal. Surely this is anything but good surgery.

SWANZY says that (intra-orbital) "dermoid cysts are amongst those most frequently found," (a somewhat vague statement,) that "they grow slowly, attain a considerable size, and cause exophthalmus." The contents are generally either serous or honey-like, and, occasionally, hairs and other epidermic formations have been found in them. His recommendation as to treatment is strikingly at variance with that of the other authors quoted. He says:

"The cyst should be freely opened at the most prominent point, evacuated by gentle pressure of the eyeball backwards, and the sac syringed out two or three times daily with some antiseptic solution until all discharge has ceased. The opening will then

close, while the eyeball will already have returned to its place. If the contents of the cyst are solid, or nearly so, it becomes necessary to extirpate it *in toto*." His description of the operation to be performed in such cases implies a deep orbital dissection, the very thing which I propose to show may be, and always should be, sedulously avoided.

It will be noticed from the foregoing that extirpation is the prevailing idea, and that no other plan of treatment is suggested as suitable for all cases.

Total extirpation of small, superficially situated cysts is, doubtless, easy of execution and safe enough, but how about the larger growths that are admitted to extend for an unknown depth within and even beyond the proper limits of the orbit, that may have extensive adherence to the walls of the orbit, to the ocular muscles, and even to the eyeball itself, complications which may entirely prohibit complete extirpation? Clearly, it is worth while to have some more reliable method of removing the deep-seated cysts. This is what I have endeavored to find, and the same method seems equally applicable to the superficial cysts, and therefore may be followed in all cases.

The first case I alluded to was one in which a rather large cyst occupied the upper and inner part of the orbit, and evidently extended rather deeply into this cavity, as well as presenting an ungainly swelling above the inner canthus. I dissected the cyst out as carefully as possible, but, owing to extensive adhesion to the orbital periosteum, I inflicted irreparable damage to the pulley of the superior oblique, and my patient made a good recovery with the exception of a permanent diplopia. Fortunately he was of tough material and did not mind it much.

The second case was intrinsically much more difficult to deal with, but I had gained the wisdom of experience, and adopted a totally different plan of treatment and was rewarded by a most gratifying result.

I first saw this patient in the year 1881, on account of an absorption ulcer of the left cornea, which recovered in a few weeks without leaving a trace of corneal opacity.

In July, 1890, the child was brought to me on account of a swelling in the left orbit, which had first been noticed two years

previously, and had increased slowly ever since. I found the eyeball pushed strongly upwards, outwards, and somewhat forwards. Only the lower quarter of the cornea was visible, nor could more of it be seen by any voluntary effort on the part of the child; thus there was a considerable restriction of the movements of the eyeball in a direction down and inwards. The lower lid was pushed forwards too, and presented a number of dilated subcutaneous veins. A large elastic mass occupied the lower and inner part of the orbit. Its surface felt uneven, as if covered by a mesh of soft, irregular cords. The peculiar form of proptosis gave the child a curiously sinister appearance, and was altogether a most unpleasant deformity.

For some time I was in doubt as to the diagnosis, thinking it might be a nævoid growth. Against this, however, was the fact that there was no increase of swelling when the head was thrown forwards. An exploratory puncture settled the question by revealing some of the sebaceous contents of the tumor.

I then decided to evacuate the cyst, and, if possible, destroy its secreting surface.

With the usual antiseptic precautions and under ether anesthesia an incision was made, $\frac{3}{4}$ inch in length, through the lower lid, parallel with the orbital margin, and the contents of the cyst evacuated by pressure. The cyst contained about a sherry glassful of pultaceous material of a yellowish color and about the consistence of cold porridge. To make sure of cleaning out all the oily debris, I syringed the sac freely with a $\frac{1}{2}$ per cent. of caustic soda, and finally with plain warm water. Exploration with the finger showed that the cyst cavity extended as far back as the apex of the orbit. I now introduced a crystal of nitrate of silver weighing 15 grains, as far back as possible, and another weighing 5 grains, a short distance within the wound, which I lightly plugged with sterilized gauze and covered the whole with a large pad of gauze soaked in a solution of perchloride of mercury. This dressing was changed the next day and for several days afterwards for pads of absorbent cotton soaked in the same solution, ice cold and frequently changed. There was a good deal of swelling and reaction for a few days, and then a copious discharge of serous

fluid and gray, shreddy masses, evidently the necrotic walls of the sac. The discharge gradually ceased and the swelling subsided. At the end of three weeks the wound was closed and the eyeball in its proper position, though not altogether free in its movements.

On October the 9th, about ten weeks after the operation, there was scarcely a trace of the wound, and the position and movements of the eye were perfect.

Now, this was just one of the orbital cysts, which, according to authorities, should have been dissected out. It is more than doubtful, however, whether such an operation could have been performed without inflicting permanent injury upon the important structures within the orbit.

I made use of nitrate of silver instead of any other irritant, firstly, because it is a potent antiseptic; secondly, because it is self limiting in its action; thirdly, because it is sufficiently powerful to insure complete destruction of the epithelial lining of the cyst, and thus leave the whole surface in a suitable condition for complete adhesion and obliteration of the cavity. I know of no other substance possessing all these qualities so perfectly as the silver nitrate.

I have followed the same plan of treatment in a number of other cases since and always with perfect success. In one only an abscess formed in the same situation, about two months after healing. This was opened and washed out with solution of perchloride of mercury, and perfectly recovered in a few days, and there has been no trouble since, now two years.

I cannot see why the objection urged against the injection of the cavity with irritant solutions (the supposed danger of setting up an inflammatory process which might extend to the cerebral meninges,) should be valid here. In the first place, the silver nitrate renders the cavity perfectly aseptic, and, with the cyst wall, forms a barrier against the extension of any pyogenic germs, which might possibly find entrance during the process of exfoliation. Such a contingency, however, is easily guarded against by cleansing the cavity twice daily with some antiseptic solution, and a suitable external dressing, such as iodoform gauze,— this in the form of ice-cold compresses during the period of reaction.

It is of some importance to keep the orifice of the cavity open as long as any debris of the cyst wall remain, if one would prevent the formation of an abscess later on, as occurred in one case, a restive child, whose mother was entrusted with the after treatment.

I cannot give an exact statement as to the amount of silver nitrate to be used, but may say it will depend upon the size of the sac and the thickness of its walls. In two cases, a crystal of five grains weight sufficed,—in both of these the sac was small.

I have found the sac wall relatively thin when the cyst contained an oily fluid, and after thorough cleansing I have little doubt the injection of a few drops of silver solution,—say of thirty to sixty grains to the ounce — would suffice.

If others will adopt this plan of treatment, I do not doubt we shall soon have definite information as to the minimum quantity of silver to be used in any given case.

DISCUSSION.

DR. ARTHUR MATHEWSON, Brooklyn.— I have long been in the habit of following a similar procedure, and found it effectual. It is to tie a cotton pledget on a probe and apply silver nitrate.

DR. MYLES STANDISH, Boston.— In these cases it has been my habit to use iodine on cotton and swab out the sac. Pack it with cotton and remove it on the following day. It will then heal without anything further.

DR. S. B. RISLEY, Philadelphia.— Have you seen the statement anywhere that these cysts are usually congenital?

DR. BULLER.— Yes; the statement is made by more than one author, and I myself believe they are always of congenital origin.

DIPHTHERITIC CONJUNCTIVITIS.

BY MYLES STANDISH, M.D.,

BOSTON, MASS.

Diphtheritic conjunctivitis, as we all know, is one of the most destructive of all the acute conjunctival diseases, and an early diagnosis is of the utmost importance for proper treatment.

Since the establishment of a bacteriological laboratory at the Massachusetts Charitable Eye and Ear Infirmary it has become evident to me that a diagnosis from the clinical picture in these cases is absolutely untrustworthy, and the purpose of this paper is to call attention to the necessity of an early bacteriological examination in all suspicious cases.

These three cases, as will be seen, present three distinct clinical pictures, in which two were undoubtedly diphtheritic, while the third, which presented on the conjunctiva the clinical picture of a diphtheritic membrane as seen in the throat, proved to be due to an infection of the staphylococcus albus.

The first case presented the classical picture of diphtheritic conjunctivitis and undoubtedly was such, as the septic poisoning which resulted in the child's death proved, yet did not show the presence of the Klebs-Loeffler bacillus. This was due in all probability to the fact that the child was received after the disease was well established; as I have before found the Klebs-Loeffler bacillus in the earlier stages of the disease, and after the brawny swelling was fully established, inoculation of tubes made in the most careful manner failed to show the presence of the bacillus.

The second case had a typical croupous membrane, yet the child was suffering from a diphtheritic infection which ran rapidly to a fatal termination.

These cases have been selected from a number of diphtheritic cases which have come under my care in the last few years, simply to show the difficulties of diagnosis and the importance of an early bacteriological examination.

CASE I. Child nine months old, entered the Massachusetts Charitable Eye and Ear Infirmary Dec. 6, 1895, with swollen lids, the conjunctiva brawny, of brownish gray color both on upper and lower lids, and also on the globe of the eye, near the inner canthus a dense white membrane which could not be wiped off, although the attempt to do so made the surface bleed. There was a thin, watery discharge. In short, the typical clinical picture, diphtheritic conjunctivitis, as described in the text books, and as I was taught in Berlin when a student.

Cultures were taken from the membrane and conjunctiva. These after proper incubation failed to develop any Klebs-Loeffler bacillus.

On December 7th the cornea perforated with prolapse of iris, and the child developed marked dyspnœa, although no membrane was to be seen in the throat or nose. A diffuse blush covered the skin of the upper half of the body. Temperature 103°. At 10.30 A. M. child was given 2 cc. of antitoxin. That evening the dyspnœa greatly increased without any membrane in throat or nose; there was a temperature of 104°, pulse 160, respiration 80°, abdomen much distended, and a very pronounced septic condition. The child died at midnight.

CASE II. Child eighteen months old. Entered the Massachusetts Charitable Eye and Ear Infirmary June 22, 1896, with the whole conjunctival surface of both lids and bulb of both eyes covered with a dense white croupous membrane, which, when seized with the forceps, pealed off as clean as if a cast had been made of the conjunctival sac; the surface left did not bleed, and looked like normal slightly injected conjunctiva. Both corneæ were clear, the lids swollen and œdematous. The mother reported the child as well.

By the next morning the membrane had rapidly reformed, but the corneæ were clear; there were no membranes in throat or nose. The next day, June 24th, although there were still no membranes in the nose or throat, the house officer reported the child as "somewhat croupy" at times. The temperature was 100.5°. Calomel fumigations, sponge baths, etc., were employed, but during the day temperature rose to 105°, and at 5 A. M. the next day the child died of heart failure. The breathing remained fair up to the last.

A report of the pathologist, Dr. William D. Hall, says: "A thick membrane from the conjunctival sac, measuring in the fresh state about two centimeters in length, was taken from same with ease, leaving no bleeding or raw surface. It presented reduplicatures and was friable. The membrane reformed, and was again taken off twenty-four hours after patient's entrance into the hospital.

"Cultures were made from the conjunctival sac, from the first membrane, and from the child's throat. The throat culture showed the staphylococcus pyogenes aureus, staphylococcus pyogenes albus, streptococcus pyogenes.

"The cultures from the conjunctival sac showed the Klebs-Loeffler bacillus, streptococci and staphylococci. Those from the membrane showed the Klebs-Loeffler and the ordinary pyogenic micro-organisms as from the conjunctival sac.

"The culture medium used was in every case the beef bouillon blood serum prepared by the Councilman-Mallory method, and all tubes (there were three from each place) presented in twenty-four hours the typical growth.

"Sections of the membrane were made after fixations in ascending alcohol and imbedding in celloidin. These were stained by Gram's stain for bacteria in sections, and gave the following results: Only at the edges of the membrane could the micro-organisms be made out. There were recognized chains of streptococci, many diplococci, and in one slide a number of long slender bacilli, some of which showed a swelling at one extremity, and all of which resembled the Klebs-Loeffler bacillus of diphtheria."

CASE III. A child two and a half years old entered the Massachusetts Charitable Eye and Ear Infirmary with swollen œdematous lids, and the conjunctival surface covered with a whitish membrane, not so dense as the two previously described, but which, when it was gently removed from the conjunctiva left many bleeding points. There was some slight muco-purulent discharge. This was a membrane that in the throat would have been clinically pronounced diphtheritic without a moment's hesitation. Temperature normal and child appeared well. The corneæ were clear. The cultures, as the pathologist's report

will show, developed almost a pure culture of staphylococcus pyogenes aureus, no streptococci, no Klebs-Loeffler bacilli, and the child got promptly well under treatment without any infection of the cornea.

Dr. Hall's report was as follows: "Three cultures on blood serum from a case clinically presenting the features of a diphtheritic inflammation, showed in two tubes, after twenty-four hours' incubation in the thermostat at 36° C., a large number of round white colonies, which at the bottom of the slant tended to confluence, but elsewhere were round, white, and discreet; in short, presenting the typical appearance of the stapylococcus pyógenes aureus, but exhibiting a remarkable twenty-four hour culture in point of growth. The other tube was essentially the same, all the colonies being discreet. These cultures were all made in the usual manner, by touching a sterilized platinum wire to the membrane, after cooling in the water of condensation of a sterile tube. Cover slip preparations made from different parts of each tube and representing as nearly as possible each a single colony, bore out by their behavior toward certain stains, notably Gram's, and also by their morphological characteristics, the fact that it was the staphylococcus albus with which one had to do."

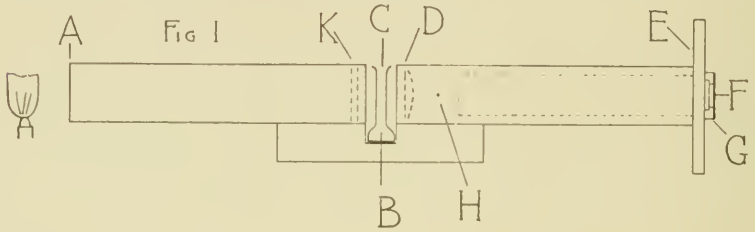
A SIMPLE INSTRUMENT TO MEASURE THE POSITION IN WHICH THE AXIS OF A CYLINDRICAL LENS IS WORN BY THE PATIENT.

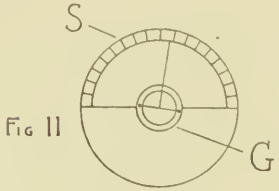
By CHARLES H. WILLIAMS, M.D.,

BOSTON, MASS.

It is often desirable to measure the position in which a cylindrical lens is being worn, and with the weaker lenses of half a dioptric, or less, especially when combined with a spherical glass, it is not easy to determine quickly and accurately, by ordinary means, the position of the axis of the cylinder. For this purpose I have arranged a simple instrument, as follows:

A box (or tube) sixteen inches long by one and a half inches square, has, at one end A, a thin brass diaphragm with a very small hole at its center. The size of this hole is important for the proper working of the instrument, and my best results have been obtained by drilling through the thin brass plate with a number nine sewing needle so that the point projected about one-sixteenth of an inch through the plate. The





middle of the box at B is cut out so that the lens to be measured can be inserted in the double spring C, which holds the lens at right angles to the axis of the box. At D is a plano-convex lens of three and a half inches focus, and at E is a smaller box which slides into the larger one and carries on its outer end a ground-glass screen F, on which the rays of light from the hole in the diaphragm are focussed in a point. If a cylindrical lens, either convex or concave, is placed in the path of the rays at C the image on the ground-glass screen, instead of being a fine dot, will be drawn out into a line, and the direction of this line will be at right angles to the axis of the cylindrical lens. A circular rotating frame G is placed outside the ground-glass, and across the diameter of this frame is stretched a fine wire, which, by moving the frame, can be set to correspond with the direction of the line of light focussed below it on the glass. A pointer attached to the frame will then show on a scale S, Fig. 2, the angle at which the axis of the cylindrical lens is placed as compared with the horizontal line of the in-

strument, the scale being graduated through 180 degrees from left to right on the upper half of the circle, the zero being on the horizontal line to the left. The horizontal line of the instrument is shown by a fine wire at H passed from side to side through the center of the box. To use the instrument the patient is requested to put on his glasses, and while they are on his face, in the usual position, a ruler, or any straight edge, is held against his nose in front of the glasses, so that its upper edge stands horizontal and about in front of the center of the glasses. This edge marks the horizontal line of the glasses as worn, and is indicated on each glass by touching them with a fine-pointed toothpick moistened with ink, making two dots on each glass about three-quarters of an inch apart, all the dots being on the horizontal line. The glass so marked is now placed in the spring C, the sliding box at E is removed and a white card or paper is placed behind the glass so that on looking into the box at E the glass can be shifted, so as to bring the dots to coincide with the wire H which marks the horizontal line of the instrument. Replacing the sliding box at E, removing the card, and holding the end of the box A near a gas flame, a line of light will be seen focussed on the ground glass F, provided we are testing a simple cylindrical lens, and by moving the wire in the frame G to coincide with the line of light the angle at which the lens is worn can at once be read off on the scale of the instrument. If the prescription calls for a glass at 90°, and this test shows the angle to be 93°, or some slight variation from 90°, it will probably not make an appreciable difference to the patient, for in putting the glasses on from time to time, especially with eye-glasses, he will probably make as much or more variation than this ; but if the amount is considerable, often reaching 5° to 10°, or more, and if there is discomfort on using the glasses, the error of position will need correcting. The glasses must be placed in the spring so that the observer looks through them in the same direction as the patient does when he is using them.

If we wish to measure the axis of the cylinder in a compound lens, it will be necessary to place in the box at K a spherical lens from the trial case that will neutralize the spher-

ical component of the compound lens, otherwise the line of light will not be focussed on the screen. When measuring a concave cylinder it is easy not only to get the direction of its axis but also its power, when less than one and a half dioptrics, for if we withdraw slowly the sliding box at E we find a point where the rays of light will be brought to a focus in a line at right angles to the first line, and a scale on the side of the sliding box will then show the power of the concave portion of this glass, it being necessary to draw the sliding box further out the higher the power. Such an instrument can be obtained from Messrs. Millar & Weltch, 38 West St., Boston, Mass., and is now made with a longer tube. The sliding end can be pushed in and drawn out from the zero point so that the power of both convex and concave cylinders up to one dioptric, as well as the direction of their axis can be measured by the instrument, and with the increased length of the tube the axis of a cylinder of only one-eighth of a dioptric can be easily determined.

DISCUSSION.

DR. C. F. CLARK of Columbus. — For the last year or two I have noticed that my optician has been much more accurate in his work than formerly, and I recently saw in his shop an apparatus for this same purpose. It was of a simple form and very accurate. He wished me to bring it on with me and I did so; but as I had not used it I did not think proper to present it. The instrument may be seen in the adjoining room.

READING WITH DEFECTIVE VISION.

BY CARL KOLLER, M.D.,

NEW YORK CITY.

A few cases of defective vision from various causes, but of stationary character, in persons who greatly deplored their inability to read, have caused me to examine the relations of acuteness of vision and ability of reading. As a result of this examination I constructed a little contrivance in the way of a reading-glass, which proved successful in these cases. Although no new optic principle is involved, I thought it worth while to bring the matter before you, as it may be the means of benefiting some more of these patients.

The ability to read depends, apart from a satisfactory function of the cortical centers, on a sufficient degree of acuteness of vision. Although for the easy performance of the act of reading a good field of vision is an important condition, experience shows that reading is possible with a defective field, and that even an extremely limited field, as we find it, for instance, in retinitis pigmentosa, allows reading under some difficulty.

For the purpose in question it will not be necessary to analyze the idea "acuteness of vision" and go back to its last meaning, but it will be sufficient to take the term as it is used in ordinary ophthalmological parlance, meaning the power of distinguishing letters of definite shape and size at a definite distance. This ability of distinguishing letters depends on the size of their retinal images.

For reading the print of most of our books and newspapers at the usual distance the possession of the normal or average vision is by no means necessary. The size of book and newspaper type is by far too large to demand this vision as necessary for making reading easy. If we had always to read at the limit of our acuteness of vision, we would not be able to keep it up for a long time. For the sake of ascertaining the size, the type of a number of the principal newspapers was measured by microscope. I found most of the samples very near the size of Jæger No. 4 (edition revised by Fuchs) or Snellen's fourth number (D = 1). Smaller type is rather uncommon in books and newspapers. The distance at which the samples taken could actually be distinguished agreed very well with the distance calculated, — that is, the distance at which the type would appear under an angle of 5 minutes. Of the two types named, Jæger No. 4 ought to be read by a person with vision 6/6 at a distance of 90 centimeters (36 inches), and is actually read by most persons with good vision at a distance of something over 100 centimeters (40 inches). Snellen No. 4 appears under an angle of 5 minutes at the distance of 100 centimeters (40 inches), and is actually read at a distance of about 110 centimeters (44 inches).

The customary reading distance is about 12 inches (30 centimeters), or to take the limits, from 10 to 14 inches (25–35

centimeters). This is between one-third and one-fourth of the distance at which the types named can be distinguished, and consequently the retinal images of this type held in ordinary reading distance will be three or four times as large as would be necessary for just distinguishing them. Consequently a person with vision 6/18, and even 6/24, will be able to read this medium-sized print at the ordinary reading distance. This agrees very well with the observation which all of us make in our practice, that patients with failing vision do not become aware of their trouble by experiencing difficulty in reading, but by their inability to distinguish distant objects. Their acuteness of vision must have gone below 1/2, down to 1/3 or 1/4 before they experience any great difficulty in ordinary reading at the usual distance.

Persons with an acuteness of vision below 6/36 are unable to read medium-sized print, provided they are not myopic in a high degree. Myopes with defective vision have a large advantage over amblyopes of emmetropic or hypermetropic refraction. By bringing the reading matter near to their naked eye they enhance the size of their retinal images to such a degree — and the more the stronger the myopia is — that persons with a very defective vision surprise us by the smallness of the print which they are able to read with ease. It may be remarked in parenthesis that the retinal images in axial myopia are anyhow larger than those of emmetropic and hypermetropic eyes, but this does not play a great part compared with the enlargement resulting from proximity. This relative superiority in regard to reading of myopic eyes with defective vision shows us the way to help amblyopic patients of emmetropic and hypermetropic refraction. We have to enlarge the retinal images to such a degree as to bring type of a certain size within their acuteness of vision.

Among the means for enlarging at our disposal are the ordinary magnifying glass with a handle, *Bruecke-Chevaliers Loupe and Steinhohls Conus*. Of these the magnifying glass with handle as sold by the opticians is not of much use in the higher degrees of amblyopia. If it is of any larger size its strength is limited by considerations of weight, so that the glasses are hardly stronger than 4–6 D. The enlargement attainable with

such a glass as compared with the naked eye is very small, and amounts only to a fraction of 1. Besides it is rather uncomfortable to hold the paper in one hand, the heavy glass in the other, to maintain the relative distances, and at the same time move the head with the glass. For these reasons the magnifying glass as a reading glass is but little in use. Bruecke-Chevaliers Loupe makes a very much better showing. It is a *Galilean Telescope* arranged for short range. The enlargement grows with its length. The instrument which I hand around for your inspection has a length of 10 centimeters (4 inches); its focal length is 26 centimeters taken from the ocular, and the enlargement of an object compared with its size when looked at with the naked eye at this distance is something over fourfold. The field of vision is small, as in every telescope; in this particular instrument it is 2° 20′. This narrowness of the field and the large lateral displacement of the images with the slightest movement detracts seriously from the practical usefulness of the instrument. As far as I know Bruecke-Chevalier Loupe is not commonly used as a reading glass.

Steinhohls Conus is a small Galilean telescope made of one piece, as it were, the space between objective and ocular being filled in with glass. It shares with Bruecke Loupe the drawbacks of a small field and large lateral displacement.

If we consider the means or principles by which an enlargement of retinal images can be accomplished, we find they are chiefly two:

1. Eye and object remain in their relative positions. By interposition of an optical instrument we cause the posterior nodal point to advance, from which advancing the enlargement results. The telescopes are representatives of this kind of enlarging the retinal images.

2. We approach the object and take care that in spite of changed distance clear retinal images are engendered.* The apparatus of accommodation in the human eye is the foremost example of this principle of enlargement by approaching the object.

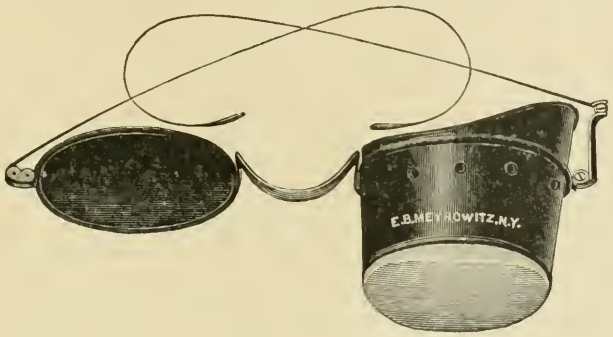
* The enlargement is in inverse ratio to the distance.

Both kinds play a part in many of our devices for magnifying, although one of them is predominant.

In the second way considerable enlargement can be attained with very simple means. This was the reason why in a number of cases with very defective vision, taking the excessively myopic eye as a pattern, I have resorted to strong convex glasses from 15 to 30 D. for constructing a reading glass. I will illustrate this by a case.

In May, 1890, Mrs. S. presented herself, a lady of 59 years of age, who for a number of years had been suffering from diabetes, but nevertheless was active in body and mind. For three years she had not been able to read on account of insufficient vision. The ophthalmoscope showed an old lesion, at the site, of the yellow spot, of typical appearance. Her vision was 3/60 in either eye, that is 1/5 of the acuteness of vision necessary to read Jæger No. 4 in ordinary distance. To enable her to read this print, the retinal images would have to be enlarged five times the size they have when the paper is held at 30 centimeters distance. This would be accomplished by holding the paper at 6 centimeters from the eye, to which end an addition of 16 D. to the refraction of the eye is necessary. The holding of a paper at such a short distance is very inconvenient, and carries with it considerable difficulties in the matter of illumination. To overcome these difficulties, I placed the lens 5 centimeters (two inches) before the eye at the end of a short aluminium tube, blackened inside and outside, which was fastened in a spectacle frame. The distance at which the lens is placed before the eye does not change anything in the matter of enlargement as long as the condition is fulfilled that the object remains in the focus of the lens. Now the type can be held at a distance of ten centimeters (4 inches) from the eye, but the enlargement is proportionate to the shortening of the distance at which the paper is held from the lens. The other eye is excluded by a hard rubber plate fitted into the spectacle frame to prevent double images at this short distance. The field of vision of such an arrangement is considerable, and sufficient to cover several words at a time. As the glass is held in an immovable position, the paper only has to be moved past the eye, or

rather the head along the lines, which latter is more convenient. In a short time the patient had learned to use this arrangement and read with comparative ease her daily paper for five years.



She died last year, and always felt grateful for the service rendered to her.

In the space of six years I had such reading glasses made* for several more patients, altogether five. The class of patients who can be benefitted by it is naturally very limited. Stationary defects of vision arising from incurable opacities of the cornea, or vitreous body, or lesions resulting from affections of the retina, choroid, and the optic nerve may furnish suitable cases. Congenital defects of vision or such acquired in early youth may also be benefitted, although as a general rule such patients have already accommodated themselves to their conditions and are frequently able to read without the help of glasses. They avail themselves of the very same principle of enlargement by approach, entirely renouncing distinctness of the retinal images in favor of their size — a proceeding which is well known to all ophthalmologists, and which goes by the name of "seeing in circles of diffusion."

*I am indebted to Mr. Meyrowitz for his help in constructing the little contrivance.

A NOTE ON KERATITIS PUNCTATA SUPERFICIALIS.

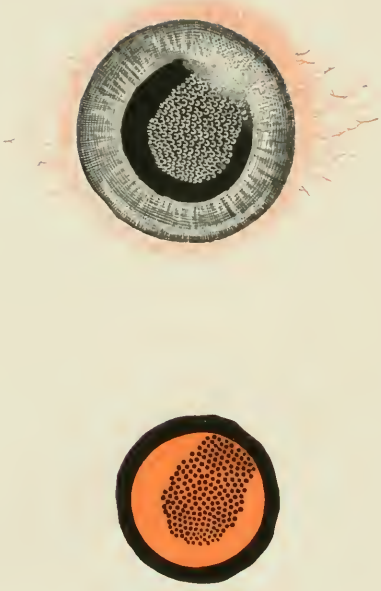
BY B. ALEX. RANDALL, M.D.,

PHILADELPHIA, PENN.

Minute differentiation of corneal diseases may easily be carried further than is practical; yet it seems well that some of the recent refinements of our diagnosis and nomenclature should be clearly recognized because of the pathologic and therapeutic peculiarities One of these, to which my attention has only just been practically called, is the superficial form of punctate keratitis; and having once clearly recognized it, I cannot but question if some of us have not been confounding it with Descemetis, so similar is the picture by transmitted light. The case which I have to report differs from those described by Fuchs and others, and threatens to prove anything but the rather fleeting and controlable affection he portrays: so I hope that others have had experience of it which may be helpful to me in my need.

Mrs. ——, aged 57, was sent to me with her right eye injected, dim, watering and painful since a slight blow near the outer canthus, apparently not touching the eye itself, three weeks before. Atropia had been instilled daily for a week or ten days, hot fomentations for short periods carefully used and her impaired general health, dating from a recent influenza attack, treated by hygiene, diet, and tonics. The local condition was growing worse and the sight more impaired, while the pain, usually nocturnal, was yielding less decidedly to heat. Inspection showed the trouble to be unilateral — the left eye normal except in sympathizing with the weakness of its fellow. The right eye showed distinct conjunctival and circum-corneal injection, with nearly normal palpebral conditions; the iris was well dilated (7 mm.) and of normal aspect; while the deeper media and the eyeground revealed no abnormality. There was low H. and the tension was slightly subnormal.

The cornea showed superficial infiltration near the lower-



outer margin, corresponding with the maximum ciliary injection and extending in lessening degree over the polar portion. The surface was nowhere abraded, but showed nearly uniform pin point elevations over the whole affected area. Transmitted light gave the appearance of the dark points characteristic of Descemetis, but with none of their usual arrangement in a triangle with base down and apex at the pole: the opacities corresponded exactly in distribution with the superficial elevations and careful illumination succeeded in proving their identity. This point, essential to the diagnosis, presented considerable difficulty, as I think will be noted by others who wish to prove beyond peradventure that no Descemetis coexists. No slightest break could be detected in the epithelium at this time nor ten days later when fluorescin was employed as an aid. The dots were discrete unless down and out, where the greater opacity seemed due to coalescence; and at the second visit there was no notable staining of the affected tissue. A week later the points were more commonly confluent, making rather radiating lines of faint opacity in which the punctate character was still discernible; and the tissue now stained faintly with flurescin, although the surface seemed entirely intact. Still later, when last seen, there was some increase of the opacity down and out, suggestive of coming ulceration, while the corneal pole was abraded, the sharp-cut oval of mere loss of epithelium measuring 1.5 mm. horizontally by 1 vertically. The iris seemed still uninvolved, as it was dilated evenly to 7 mm. under atropine; in the interval, when the mydriatic had been replaced with weak eserine, the pupil was small but very prompt. The hemicranial pain had again been severe, especially at night, and sight was worse.

As to the therapeusis, atropine (1%) and hot fomentations were in use when she came to me and have been continued, except for the substitution of eserine for three or four weeks. This not only reduced the vision by contracting the pupil under the opacity but failed to retard the advance of the process: so we returned to the atropine. Fuchs and others depend largely on mydriatics, I note, and I should incline to do so in

FOOT NOTE. The opposite plate illustrates the appearances by incident light below and by transmitted light above, of the earlier stage.

future. Ointment of iodol has apparently soothed and helped: yet I can but admit that the case is rather worse than better and offers no early prospect of cure. All study of the etiology has been fruitless as yet. There is no known malarial, syphilitic or other taint and the general health is not very noticeably depressed, although not yet returned to a robust state. The deeper structures seem still unaffected and the case remains a puzzle and mortification to me, and unique in my experience.

A CASE OF EXTRACTION OF A BIT OF COPPER FROM THE VITREOUS WHERE X-RAYS HELPED TO LOCATE THE METAL.

BY CHARLES H. WILLIAMS, M.D.,

BOSTON, MASS.

Mr. J. M., seventeen years old, was brought to me June 5, 1896, by Dr. Shurtliff, of Somerset, with this history: yesterday he had placed a Flobert rifle cartridge in a vise and hammered it; the cartridge exploded and a piece struck his left eye. Examination showed no injury to the eyelids, but a vertical cut extended two-thirds across the cornea, the anterior chamber was empty, and the pupil was filled with a mass of opaque lens substance. Under atropine there was some adhesion between the iris and lens capsule, and no view could be had of the interior of the eye on account of the opacity of the lens. There was very little redness of the sclera and no complaint of pain. Light projection was fairly good upward, inward, and outward, but uncertain downward; fingers could not be counted.

It was hard to decide whether this injury was caused by a piece of cartridge which had struck the eye and then rebounded, or whether the metal had lodged within the eye. No use could be made of the electro-magnet for diagnosis or removal, as the metal was probably copper, and in order to throw some light on the question of its being still in the eye two radiographs were made by means of x-rays, through the kindness of my brother,

Dr. Francis H. Williams, and Professor Norton, at the Massachusetts Institute of Technology. The apparatus used was a Wimshurst machine, which had twelve plates, each twenty-six inches in diameter, and gave an almost continuous series of sparks. The principal advantages of this apparatus were that it did not break the Crookes tubes, and that the rays were constantly given off from one electrode so that a better defined picture could be made than with the usual form of alternating current and induction coils where first one electrode and then the other becomes the source of rays.

A preliminary experiment was made by having Professor Norton lie on the table with his left cheek resting on the plate-holder and a bent piece of copper wire one-sixteenth of an inch thick on his right eyelid, the Crookes tube being placed about eight inches from his head so as to throw a shadow of the wire through his eye upon the distant plate. After ten minutes exposure the plate showed, on being developed, a well-defined picture of the bent copper wire. The patient was then laid on the table with his left or injured eye close to the plate-holder, resting on it as on a pillow, while the Crookes tube was placed so that the rays passed partly across the bridge of the nose and partly through the thin nasal and orbital bones to the injured eye and so on to the plate. After ten minutes exposure the developed plate showed what appeared to be a foreign body a little back of the center of the eyeball. A second radiograph with the tube in a different position showed no foreign body, but this was accounted for by the fact that the metal when found was a thin strip, therefore the rays in the first case may have struck it on the flat and given a picture, and in the second case have struck it edgewise with no effect.

It is much more difficult to get a satisfactory x-ray picture of a foreign body in the eye, than in other parts of the body where there is no surrounding bony wall, as in the orbit, to make a poor conductor of the rays; but, as this case shows, a picture of such a body can be taken by using a powerful apparatus even under these unfavorable conditions, and such a picture can be of use in determining the presence of the foreign body if it is of sufficient size to give a radiograph impression.

In this case the history, the condition of the eye and the assurance given by the radiograph led me to operate, hoping to find and remove the metal.

Under ether, a conjunctival flap was made between the external and inferior rectus muscles, a cataract knife was then passed through the sclera into the vitreous, making a cut about three-eighths of an inch long parallel to the edge of the cornea and about three-sixteenths of an inch from it. Through this cut a curved iridectomy forceps was introduced, and a hard substance was finally grasped in the posterior portion of the vitreous and extracted. This proved to be a thin, nearly straight strip of copper, one-fourth of an inch long by one-eighth of an inch wide and of the thickness of the cartridge shell. There was considerable hemorrhage from the wound during the operation, and this extended into the shallow anterior chamber, but when the protruding vitreous was excised and the wound closed by bringing the conjunctival flap together with three fine sutures, the bleeding nearly ceased and gave no further trouble. The eye was irrigated with a 1-to-6000 solution of corrosive sublimate before and during the operation, and dressed with an absorbent cotton pad and flannel roller bandage. No anodyne was required during the whole course of the healing, and there was never any complaint of severe pain in the eye. On the eighth day the conjunctival sutures were removed and the scleral wound was healed. There was some injection of the ocular conjunctiva, but no swelling of the eyelids or pain.

The patient was sent home on the eighth day, and at the end of a week, and again in two weeks, reported in person. There had been no bad symptoms, the corneal wound had closed, there was a development of fine vessels from the edge of the cornea toward the corneal wound, and the ocular conjunctiva showed less congestion. At the date of the last visit the eyeball had begun to shrink in size, and at the site of the scleral wound there was a slight depression. There was no perception of light in the injured eye at this time, and the cornea was not clear enough to allow an inspection of the interior of the eye. The other eye was normal in sight and condition.

July 11th, or about five weeks after the original injury, the

patient reported to me, saying that the day previous he had hit the injured eye with a bit of wire, most of the blow falling on the outer edge of the orbit. The eye was red and tender, and he complained of occasional flashes of light before the sound eye during the last few hours. Up to this time both eyes had been quiet, and it seemed as if at least a good-looking eyeball could be preserved on the injured side; but this second accident made it necessary to advise enucleation of the injured eye on account of danger of sympathetic inflammation, and this was done the next day. Vision remains normal in the sound eye.

This case is interesting as being the first, so far as I am aware, in which a piece of metal has been located by the x-rays in the vitreous and successfully extracted from a living eye.

A QUESTION AS TO THE PRESENCE AND LOCATION OF A MINUTE FRAGMENT OF STEEL IN THE EYE DETERMINED BY THE ROENTGEN RAYS—SUCCESSFUL REMOVAL BY THE ELECTRO MAGNET.

BY DR. C. F. CLARK, M.D.,

COLUMBUS, OHIO.

That the general surgeon has found a new and most valuable aid to diagnosis in the application of radiography or skiagraphy is apparent to all, but I had until recently found myself somewhat in doubt as to the possibility of the ophthalmic surgeon availing himself of its wonderful advantages. The inaccessibility of the eye, the minuteness of foreign bodies which may be removed and still allow us the hope of saving the eye, and the other means at our command would appear to leave little field for the practical application of this newly discovered method.

A case which recently came to my attention has, however, led me to take quite a different view of the subject and to believe that in a limited number of cases and under favorable circumstances Roentgen's discovery may be of great advantage

to us as well as to the surgeon in general practice, especially in dealing with small foreign bodies in the region of the ciliary body — just the portion of the eye which cannot be explored by the ophthalmoscope.

On June 30, 1896, a laborer from the oil regions of Northwestern Ohio was sent to me by Dr. Bowman of Upper Sandusky.

Seven days before coming to me, while driving the key out of a pair of pipe tongs by striking it with a hammer, he shattered the hardened steel and a small piece struck him in the left eye, producing sharp pain, and, as his companions said, cutting the eyeball, though there was no hemorrhage.

He continued his work, but the pain becoming severe he consulted a physician near his home, and a few days later saw Dr. Bowman, who referred him to me.

I found the bulbar conjunctiva deeply injected, but no swelling, the cornea clear, pupil well dilated with atropine which he had used for some days, pupillary space clear. The ophthalmoscope revealed clear media and a normal fundus excepting slight enlargement of the veins. Tension normal.

He has always been myopic but the left was his better eye.

Vision. R. E. 2/60 — 4. sph. = 6/9.

L. E. 6/30″ — 4. sph. ◯ — 1. cyl. ax. 90 = 6/9.

Though he had not worn glasses he did not think his vision was worse than usual.

A minute examination revealed, at a point on the nasal limbus, about 3 mm. below the horizontal meridian, a slight thickening of the conjunctiva which projected ½ mm. on the cornea but was not markedly vascular. At this point and at a distance of one to two mm. from the corneal margin was a vague, indefinite appearance suggesting a cicatrix. From the surface of the conjunctiva at this point I removed a minute black particle resembling oxide of iron.

Oblique illumination revealed beneath this small conjunctival projection an unusual appearance in the extreme angle of the anterior chamber. To my eye it suggested a foreign body partly encysted while to another oculist in whose observation I would place as much reliance as in my own it appeared after a

minute examination more like a depression or pigment spot in the iris. It occupied, as I have said, the extreme angle and was so indefinite that neither of us felt justified without further evidence in attempting an operation, as nothing short of a quite thorough-going procedure would have been warranted, and, if what we saw proved to be only the cicatricial path of a foreign body which had penetrated the deeper structures it would be necessary to follow that path and thus inflict a considerable amount of damage on an eye which was functionally quite perfect.

An attempt to locate the metal was made by using a somewhat primitive astatic needle which on several previous occasions had served an excellent purpose, but, while the needle exhibited a slight tendency to linger longer in the suspected region than in the other parts of the eye, the results for practical purposes were negative.

The patient was referred to St. Francis Hospital, put to bed, atropia instilled every four hours and ice cloths changed every few minutes day and night.

By this means, the pain was controlled to some extent, but the injection continued and even increased.

On July 3d, as Benjamin F. Thomas, Professor of Physics in the Ohio State University, kindly consented to undertake to make a radiograph of the eye, I took the patient to his laboratory, and after one unsuccessful effort he succeeded, after an exposure lasting eight minutes, in obtaining an excellent picture showing a dark shadow at the exact point occupied by the body supposed to be seen in the eye.

With this additional evidence as a warrant, directions were given to prepare the patient for operation.

July 4, 1896, between 11 and 12 A. M. I operated with the assistance of Dr. W. K. Rogers and Dr. Black, the resident physician. Ether was given and an incision made extending from a point 5 mm. above to the border of the supposed foreign body. This was found too small and it was enlarged downward with scissors to a length of 7 mm.

On inserting the point of the electro-magnet repeatedly I was greatly disappointed to find nothing, but after passing in a

small bulb-pointed silver probe and stroking the iris repeatedly from the periphery toward the pupil, I again inserted the pole of the magnet and at once drew out a small, thin, irregular, sharp-angled fragment of steel, approximately 1 mm. square.

The iris was not apparently wounded and the pupil remained round, and only one or two drops of blood appeared in the anterior chamber.

A gauze patch on the left, and a pad of cotton on the right eye secured by a four-tailed bandage of one thickness constituted the dressing, and over this on the operated eye ice cloths were laid at intervals of one or two minutes day and night.

The patient suffered no pain after the first night, the cornea remained clear, the pupil round, the iris apparently normal, and at the end of six days a test of his vision revealed the following:

R. E.— 4. sph. = 6/9.

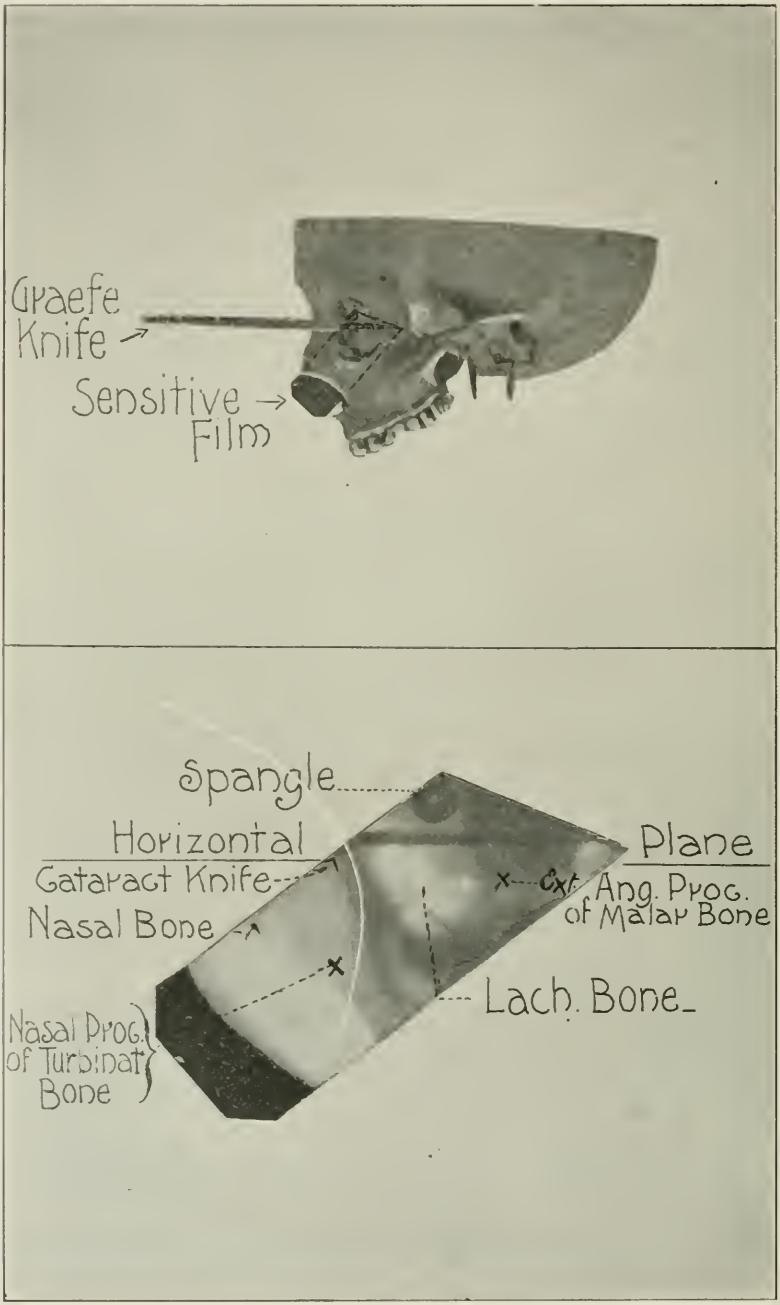
L. E.— 1.5 sph. = ○— 1. cyl. ax. 60° = 6/12.

There remained only such injection of bulbar conjunctiva as one would expect after such prolonged irritation by a foreign body, and I felt justified in allowing him to return to his home in Upper Sandusky.

After obtaining the above result, Professor Thomas agreed with me in the belief that it would be entirely practicable by means of the Roentgen rays to locate a foreign body of sufficient density in any part of the human eye, and we have undertaken a series of experiments by which we hope to establish this proposition; but as we have not yet been able to obtain a cadaver with the eyes in proper condition we to-day used a skull into the left orbit of which I inserted an eye which I had enucleated four months ago on account of absolute glaucoma.

It had been hardened in formol and preserved its form perfectly and was held as nearly as possible in the normal position in the orbit by means of absorbent cotton saturated with the preserving solution. The skull cap was removed and the lower portion lay in an inverted position upon a stand with the eye fifteen inches from and a little above the center of a Crooks tube of the type known as the "focus tube."* The coil used

* Made by the New York and Ohio Co. at Warren, Ohio.


Graefe Knife
Sensitive Film
Spangle
Horizontal
Cataract Knife
Nasal Bone
Nasal Proc. of Turbinat Bone
Plane
Ext. Ang. Proc. of Malar Bone
Lach. Bone

was one which produced a spark 6 inches long with twenty breaks in a second.

In the nasal quadrant of the ciliary region at a point about 3 mm. from the corneal margin I made a vertical incision and thrust into the eye a small brass wafer-like spangle 7 mm. in diameter. A Graefe cataract knife was then thrust from before backward through the eyeball, entering the cornea near the inferior margin and passing in until its point touched the bony wall of the orbit near the upper margin of the superior maxillary fissure.

A narrow strip of sensitized film wrapped in black paper was next passed well up into the left nostril against the septum until its point touched the lower surface of the cribiform plate of the ethnoid bone after which the current was turned on and continued for eleven minutes.

The negative and photographs of the contents of the orbit will be best understood when studied in connection with that of the skull with a piece of cardboard shaped like the sensitive plate in the nose and the cataract knife occupying the same position as seen in the radiograph. These, with the prints of the radiograph negative were kindly made for me by Dr. W. K. Rogers.

The knife penetrated the eye to a distance of one inch and was in a plane parallel with and one inch distant from the sensitive film. The spangle was in a plane $\frac{1}{4}''$ inch nearer the sensitive film, and it will be seen that sharp definition was obtained notwithstanding the distance from the film and the fact that the point of the knife, which lay behind the thick external angular process of the malar bone, is easily made out is the best evidence that by this method a foreign body in the vitreous may be shown.

Some may be inclined to doubt the practicability of passing so large an object as a strip of film up into the nasal cavity to a distance sufficient for this purpose, but the writer has established this point by having a loop of 3 mm. wire $\frac{1}{2}$ inch wide passed upward and backward in his own nose a distance of $2\frac{7}{8}''$ inches to a point corresponding to that used in obtaining the accompanying radiograph.

HYPOPYON-KERATITIS — BREAK IN DESCEMET'S MEMBRANE PRECEDING CORNEAL PERFORATION.

BY JOHN GREEN, M.D., AND ARTHUR E. EWING, M.D.,*

ST. LOUIS, MO.

The specimens shown are from a case of ulcer of the cornea from exposure, occurring in a case of exophthalmos due to an orbital tumor. Vertical sections show that hypopyon originates from two sources, and possibly from a third.

A — The first source is by a direct break in Descemet's membrane, either by necrosis, or by direct pressure, or both.

B — The second source is from an exudate from the iris.

C — A third possible origin is from the endothelium of Descemet's membrane.

A recent volume of the "Archiv für Ophthalmologie (Vol. XLII, Abtheil. I, page 42) contains an article by Professor Uhthoff and Dr. Th. Axenfeld, in which doubt is implied regarding the origin of hypopyon from the cornea, for the reason that definite proof of such origin was not established in a series of investigations cited by them. The case now reported is of interest as bearing directly upon this point.

The patient, a male infant fifteen months old, was first seen May 10, 1895. A small red spot had been noticed upon the right lower eyelid a few weeks before. The child had been taken to a hospital, where an operation had been performed, apparently for supposed dacryocystitis. From about this time the eye began to protrude, and the protrusion rapidly increased. The child appeared to be in excellent health, with the exception of an eczema of the head and face. The right eye diverged, and protruded strongly, the lids barely closing over the cornea. In the upper-inner region of the orbit there was a firm, solid

* The case which furnished the specimens described in this communication occurred in the practice of the undersigned; the histological investigation was made by Dr. Ewing.— JOHN GREEN.

tumor about half an inch in diameter. To all appearance the globe itself was normal, except that there was a slight irregularity of the epithelium in the lower segment of the cornea. From all portions of the fundus the ophthalmoscope gave a normal reflex. The child was very refractory, so that no well-defined view of the disk and retinal vessels could be obtained.

On May 13th the child was admitted to the hospital, and the eye was again carefully examined the same evening. In the lower portion of the cornea there was now a well-defined ulcer, with beginning hypopyon. The globe was a little red about the lower corneal margin, and there was a moderate mucous discharge from the conjunctival sack. The upper portion of the cornea was clear, the pupil and iris normal in appearance, and the anterior chamber of normal depth.

Early the next morning, May 14th, enucleation was performed, with removal of the tarsal cartilages and tissues of the orbit. The tumor proved to be a sarcoma, extending from above and behind the inner canthus into the spheno-maxillary fissure. The child was seen again in December, 1895; the tumor, which had reappeared in August, then filled the orbit and involved the entire right superior maxilla.

The condition of the globe at the time of the enucleation was as previously noted, except that the hypopyon had increased a little, with some increase in the vascular congestion of the lower portion of the globe, and with the appearance of a barely noticeable pink ring around the upper corneal margin.

The enucleated globe was placed immediately in a 5 % formol solution, in which it was preserved for further examination, the solution being renewed about once in two months. About the middle of December it was frozen, and bisected vertically, as nearly as possible through the centre of the ulcer. Unfortunately it was not thoroughly frozen, and the lens was dislocated in making the section. One of the halves was then placed in a 20 % glycerine solution, with the intention of making a gelatine preparation; the other half was returned to the 5 % formol solution. Two weeks later, after washing for an hour in freshly sterilized distilled water, it was placed for three hours in a 1 % osmic acid solution, again washed for an hour,

and carried into 10 % dilute alcohol, the strength of which was gradually increased during the next two days to 95 %. A few days later it was embedded in celloidin and cut. The sections were stained with hematoxylin, with fuchsin, and with methyline blue.

In general, the sections show an ulcer involving the lower third of the cornea (Fig. I, *U*). At the upper border of the ulcer the cornea is apparently a third thicker than the normal cornea above. In the ulcer itself the corneal tissue is reduced to about two-thirds the normal thickness, except at the extreme lower part, where it is but little more than half the normal thickness. The excavation above is gradual; below it is sharp and deep, and filled with a fibrinous exudation. The anterior chamber is of normal depth, but is encroached upon behind the upper border of the ulcer by the apparently swollen cornea. Throughout the lower half of the anterior chamber there are numerous fibrinous shreds (Fig. I, F_3), and in its lower portion it is filled to a height of 1.5 mm. by a solid mass (Fig. I, *H*). The pupil measures 3 mm. in diameter. The upper half of the iris is swung a little backwards; in its lower half the iris is held nearly in position by the shreds of exudation, but is pressed backwards by the hypopyon against the lens, and is partially moulded to its curvature.

In the upper portion of the cornea the epithelium is normal nearly to the border of the ulcer, where it appears a little thickened and ragged. At its lower border the ulcer extends beneath the thickened epithelium of the sclero-corneal junction.

Bowman's membrane ends abruptly at the borders of the ulcer, and shows only a narrow band of less than 0.5 mm. at the lower border. Above it is denuded of epithelium for about 0.33 mm.; at the upper margin of the ulcer it is a little thicker than normal.

As regards the corneal tissue proper, at the upper and lower margins of the ulcer, and in the ulcer itself to a depth corresponding to several of the anterior layers of the cornea, it is in a necrotic condition. A slight infiltration begins opposite the swollen epithelium. In the deeper layers this infiltration becomes more marked, pressing the corneal fibres

FIG. I.

A, Abscess; F, F1, F2, F3, fibrin; H, hypopyon; P, pus; Sc, Schlemm's canal; U, ulcer.

(The part of this plate showing the fibrous net work, F1 to F3, has been slightly retouched on the plate.)

FIG. II.

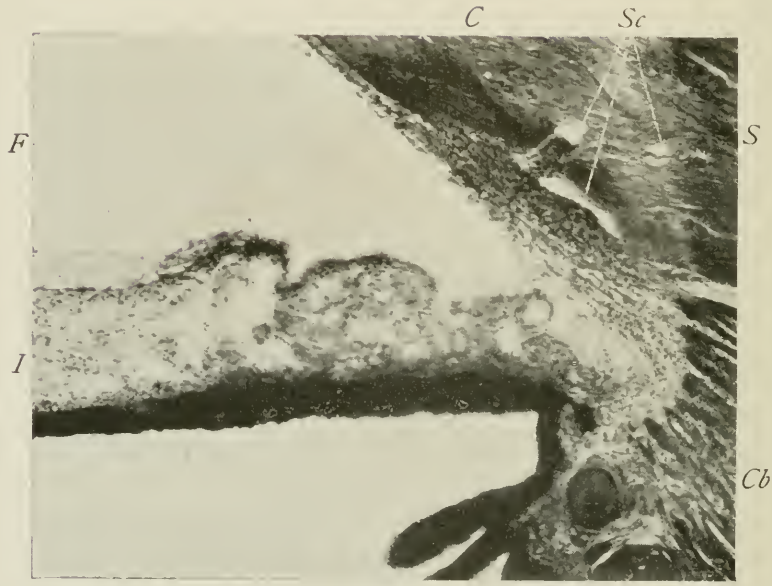


FIG. III.

A, abscess; B, break in Descemet's membrane; C, cornea; Cb, ciliary body; Dm, Descemet's membrane; F, F2, fibrin; I, iris; P, pus; S, sclera; Sc, Schlemm's canal; T, broken ends of Descemet's membrane; U, ulcer.

apart, and at Descemet's membrane it passes into a small abscess (Figs. I and II, *A*), measuring 1 mm. vertically, and 0.25 mm. from before backward. This abscess is directly opposite the denuded Bowman's membrane at the upper margin of the ulcer. From it a dense irregular stream of leucocytes and pus cells extends downwards and outwards towards the lower margin of the ulcer. Scattering cells also pass downward through the deeper layers of the cornea to Fontana's space, becoming less and less numerous as they approach the angle.

From the little abscess a much larger and denser stream presses backwards, breaking through Descemet's membrane (Fig. II, *B*), emptying into the anterior chamber, and banking itself against the break to twice the mass of the original abscess (Figs. I and II, *P*), being apparently held there by a dense wall of fibrin (Figs. I and II, F_2) which has come across from the iris. Between this fibrin and Descemet's membrane a smaller stream gravitates downward into the anterior chamber. The break in Descemet's membrane is triangular, and about 0.25 mm. in diameter (as shown by the number of the sections), and the broken ends of the membrane, as seen in the sections (Fig. II, *T*), are swung backwards into the anterior chamber. In the neighborhood of the break the membrane itself is normal, but there is great disturbance of its endothelium. In all the upper portion of the cornea the endothelium is intact, though quantities of leucocytes lie against it; and at a point 1.5 mm. above the break, they are seen to crowd between it and the basement membrane (Fig. 5, *L*), pushing the endothelium into the anterior chamber (Fig. 5, *E*, E_1), and denuding the membrane to the width of 0.75 mm. above the break. Below the break Descemet's membrane is entirely denuded of endothelium, except for a little distance above Fontana's space in some of the sections. Groups of endothelial cells may be seen, here and there, among the contents of the anterior chamber. There is nowhere any swelling or other change in Descemet's membrane proper, except that in some sections the extreme broken ends appear granular.

The upper portion of the anterior chamber is clear, with the exception of leucocytes clinging to Descemet's membrane, and

a thin layer of fibrinous exudation (Figs. I, III, and IV, *F*) which covers the anterior surface of the iris, and extends as a very delicate shred into Fontana's space. Just over the large circular vessels at the root of the iris the fibrin becomes denser, and its individual fibres large and well-defined. It clings to the anterior surface of the iris, and is apparently intimately connected with its endothelium (Fig. IV, *F*). At the margin of the pupil it divides into numerous shreds, some dropping into the hypopyon, but the main portion swinging across to the cornea (Fig. I, F_1, F_2), just above the break in Descemet's membrane. Here it forms a dense fibrinous wall (Figs. I and II, F_2), covering the intruding mass of pus, and extending 2 mm. below it. From where it begins to cross over to the cornea it spins a web through the whole lower portion of the anterior chamber (Fig. I, F_3).

The hypopyon (Figs. I and VI, *H*) consists of a dense mass of leucocytes, in all stages of degeneration, included in a web of fibrin, and crowding into the lower angle between the iris and the cornea, so as completely to fill Fontana's space, Schlemm's canal (Figs. I, III, and VI, *Sc*) is not involved, except as it appears to be a little flattened as a result of pressure.

The iris throughout is somewhat infiltrated, and notably so in the region of the hypopyon, where the leucocytes and fibrin crowd everywhere between the normal tissue elements (Fig. VI, *H*).

In the posterior chamber there is no evidence of any disturbance, except that in the extreme lower angle, just behind the root of the iris, and among the sulci of the ciliary processes, there are a few leucocytes, but no fibrin (Fig. VI, *L*). There is also a possible disturbance of the pigment layer, indicated by a shower of pigment granules along the posterior surface of the iris. The deeper portions of the globe are normal.

No cultures were taken from the ulcer, and none of the ordinary staining methods have given any satisfactory bacteriological results.

The prevailing older idea was that hypopyon is derived either directly from the cornea, because of the string of pus

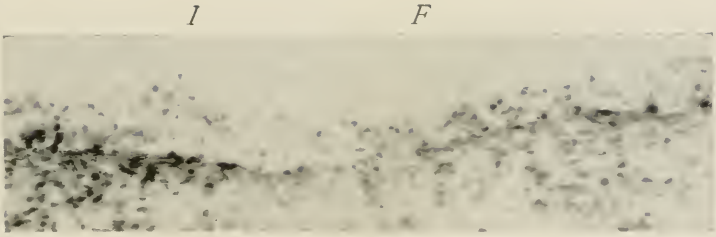


FIG. IV.

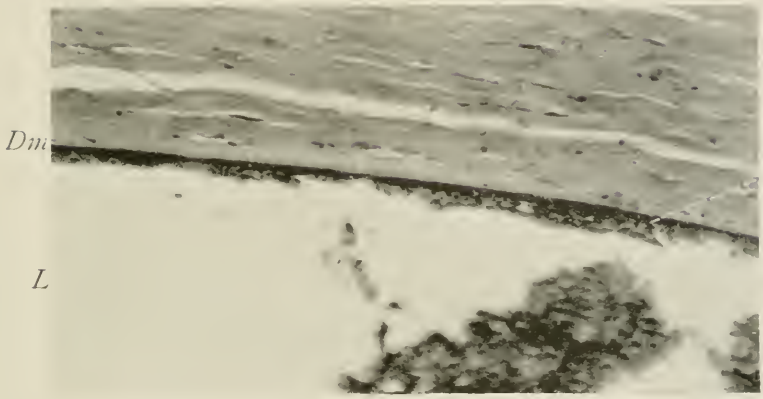


FIG. V.

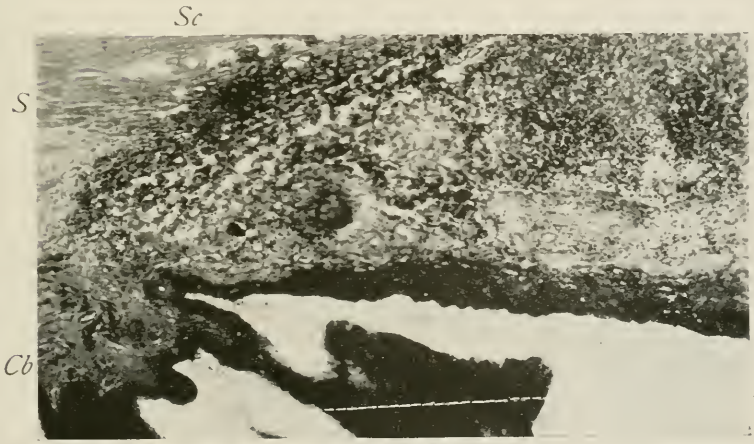


FIG. VI.

C, cornea; Cb, ciliary body: Dm, Descemet's membrane; E, E1, endothelium of Descemet's membrane; F, fibrin; H, hypopyon; I, iris; L, leucocytes; S, sclera; Sc, Schlemm's canal.

that is often seen in the anterior chamber descending from the purulent mass, or else from the iris, the anterior chamber being regarded as a serous cavity capable of furnishing an exudate as in the case of the pleura or the peritoneum (Wardrop, 1808). Later writers have explained the formation of hypopyon in different ways, namely:

(1) By the direct passage of leucocytes through Descemet's membrane. ("Zur Lehre von der Hypopyon-Keratitis," Marie Bokowa, Inaug.-Diss. Zurich, 1871.)

(2) By passing around Descemet's membrane, the leucocytes traveling downward through the corneal tissue and pressing into the anterior chamber through the openings in the ligamentum pectinatum. (Schweigger, "Handbuch der Augenheilkunde," II Aufl., 1873, page 307.)

(3) By leucocytes originating from the endothelium of Descemet's membrane. (Hoffmann, "Bericht über die siebenzehnte Versammlung der Ophthalmologischen Gesellschaft," Heidelberg, 1885.)

(4) By a direct rupture of Descemet's membrane. (Weber, "Archiv für Ophthalmologie," Vol. VIII, Abtheil. I, page 322; Verdese, "Archives d'Ophtalmologie," 1887, November and December, and 1889, March and April; Silvestri, "Archiv für Ophthalmologie," Vol. XXXVII, Abtheil. II, page 234.)

(5) By leucocytes proceeding from the canal of Schlemm and from the small deep circumcorneal vessels; in the same article the possibility of origin from the posterior chamber is mentioned. (Nuel, "Archives d'Ophtalmologie," June, 1895.)

(6) By leucocytes proceeding from the angle between the cornea and the iris, from the ciliary body, and from the circulus venosus. (Stromeyer, "Archiv für Ophthalmologie," Vol. XIX, Abtheil. II, page 37.)

(7) From an exudate thrown out by the iris. (Arlt, "Archiv für Ophthalmologie," Vol. XVI, Abtheil. I, pages 8, 9, and 10.)

The accompanying half-tone prints, made, without retouching, from photographs of our sections, show very clearly the

passage of the leucocytes through a rupture in Descemet's membrane, as stated by Weber, Verdese, and Silvestri (Fig. II, *B*). They also confirm Arlt's opinion (Figs. I, III, and IV, *F*), and very well support that of Hoffman (Fig. V, *L*).

Nuel remarks, in his paper, that the fibrin proceeds from the iris; Verdese's cuts show that the accumulation of fibrin is mainly in the anterior chamber.* In our sections there is no fibrin, either in the corneal abscess or in the pus from the abscess after passing through Descemet's membrane; but there is an abundant fibrinous exudation in the anterior chamber, covering and enclosing the mass of pus. On the iris the fibrin begins as a visible layer about 0.5 mm. from the ligamentum pectinatum, where it rapidly thickens to form a nearly uniform layer, about 0.1 mm. in thickness, covering the whole anterior surface of the iris above the pupil. Below the pupil it covers the whole anterior surface of the iris, and is connected with the general fibrinous web occupying the lower portion of the anterior chamber; but here also it is denser along the iris, or where it has been torn away from the iris by the hardening process. In the superior angle between the cornea and the iris it can scarcely be detected, and then only in the most minute quantity. If this exudate originated in the angle, from the fine corneal vessels in the region of Schlemm's canal, and were simply flowing over the iris, the ligamentum pectinatum and Schlemm's canal in the upper half ought to be packed with fibrin and leucocytes, and in the lower half there would be no fibrin attached to the iris above the hypopyon. More than this, the upper half of the anterior chamber would be filled with the fibrinous web and leucocytes in the same manner as the lower half. In our sections the canal of Schlemm, even below the hypopyon, is seen to be open and unobstructed.

A further suggestion offered by the sections is the part that the iris plays in assisting the cornea when the latter tissue is in distress. The passing of the fibrin from the iris across to the inflamed region of the cornea, as is here clearly shown, and the fact that fibrin has been found by other investigators

* Leber has called attention to the same fact.— Heidelburger Ophthalmolog. Gesellschaft, 1885, page 239.

to exist in the same way about the inflamed region, go far to prove that it does important service in the work of resistance and restoration.

THE MANAGEMENT OF GLAUCOMA, CHRONIC SIMPLE GLAUCOMA (CHRONIC INTERSTITIAL OPHTHALMITIS).

BY STEPHEN OLIN RICHEY, M.D.,

WASHINGTON, D. C.

After many decades of unsatisfactory surgical interference in this class of cases, the above title may excite little interest, as many clinicians of experience are skeptical of good results, a skepticism founded upon the probable results of surgery. And why should we expect to *cure* a local expression of a general dyscrasia by local operative interference, to which nothing is added because we have labored in the dark, ignorant of the cause and nature of a disease, whose local pathological changes are of low grade, slowly and insidiously progressive? Operation does not modify the cause: it serves only to gain time in some cases, until such modification of the cause can be secured; or to recover functional integrity, the cause being controlled.

From the date of Von Graefe's observation that loss of vision in acute glaucoma was often prevented by iridectomy, this operation has been empirically continued. A symptom, increased intraocular tension, has been accepted as the *corpus et spiritus morbi*, and all study and every remedial measure has been addressed to this feature; a mistake which has fostered the practice of iridectomy in simple glaucoma; has substituted for it anterior, or posterior sclerotomy, or stretching of the supra-orbital, or the external nasal nerve. The same untoward fate has attended all forms of operation in this malady. All local means having been tried, it has been the common practice, unpleasant to dwell upon, to desert the case without fur-

ther effort. Any one of the operations named may temporarily relieve high intraocular tension in one case, and the next case may be worse for it. High intraocular tension may be reduced without influence upon the visual power or the advance of the disease, for the affection progresses in some cases without demonstrable increase of tension.

The above considerations, and many others, but chiefly that in recommending to a glaucomatous person, an iridectomy, I could not assure him of a probable outcome, but had to say "the operation is classical, and is the best measure known to the science," induced me to enter upon a study* of the affection, laying aside my acquired views, as long ago as 1884. I may state that I have never seen a case of glaucoma, acute or chronic, that did not have a history of gout, inherited or acquired; or show sooner or later the ordinary symptoms or developments of gout, except a few cases caused by syphilis, the cause in such cases being clearly indicated by the history. Farther: in my experience, the eye affection may be more satisfactorily managed by the best measures employed in handling gout than in any other way; *provided*, *always*, that the acute form is seen before the loss of visual power is so imminent as to require immediate interference to relieve pressure symptoms. An acute attack of glaucoma may occur, and there may never be another, even if iridectomy be not done.

Whatever details of treatment are adopted, it is possible to lay down certain broad propositions by which, as a guide, the constitutional vice may be influenced. I have never seen an acute glaucoma from syphilis, and think it does not occur.

First. When syphilis is the agent of causation, the indications are clear; anti-syphilitic treatment.

Second. Acute or chronic glaucoma of other origin finds its initial cause and beginning in the digestive tract.

*To aid brevity in this communication reference is made to my papers on this subject that those interested may follow the argument showing that chronic simple glaucoma is a chronic interstitial ophthalmitis, generally of gouty origin. They are: "The Prime Etiological Factor of Glaucoma is Constitutional," (TRANS. AM. OPTHAL. SOC., Vol. vi, part 2d, p. 283, 1892); "The Disease-Process, Glaucoma," (Am. Journ. Med. Sci., June, 1893); "The Halo-Symptom in Glaucoma," (TRANS. AM. OPHTHAL. SOC., 1894, and Annals of Ophthalmology and Otology, July, 1894); "Chronic Interstitial Ophthalmitis," (Chr. Simple Glaucoma), (Annals of Ophthalmology and Otology, July, 1895).

Third. A departure from the normal physiological processes in the digestive tract intoxicates slowly, progressively, and accumulately, both the vascular* and the nervous systems, producing a degrading tissue change in various organs; an interstitial nephritis, an interstitial hepatitis, or an interstitial ophthalmitis: one, or all, of a chronic and progressive character, which may advance slowly or rapidly, or be precipitated into a violently active form by injury, exposure, a more than usually indiscreet meal, or by a severe emotional crisis.

Fourth. That chronic simple glaucoma consists in a hyperplasia of connective tissue involving ultimately the whole bulb, and cannot be *cured* by operation.

Fifth. That the acute form is *vascular* in character, and may be engrafted upon the chronic form, it being thus modified into what is called "irritable glaucoma."†

Sixth. That to meet the indications on this basis, we must begin with the beginning of the disease and correct individual habits, while obviating the danger arising within our special jurisdiction; not simply to operate and neglect further precautions. The application of such precautions require more than *special* knowledge, as we use the term.

In a paper read before this Society in 1892 claiming glaucoma to be gout of the eye, reference was made to the kind influence of clothing, exercise, regulated diet, galvanism, arsenic, lithium, and salicylic acid in the form of salol, as measures of constitutional importance. In an affection of so much complexity and difficulty, of such great chronicity, and such unreliability in responsiveness to measures wholly within the caprices of the patient, it was impossible to be sanguine, even if the results had been better than those usually secured by other means. The added experience and observation of four years have convinced me of the accuracy of the views then advanced, though the means have been somewhat modified and made more exact, as follows:

* By auto-intoxication, the nervous system through the blood-channels, with reaction upon the vascular system by means of the vaso-motor nerves.

† *Hæmorrhagic* glaucoma is differentiated by vessel-coats too rotten to sustain the increased arterial tension. In such cases death usually comes by intra-cranial hæmorrhagic effusion from the same cause.

As to the local treatment, it is based upon the hypothesis of intraocular venous stasis as the cause of increased intraocular tension, and consists in the use of a collyrium of eserine, varying in strength from 1–4000 to 1–1000, *in one-drop doses*, repeated as often as is necessary, at short intervals, to contract the pupil, if it is possible for it to do so. If eserine proves irritating, pilocarpine may be substituted. Advancement of the lens and iris, and dilatation of the pupil in glaucoma are caused by the great fullness of the intraocular venous system, and the miotic acts by its effort to empty the veins by pressure from in front. When this turgidness is not reduced the pupil fails to contract, and an increase in the strength of the collyrium causes violence and danger of iritis, without compensating efficiency. A drop every ten or twenty minutes, of the strength named, maintains safely all the possible influence of the miotic, even if the pupil does not contract. While continuing its use, light taxis of the bulb through the closed lids, over the cornea and ciliary region if the eyeball is not too tender, with the palmer surface of the two index, or the two index and middle fingers, should be practiced. The pressure should be light and alternating in character, and it aids the contractile action of the pupillary muscular fibres, empties the swollen veins of the fundus, and restores the iris and lens to their normal position. The pupillary nerve filaments recover their tone of which the pressure deprived them, the pupil recovers its size, and tension is reduced. By this system of taxis, without other mediation, I have reduced tension. In chronic glaucoma, not responding in the slightest manifest degree to eserine, I have found tension lowered and the pupil contracted under gentle taxis for ten minutes, even less. When tension has been reduced, the pupil contracted, and the iris replaced, this condition may be maintained by the miotic, used with decreasing frequency; aided, if necessary, by daily taxis. The miotic alone has maintained this condition for weeks, used twice a day, in the strength of 1–8000, and in chronic glaucoma.

If high tension is incorrigible to these measures, the local abstraction of blood by leeches may serve a good purpose, as it did for me once in a gouty patient with contracting kidneys

who was confined to bed, and had an acute exacerbation of a chronic glaucoma, with severe headache; result, lowered tension, headache relieved, pupils contracted readily to eserine 1–8000, which they had declined to do before.

Nothing more than a reference to the effect of topical heat is necessary here, as all are familiar with it.

The question of constitutional agents is most important, but exercise, clothing, diet, and galvanism will not be considered, as they require too much time.

Habitual high arterial tension and glaucoma are found associated; though arterial tension exists without glaucoma, the latter seems to depend upon the former, for high arterial tension precedes and coexists with glaucoma. Hence the suggestion of the general *hot* bath (103° to 108°).

The habit of over-eating, of eating in excess of the requirements of the system, or beyond the powers of digestion and assimilation, results in the collection in the blood-current of irritating material; the coats of the blood-vessels, especially of the peripheral small vessels, being irritated thereby, contract and resist the passage of the blood-current, increasing the action of the heart; the cranial vessels having the least power of contraction permit an excessive volume of blood to reach this region.

Nitroglycerine and nitrite of amyl are the two most efficient and prompt drugs within our knowledge for the reduction of arterial tension; alike in their mode of action and their effect upon the system. Both reduce tension by their influence upon the great vaso-moter center in the medulla oblongata, causing paralysis of this area, with consequent inertia of the vaso-constrictors and dilatation of the blood-vessels, beginning with the nearest, those of the head and neck, producing headache, nausea, and languor. An over-effect may cause death in this way, from paralysis of the muscles of the heart and respiration, the involuntary muscles. Another danger is to be found in idiosyncracy, as some persons are intoxicated by minute doses. They are incapable of sustained effect, as this depends upon paralysis of the dominating vaso-motor center, which can not be continued. Nitroglycerine (and probably

amyl) seems at times to produce toleration of rational dosage; and, moreover, both in their mode of action begin at the nerve center, while the cause of arterial tension works at the periphery.

A natural and safe agent, capable of sustained effect, is to be found in the *hot* bath, which dilates the superficial vessels, and contracts the cerebral vessels by indirection; the dilatation of the superficial arterioles lowers general arterial tension, lessens the local volume of blood by diversion to the surface and reduces the whole volume by the transudation of its watery constituent through the skin. It is valuable in the emergency of acute glaucoma, and as a habit in chronic glaucoma. It partly removes the cause, and, like iridectomy in acute glaucoma, it palliates the expression. The cold, still bath in glaucoma is suicidal.

Prior to 1892, I had relied upon salol in these cases under the impression that it offended the stomach less than other salicylates, and because the phenol in the combination is an intestinal antiseptic. A combination of salicylate of sodium in *proper dosage* is as well tolerated, and more effective. A danger from the salicylates is that they weaken the heart action, but do not at the same time reduce arterial tension.

Ammonia, which is a volatile alkali and renders any other unnecessary, and is also a solvent of the alleged toxic agent, should enter into the combination with salicylate of sodium. It is a normal constituent of the blood, helping to maintain its fluidity by holding the fibrin in solution (Bartholow). It increases the temperature of the extremities by lowering arterial tension, and relieves the labor, and consequent excitability of the heart, thus promoting the permanency of the effect of the hot bath. It keeps the hæmin crystals in solution, and probably leaves the stomach as the less volatile chloride by combination with the gastric hydrochloric acid. Hot pediluvia and muriate of ammonia fomentations are said to have cured senile gangrene.

Observation leads me to the opinion that the growing prevalence of lithæmia may be due to the reduced ingestion of ammonia with our food, from which (being volatile) it is probably

driven off by the process of cooking. Every other alkali is wanting in the diffusible *indirect* stimulating effect of ammonia. It renders salicylate of sodium safer by reducing arterial tension as the salicylate lowers the action of the heart.

Taraxacum, a mild hepatic stimulant, is a third ingredient. A combination of these is the best form in which to secure the best effects of all the constituents, and I have seen the peculiar pallor of the gouty and glaucomatous individual promptly replaced by the health tone, under its influence.

Colchicine. Colchicum is an old remedy with virtues, and colchicine, the active principle, is the most convenient form in which it can be used. Like every other form of colchicum it has a marked influence over the digestive tract, causing diarrhoea, and must be used cautiously.

It is sedative to the nervous and vascular systems, sometimes increasing and at other times diminishing the irritability of the stomach, depending upon idiosyncracy. Acute glaucoma seems to be most susceptible to its influence; at times being promptly aborted by it. In other cases it seems to be without effect, and so far I have been unable to distinguish the cases except by trial. It has most quickly improved the worst cases of serous iritis I have seen when they were amenable to nothing else. Its peculiar action in gout has never been explained satisfactorily, but it seems to be selective in its action.

I have used it watchfully in doses of gr. 1/100 to gr. 1/50, three or four times a day, guided by the more or less intestinal-irritation produced. The chronicity of simple glaucoma limits its usefulness to the exacerbation.

To recapitulate:

In acute glaucoma, the general *hot* bath, the use of the miotic with taxis, exhibiting colchicine at once. Repeat the hot bath after several hours if necessary, always keeping the patient warm after it. The employment of such means, while waiting to determine the necessity for an operation, will often obviate iridectomy. After gaining control of the attack, prophylaxis, as in the management of chronic simple glaucoma.

In chronic glaucoma a bath should never be taken except in

hot water, and this should be a resort several times a week. Sponge-baths should be interdicted ; always tub baths, immersing the whole body for the reasons given above, and in a warm room. This bath need not be above 102° to 104°, nor continued long enough to cause sweating. A weak collyrium of the miotic should be persisted with, aided by daily taxis for a few minutes until tension is normal and remains so. At intervals taxis must be repeated for a few days.

The mixture of salicylate of sodium, ammonia, and taraxacum should be pushed to the point of the physiological tinnitus, and be continued at this as long as necessary, combating any symptoms of irritable glaucoma which may arise with colchicine (if it acts well) suspending the mixture while doing so. The intestinal tract must be *soaked* out with hunyadi janos ; this favors intestinal digestion. Three or four ounces of the water should be taken at bedtime, not standing upon the feet afterwards ; and this should be repeated every night, perhaps in less quantity, until the stools become yellow. It should be used in this way once a week, or fortnight.

Other indications should be met as they arise, by calomel gr. 1, in divided doses, for hepatic inaction ; tinct. nucis vom. as a stomach tonic ; Fowler's solution of arsenic as a preservative of food in tardy digestion, drop doses at mealtime, in the soup or a glass of fluid.

Cases have been under my observation for ten and twelve years in which the halo-symptom has been persistent, the refraction has increased, and the excavation of the disc has steadily deepened, but there has been little loss of acuteness of vision, and no persistent contraction of the field, which has always been associated with increased tension easily reduced. In acquired glaucoma the outlook is more favorable. In case of inherited tendency, the whole plan of living requires modification to suit the individual case, and is too elaborate for consideration here. In such cases vision may be preserved, but they are never *cured*, I fear.

A CASE OF CHRONIC GLAUCOMA WITH SOME UNUSUAL FEATURES.

BY ROBERT L. RANDOLPH, M.D.,

BALTIMORE, MD.

T. W., strong, healthy man of sixty-one years of age. He is the manager of a large brewery in Baltimore. Four years ago he consulted me about his right eye. On examination I found the cornea of his right eye the seat of a haze which was so dense as to almost render indistinct the outlines of the iris. He told me that this haze made its appearance every day at the same time. Usually an hour after breakfast a faint cloud would appear before his right eye, and in two hours or maybe a little over this cloud had become so dense as to make reading with that eye impossible, and everything appeared as though seen through a thick veil. This haziness now began to fade away, and in two hours the cornea was perfectly clear.

Two periods of time served to impress upon him the duration of the haze. He reached his office every morning between half-past eight and nine o'clock, and the haze began to appear within a half-hour. He dined at half-past one o'clock and afterwards he would smoke a cigar, and by that time it was about three o'clock and the haze had entirely gone. These two points in the history of the condition had impressed themselves upon him, first the beginning a short time after reaching his office, and the end about the time he had finished his afternoon cigar.

The clouding appeared to involve the substance proper of the cornea, and was quite uniformly distributed. There had been no pain ; in fact, the only unpleasant feature was the disturbance in vision. The ocular conjunctiva was absolutely free from congestion, and, with the exception of the cornea, the eyeball seemed perfectly normal. It was impossible to see the fundus owing to the condition of the cornea, so he was told to return that evening after the cloud had passed away, though, I must confess, that I was rather skeptical of any such result. He came back that night, and the cornea was absolutely clear and

bright. The ophthalmoscope showed a high grade of myopia, at least 10 D. There was glaucomatous cupping of the disc, but this condition was not by any means striking. The fundus, as a whole, resembled what we usually see in very high grades of myopia. With this myopia corrected his vision in the affected eye was 20/40, while the vision in the other eye was nearly 20/20. This condition had existed for the past three weeks. I prescribed eserine — one grain to the ounce — to be used three times daily. He returned in five days with the report that the haze made its appearance every day, but that it only lasted for an hour or maybe less. A week later he reported that he had not noticed the haze for three days.

I lost sight of him then till November, 1895, just four years from the time when he had first been under my care. He had used the eserine off and on during the winter of '91, and had controlled the attacks completely. He was entirely free during the spring and summer of '91, but in the fall of that year — early in November — the haze again appeared, and he again used the drops with the same good effect. At this time he consulted no oculist. Several times during the autumn of '92, '93, and '94 the clouding was noticed, but it never lasted long, as he promptly resorted to the eserine. I may say here that he had never noticed the clouding in the slightest degree in the warm weather, that is to say during the spring and summer months. In November, 1895, the haze returned with vigor, and the eserine produced no apparent effect. Early in the month he came to see me with the right cornea so opaque as to closely resemble a pronounced case of interstitial keratitis. The tension was decidedly elevated, and vision was reduced to 20/200 with glasses. I prescribed a stronger solution of eserine, but with no good effect, and the vision continued to grow worse. The haze would appear every day, and always at the same time, and generally by the afternoon the cornea had cleared up. He told me that the haze had only persisted two or three times after nightfall, and then he had noticed the peculiar halo around the street lamps. One month later his vision was reduced to the ability to count fingers half-way across the room. Iridectomy was advised. A week later he came and said that he had decided to

have the operation performed. During that week he had consulted two other oculists, and both of them had advised the operation. One of these gentlemen had expressed some doubt as to whether the cloud actually disappeared in the afternoon, and was much surprised to find that such was the case at a second visit that evening. The operation was performed, and in two weeks he was at work again, and now, four months after the operation, his vision in that eye is 20/40 and some of the letters in the 20/30 line can be made out.

About a month after the operation on his right eye the haze was seen for the first time before his other eye, and the condition was characterized by the same periodicity. He consented to an iridectomy, which was performed. Before the operation the vision in this eye was 20/40, and now he can read several of the letters on the next lower line. There is then no very material improvement in the vision in this eye. I may say that tension in this eye prior to the operation was considerably elevated during the existence of the haze, but not appreciably so at other times. There was marked cupping of the disc.

The striking features in the case are:

First — The density of the clouding, which exceeded anything of the kind that I had ever seen in glaucoma. Tension was elevated during these attacks, and at times he was conscious of a dull pain in the temples.

Second — The periodical nature of the attacks, which came on at about the same time every day and passed away at about the same time. The fact, too, that he was entirely free from the attacks during the warm weather, though he was not using the eserine.

Third — The coexistence of myopia, and that, too, of such high grade. He is wearing now:

R. E. −10D.◯−1,25D. axis 180
L. E. −10D.◯−1,25D. axis 180

AN UNUSUAL CASE OF GLAUCOMA.

BY B. L. MILLIKIN, M.D.,

CLEVELAND, OHIO.

The following case of glaucoma has been of so much interest to myself and presented so many symptoms of unusual character that I deem a report of it quite worth our consideration.

On the 8th of January, 1891, I was called to see Mrs. K., whom I found suffering very severely from an affection of her right eye. At the time she was about 49 years of age, was of slight build, rather under-sized, of a nervous make-up, with an active, intelligent mind, accustomed to doing a considerable amount of literary work. She had always been of a frail, nervous make-up, and for a number of years had been subject to severe neuralgic attacks of the stomach, which quite laid her up in bed at each attack. She had been accustomed to doing a large amount of reading, often using her eyes late at night, and, until a recent period, had never suffered any inconvenience from them. For a period of some months, however, she had complained of their being somewhat uncomfortable after much use, and discovered that she was unable to see with the left eye as well as with the right. She had worn glasses for near work for some three or four years, but recently had noticed difficulty in procuring glasses which gave her comfort. At times she complained of much aching of the right eye when using it. A month prior to my seeing her, she had had the first severe attack of pain in the right eye, accompanied with much fogginess and temporary failure of sight. This attack passed off mostly within 24 hours or so, but she thought her vision had not been quite so sharp succeeding it. The day prior to my seeing her she had had a similar attack come on suddenly, with great fogginess, a wide halo about lights, and inability to see much more than light. The lids puffed up, the conjunctiva became red and much swollen and very severe pain occurred through the eyeball and side of the head, which was

almost unbearable. This was followed during the night by much nausea and vomiting, and her condition at the time of my visit was pitiable in the extreme. I found that even with the use of considerable doses of morphia she had been unable to procure any rest since the beginning of the attack.

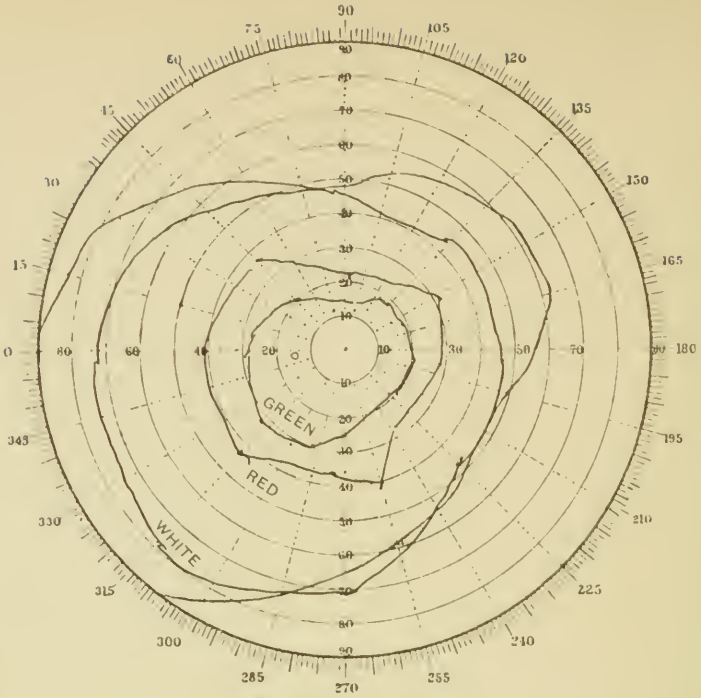
Examination showed in addition to the symptoms above indicated, a very marked haziness of the cornea, the pupil moderate in size, but not responding to light, the eyeball quite hard, T = + 1-2, as compared with the other eye. The eye was excessively sensitive to light, examination with the ophthalmoscope being very uncomfortable. At this visit eserine sulph., 1 gr. to the oz., was ordered for frequent instilation together with hot applications and morphia sufficient to relieve pain. The day following this attack I was taken ill with typhoid fever, and did not see Mrs. K. until the 31st of March following.

She was, however, immediately referred to another oculist of our city, who on the 17th of January performed a sclerotomy. The primary attack had rapidly subsided under the use of the eserine, but between the 8th and 17th of January she had had a number of attacks of pain with sudden clouding of the vision, lasting however only a short time.

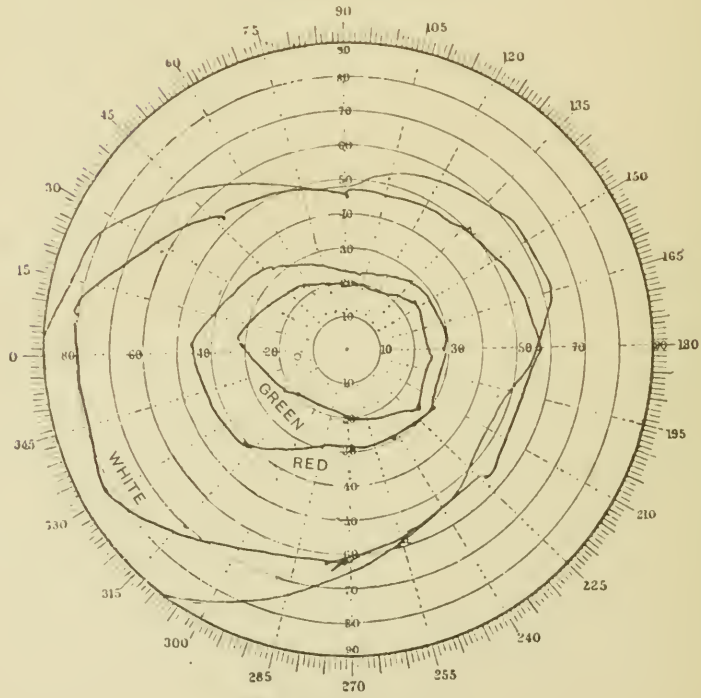
After the operation she was much improved for a considerable time. My notes taken on the 31st of March, 1891, indicate that in the intervening two months and a half she had several slight attacks of pain, lasting only a day or so, together with frequent flashes of light, coming on at intervals. Three days before this, she had had quite a severe attack of pain, with haloes, increased tension and regular glaucomatous symptoms. This had passed off entirely, so that an examination of the details of the fundus could be readily made at this visit. Examination with the ophthalmoscope at this time showed the disc large, round, narrow crescent outwardly, no depression of it, the vessels passing over the edge without bending backwards. The fundus seemed quite normal. At this time O. D. V. = 6/18 ? O. S. V. = 6/60. She had been wearing for a considerable time the following glasses:

O. D. + 1.50 Ds. (·) + 0.75 D. cy. ax. 180°;

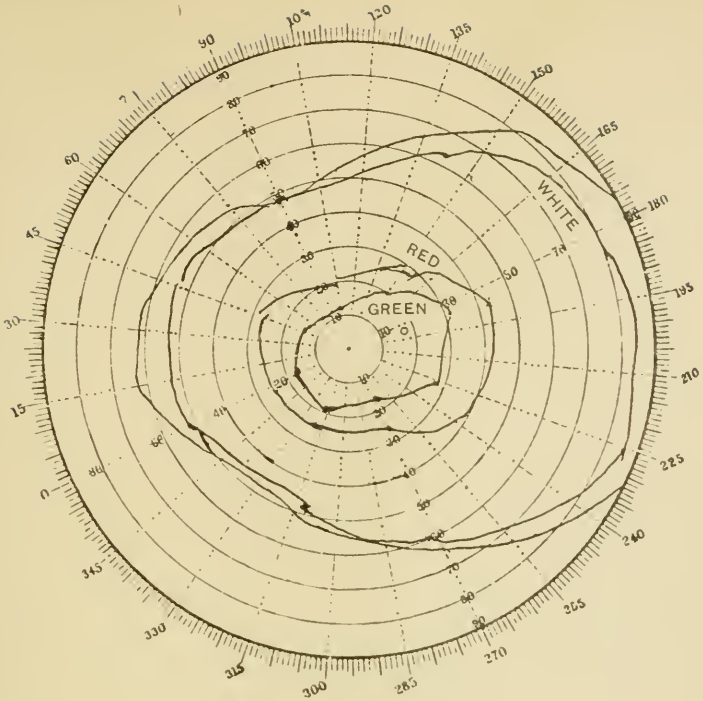
O. S. + 1.50 Ds. (·) + 1. D. cy. ax. 180°;



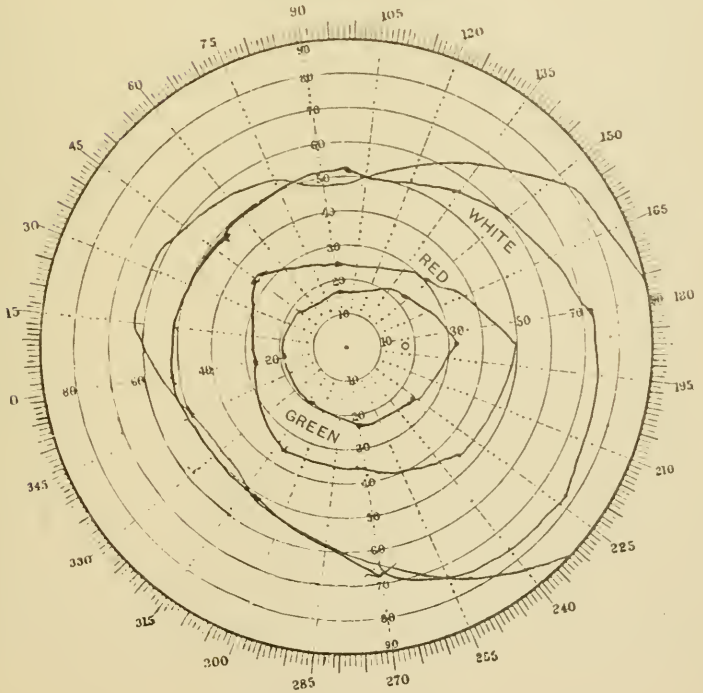
Mrs. P. E. K. Left.
November 11, 1891.



Mrs. P. E. K. Left.
November 12, 1894.



Mrs. P. E K. Right.
November 11, 1891.



Mrs. P. E. K. Right.
November 12, 1894.

but these had been quite uncomfortable for near work. Examination of the refraction made on April 13, 1891, gave the following result:

O. D. + 1.25 Ds. (-) + 1 D. cy. ax. 180°, V.= 6/9;

O. S. + 3.50 Ds. (-) + 1 D. cy. ax. 90°, V.= 6/9;

it being observed that the cylinders were at right angles to one another in the two eyes. These glasses were prescribed for constant use, the patient being instructed to avoid all close use of the eyes.

June 1, 1891, recently Mrs. K. had suffered from an attack of the grippe, and two days ago had quite severe pain in right eye and side of head. At this time the whole side of face was swollen as if there might be some irritation of the teeth, and with it much redness of the eye, pain, and evidently an acute glaucomatous attack. The attack subsided promptly under the use of eserine, hot applications, and opium to relieve pain.

On Sept. 1, 1891, proper spherical glasses with the above cylinders combined were prescribed for reading. With these she was able to do near work with comparative comfort.

On Oct. 21, 1891, it was noted that a few days before she had had another attack in the right eye, quite as severe as any from which she had previously suffered. At this time, however, her vision in the right eye with glasses was 6/6? O. S. 6/6? Her field of vision both for white and for various colors taken Nov. 11, 1891, shows, as you will see by a copy, very little contraction, nor did the ophthalmoscope in the intervals between the attacks show any positive evidence of abnormality.

I will not weary you with long detailed notes of the many attacks from which she suffered over a period of several years during which she was under my care. It is an exceedingly interesting fact, however, that whereas her former nerve explosions, or nerve storms, from which she had suffered for many years in the way of severe neuralgic attacks of the stomach, entirely subsided after the eye began to trouble her.

Another interesting feature in connection with these attacks was that any nervous disturbance would at once bring on a glaucomatous condition. For a long time, for instance,

on Sunday evenings during the absence of her family at church, her husband being a minister, the feeling of being alone was sufficient to induce an attack. Also the nervous dread superinduced by reading a paper in public which she not unfrequently did, would produce them. Any slight fatigue or nerve exhaustion seemed to predispose to this condition. For a number of years she carried with her continually a weak solution of eserine of which she would use one or two drops whenever there was any indication of an attack. This always relieved her promptly, and was for her a great safeguard.

During the winter of '93–'94 she was in California, and it was noted that while she had very many mild attacks they were always controlled by the eserine. The improvement in her general health from the change of air and interest were evidently of much benefit. A trip previously taken South for the same purpose was likewise of much benefit. Her return to her home duties, with their attendant cares and anxieties, was sufficient to re-develop the more severe attacks. Two weeks after her return from California, in May, 1894, she suffered from a most severe attack following upon the nervous excitement of preparing and reading a paper before a society, the attack coming on shortly after this event. This was most severe, accompanied with nausea and vomiting, with dilated pupil, high tension, great redness and puffing of the cheek and eyelids. The attack passed off entirely in 30 hours, leaving the sight quite undiminished. It is a matter of considerable interest that the glaucomatous attacks originated about the beginning of her menopause, this state lasting over a period of two or three years.

On June 6, 1894, the following notes were made: "Heretofore as a rule the attacks had come on during the evening, or more frequently at night. Recently they have been occurring in the mornings and at indifferent times." During this long period she has frequently had one or more attacks daily, and rarely has gone for more than one or two weeks without some show of the difficulty. Prior to this time she must have had many hundreds of the attacks, varying in intensity and duration, often simply showing temporary blurring and haloes, last-

ing but a few moments, at others affecting profoundly the eye and the whole nervous organism. A careful examination in June, 1894, gave the following result: The ophthalmometer showed O. D. 2 D. ax. 20°; O. S. 1 to 1.50 D. ax. 100°.

The ophthalmoscope at this time showed the right disc fairly large, the whole surface quite pale, cribriform fascia showing very plainly, slight chorodial ring broadening out into a crescent downward and outward The arteries were possibly a little small as compared with the viens, the latter seeming rather large. The upper retinal vein had a very peculiar appearance, the peripheral portion of the vein as far upward as it could be traced was quite large, but at a point about two to three mm. above the border of the disc it suddenly contracted to less than half its diameter, and remained thin and almost thread-like until it disappeared in the center of the disc. The blood evidently circulated in it, as there was marked venous pulsation present. The lower retinal branch showed nothing of this. The retina was slightly high colored, with slight granular appearance with probably some affection of the choroid, as far toward the nasal periphery there were a few spots of choroiditis apparently 1 to 2 mm. in diameter. There was no apparent glaucomatous cupping of the disc, nor have I ever been able to recognize the presence of this.

The left disc was pale as in the other eye, of good size, the cribriform fascia perhaps not quite so marked, otherwise in about the same condition as the right eye. On July 5, 1894, while examining her eyes in my office an attack came on while under observation. It was evidently one of the mild attacks and passed off in the course of half an hour. During it the patient complained of quite sudden and rapid diminution of vision, with halo about flame, and only moderate discomfort. The cornea, as I watched it, became quite hazy or steamy in appearance, and the tension very perceptibly increased as compared with the fellow eye. As it passed away the cornea gradually cleared and assumed its normal, clear aspect, the vision gradually returning. The last notes made on the case were taken on Nov. 12, 1894. At that time there was no attack present, and the fields, as you will see by copy herewith, show

very little diminution, and practically had not changed since the field was first taken in 1891.

With glasses her central vision had remained about the same or had even improved at this time, as she was able to read 6/6 in both eyes.

On Nov. 15, 1894, Mrs. K., with her family, left for her future home in California, since when I have not seen her, so that the balance of the history of the case must be filled out from communications from her husband and brother. During this long period she was seen by a number of physicians, local and otherwise, but no treatment suggested seemed to have so beneficial an effect as the use of the eserine. Among other gentlemen who have examined her, she was seen by Dr. Bull of New York, in February, I think, 1892, who was kind enough to send me a most full statement of the results of his examination. I am sure he will pardon me for taking the liberty of quoting a few notes from his statement. With reference to his examination he says: "I found no abnormality in the anterior at its angle nor in the iris, though the latter is slightly sluggish in action. The lens and vitreous were clear, tension certainly not increased in either eye. In the right eye a very shallow excavation in the optic disc, but atrophic, *not* glaucomatous in character. No pulsation either arterial or venous, arteries small, both on the disc and toward the periphery. At the equatorial region minute changes in the choroid, which I have learned to look upon with grave suspicion, particularly in women, just about the menopause. . . . I find the same minute changes at the periphery of the left eye also, and the optic disc is whiter than it should be. In the right eye there is a slight narrowing of the field on the nasal side for form, but not strictly glaucomatous. The field for color is narrowed all around, for all colors, which is significant of optic nerve degenerations. I do not feel at all sure that this was glaucoma."

I may add to what Dr. Bull has here said that I believe no one seeing the case for the first time in an interval between the attacks would suspect from an examination that the case was one of glaucoma. On the other hand, I do not believe that any one seeing the case during an attack could believe it was anything else.

After leaving Cleveland Mrs. K. with her husband went to Brooklyn, N. Y., for a visit, prior to leaving permanently for California. About the time of leaving Cleveland she had several slight attacks, and upon reaching Brooklyn she had a most severe attack which persisted from Saturday until the Thursday following without any abatement, according to a letter received from her husband sometime afterward. In Brooklyn she was seen by Dr. Alleman, and with him in consultation by Dr. Prout, both of whom agreed as to the advisability of an iridectomy. This was done by Dr. Alleman successfully. After recovering from the iridectomy she had two or three slight attacks of pain in the eye, but none marked in character. Eight months after the operation, a letter from her husband states that she had had no successive attacks whatever, and that the vision in this eye has remained fairly good, leaving her able to use her eyes moderately for close work. I have very recently learned from friends that she still remains quite comfortable, but that the vision of the right eye even with the correcting glasses is not so good as in the left. An interesting fact in connection with the case is that at no time has there been any difficulty of a glaucomatous character in the left eye, although the refraction error in this one was much the more marked, also so far as I was able to determine the differences in the ophthalmoscopic appearances of the two eyes has not varied greatly. The interesting points in connection with this case may be summed up as follows:

1st. A long series of nervous attacks culminating in severe neuralgic disturbance of the stomach ceasing after the development of apparently corresponding nerve storms in the eye.

2d. The enormous number of attacks of glaucoma, varying in intensity over a period of a number of years.

3d. The practically normal sharpness of vision and the fairly good, regular fields, both for form and colors, remaining after this long succession of glaucomatous attacks.

4th. The marked favorable effect upon all these attacks of the use of eserine in mild solutions continued for more than three years without its losing its effect or producing untoward symptoms.

5th. The evident relation between any nervous excitement or disturbance, or fatigue, mental or physical, to the frequency and character of the attack.

6th. The unquestionable beneficial effect of an iridectomy as a safeguard and its preference over the operation of sclerotomy.

DISCUSSION.

DR. S. D. RISLEY of Philadelphia.— I would like to say that I believe there is a distinct value in the manipulation of the ball in these cases. I have for a number of years been doing it to relieve the tension, and I am sure it gives temporary benefit. It may, at times, also relieve the pain.

DR. EDWARD JACKSON of Philadelphia. — A word about the effect of taxis or manipulation of the eyeball. It has sometimes a very marked effect in reducing the tension. Sometimes it will be a half-hour after the manipulation of the globe in taking tension with the finger-tips before pulsation of the vessels, previously well-marked, will return. If we used the ophthalmoscope before taking the tension of the globe we would more frequently discover pulsation. This effect of manipulation of the globe accounts for the difference of opinion as to the state of the tension between observers who have tested it one after the other. Usually the tension appears to the first observer more distinctly increased, while to the last observer the increase is less certain.

DR. T. Y. SUTPHEN. — Since our last meeting, when I reported several cases of secondary glaucoma treated with salicylate of soda, I have had others, and all have yielded to the same drug. In simple acute glaucoma I have used it with temporary benefit; but in these cases iridectomy was eventually done. I think there are cases of chronic glaucoma which may be held in check if not cured by the treatment given by Dr. Richey. In secondary glaucoma I believe we have a most valuable remedy in the salicylate of soda.

DR. H. KNAPP.— Your cases were secondary to what ?

DR. SUTPHEN.— One was due to traumatic dislocation of the lens, another detachment of the retina, and the remainder to some old traumatism.

LENSES FOR THE BINOCULAR EXAMINATION OF THE EYE BY OBLIQUE ILLUMINATION.

BY EDWARD JACKSON, M.D.,

PHILADELPHIA, PENN.

The history of ophthalmoscopy gives one of the best illustrations of what is possible of attainment by monocular vision, and also of the difficulties of such attainment. The wonderful refinements of ophthalmoscopic diagnosis have been reached through monocular vision. The "binocular ophthalmoscope" gives a very imperfect binocular vision, and has contributed little to our knowledge of ophthalmoscopy. Yet with the ophthalmoscope, for a definite impression of relative depth we have to resort to the measurement of refraction, or the parallax. The earlier discussions as to whether the optic nerve entrance usually presents a cup or a papilla; and the debate, probably not yet concluded, as to the cause of the light streak on the retinal vessels, illustrate the slow and difficult process by which our present knowledge of the ocular fundus has been attained.

This slow and difficult process has still to be repeated in the experience of each young ophthalmoscopist. Supplemented by accurate descriptions and minute knowledge of the anatomy of the parts, much experience is required to recognize readily and promptly the exact nature of the more common conditions revealed with the ophthalmoscope. When new and unfamiliar appearances are encountered in the ophthalmoscopic image, only by prolonged and repeated studies, with careful consideration of collateral symptoms and evidence, can the most expert ophthalmoscopist gain an appreciation of their significance.

The same difficulty in appreciating what is seen occurs in the study of the appearances of the anterior segment of the eyeball, as they are brought out by oblique illumination, when this study is undertaken with the aid of a monocular magnifier — the corneal loupe. The difficulty is not simply the difficulty encountered in using one eye without a lens. All optical instruments which magnify the object looked at in the plane perpendicular

to the visual axis diminish the amount of light received on a given portion of the retina, and hence the vividness of the impression made; and, failing to produce any enlargement in the direction of the visual axis, they cause a distortion of the image formed, which renders it positively more difficult to judge of the relative distance or "depth" of the parts seen than it is to judge of such depth in the unmagnified image obtained with the single naked eye.

This difficulty may be perceived with the telescope or the compound microscope. In the "binocular compound microscope" and the "binocular ophthalmoscope" an attempt has been made to get over this defect. But as has already been indicated as to the latter, the success attained has been imperfect, and the practical usefulness of these instruments slight.

There is a good reason for this in the general plan employed in these instruments. The pencils of rays for the two eyes are obtained by dividing the single circular pencil of rays passing through an object-glass into two semicircular pencils. In each of these semicircular pencils, the extreme rays at the angles of the semicircle originally diverge in the direction perpendicular to the visual plane (a plane passed through the two visual axes), as much as the extreme rays of the two pencils diverge in the direction of the visual plane. The images formed in the two eyes in ordinary binocular vision are formed by small isolated pencils of rays divergent from each in the visual plane by the width between the pupils, but with the rays of each pencil diverging among themselves only by the semi-diameters of the pupils. Images formed in either eye through the "binocular" ophthalmoscope or compound microscope are formed by pencils that originally diverge for each eye as much above and below the visual plane as they diverge for the two eyes in that plane. They are, therefore, images having to a very slight degree the characters of ordinary binocular images, but composed of rays so divergent in entirely different directions, that the visual centers accustomed to the ordinary problems of binocular vision are quite unable to appreciate them. Such images give a sense of indefiniteness and unreality that robs them of practical value.

The conditions of true binocular vision are such that the two

eyes receive small pencils of rays, the two pencils having sufficient divergence from one another to give slightly different images, but the rays of each pencil being sufficiently alike to allow of their forming a definite retinal image. These conditions are fulfilled when the pencils of light employed are limited, as they are in instruments here proposed, by the margin of the pupil.

The advantages of binocular vision for the examination of the anterior segment of the eye by oblique illumination have always been, to some extent, appreciated. Many surgeons have not habitually used the corneal loupe. Some, with high myopia and strong convergence, depend on their unaided eyes. Others use strong convex lenses before both eyes. Still others use something like a reading glass, large enough for both eyes to look through it at once. But none of these arrangements give a sufficiently high magnifying power. About two or three diameters, estimated by the ordinary standard, for the microscope, is all the magnification that can be secured by any of these plans. In contrast with them the lenses now to be suggested are easily capable of giving an enlargement of eight to fifteen diameters, measured by the same standard — as much as is usually attained with the corneal loupe.

The obstacle to binocular vision with the ordinary magnifying lens or simple microscope is this: The divergence from each other of the pencils of rays going to the two eyes is necessarily so great that these pencils fall so obliquely and so far toward the periphery of the lens, that they are too much distorted to be useful for purposes of accurate vision. Only by bringing the lens so close to the object as to sacrifice most of its magnifying power can binocular vision be obtained through it.

To overcome this obstacle it is necessary to divide the lens into two portions, each of which shall have its separate optical center and shall be placed with its refracting surfaces approximately perpendicular to the rays passing through it. To lessen the need for unpleasantly strong convergence, when trying to secure binocular vision at so short a distance, it is also needful to secure in some way a prismatic effect.

The first, and in some ways the simplest apparatus for meeting these requirements is the double lens, described by the

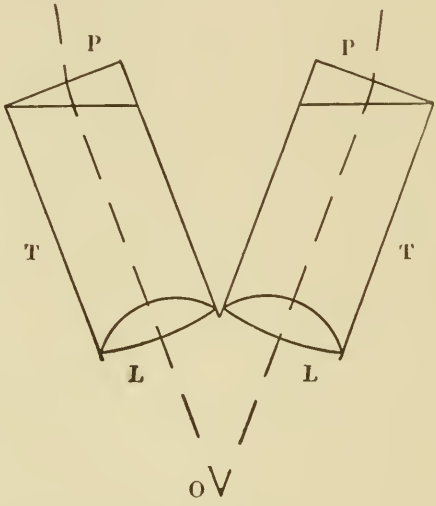
writer in the *Ophthalmic Review* for May, 1896. It consists of two plano-convex lenses so joined that their plane surfaces make with each other an angle of from twenty to thirty degrees, the optical centers of the two portions being from two to six millimeters on either side of the line of junction — farther for a weak lens and closer for a strong one. Such a lens may be made by cementing together two separately ground lenses. But Messrs. Wall & Ochs, who have made these lenses for me, have succeeded in grinding them from a single piece of glass, the one surface being spherical convex, and the other surface consisting of two planes meeting each other at the proper angle. Theoretically it is impossible to make the junction of these planes a perfectly sharp, true angle; yet it has been made true enough for all practical purposes; and the lens made of one piece of glass is free from the inconvenient liability of the two cemented halves to separate.

The learning to use such a lens is, however, attended with some little difficulty, especially to one who is accustomed to the examination of the anterior segment of the eye with the monocular lens. Even with the lens placed so that no unequal vertical prismatic effect shall be caused, and so that the two halves of the lens are properly before the observer's eyes, there remains a tendency to regard the double images seen through the two halves of the lens with one eye; and to disregard all the impressions made on the other eye, instead of regarding the images received in both eyes through their respective halves of the lens, and fusing them to binocular vision. This difficulty is met by any device which shuts off each eye from the part of the lens belonging to its fellow eye, as in the instrument here shown and described.

This later instrument, as compared with the binocular lens just described, also allows of a slightly greater reduction of aberration by the appropriate curves on both surfaces of the lenses, and some saving of effort, of convergence by the position of the prisms, close to the observer's eyes. Still to one who has learned to use the simple lens these advantages do not more than compensate for the increased bulk of the instrument.

The latter form of instrument here shown consists of two

tubes, *T T*, converging at an angle of about forty degrees. In the lower or convergent end of each tube is placed a lens, *L*, of the desired strength, usually 20 to 40 d., having curves on its two surfaces whose radii are to each other as 6 to 1; the more convex surface turned within the tube, to reduce spherical aberration to the minimum.



At the divergent end of each tube is placed a prism *P*, of 20 centrads refracting power with its base "in." The course of the axial rays is shown by the broken lines starting from the object *O*. By the prisms the divergence of the rays is reduced sufficiently to bring it well within the normal convergence power. The diameter of the tubes varies with the strength of the lens employed. With a stronger lens, which necessarily comes nearer the eye under inspection, the diameter is smaller to avoid excessive divergence of the two pencils of rays. With a weaker lens the tube is larger to give a larger field of view. With a stronger lens, too, the tube is longer; while with the weaker lens, which has to be placed farther from the eye, the tubes are shorter.

The distance between the divergent ends of the tubes has been made sufficiently small for any inter-pupillary distance. One needs only to draw back sufficiently from the ends of the tubes to have it perfectly adapted for use. The prism having

the same effect at all parts of its surface, it is not essential to have one's pupil in a line with the center of the tube, but as good an optical effect is obtained when the pupil is opposite one part of the prism as another. It is very important that the two prisms should be turned with their bases accurately toward the nose, since a slight rotation of one prism from this position will quite prevent binocular vision through the instrument, and entirely defeat its purpose.

In using this instrument the eye should be strongly illuminated from the side. The avoidance of reflections from the cornea is even more important than in the monocular examination, since these reflections necessarily differ so much for the two eyes of the observer that they constitute an appreciable obstacle to binocular fusion. The instrument is at first held closer to the eye to be examined than the focal distance of its lenses, and then gradually withdrawn to the greatest distance at which a clear view can be obtained. At this distance one gets the greatest magnification, with the least exertion of accommodation and convergence.

The advantages of binocular over monocular vision in the investigation of unknown conditions have already been referred to. One careful worker in ophthalmology writes me soon after getting a binocular lens: "I see what I never have seen before." Another who has worked with it for some little time, says he "would not know what to do without it." The writer, after two years of using these lenses, would as soon think of discarding the shadow-test or the trial case. But only experience is likely to convince any one how much the full revelation of the third dimension or "depth" adds to the significance of the magnified image. It may be noted that the angle of the divergence of the pencils of rays going to the two eyes, nearly forty degrees, gives in effect a magnification in the third dimension quite comparable to the magnification given by the lenses in the other directions.

As compared with the "binocular" compound corneal microscope the superiority of the binocular vision secured by the instrument here described, more than compensates for the greater magnifying power of the other; while its simplicity, portability,

and the ease with which it is used, make it a perfectly practical instrument for ordinary clinical work. The range of its magnifying power can doubtless be somewhat extended by the substitution of carefully chosen combinations for the simple lenses, to reduce still farther the spherical and chromatic aberration; but it is doubtful whether for the present, at least, the increase of power to be so obtained would have much value in the ophthalmic clinic.

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