ENUCLEATION OF THE EYEBALL.

One of the selected papers read before the Mass. Medical Society, June 2d, 1868.

Section of the Ciliary Nerves and Optic Nerve.

Communicated to the Boston Medical and Surgical Journal.

Some Unnecessary Causes of impaired Vision.

Communicated to the Boston Medical and Surgical Journal.

By B. JOY JEFFRIES, A.M., M.D.

FELLOW OF THE MASS. MED. SOCIETY. OPHTHALMIC SURGEON MASS. CHARITABLE EYE AND EAR INFIRMARY. MEMBER OF THE AMERICAN OPHTHALMOLOGICAL SOCIETY. LECTURER ON DISEASES OF THE SKIN, BERKSHIRE MED. COLLEGE.

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From conversation with some of my fellow members of the American Ophthalmological Society at our recent meeting at Newport, R. I., I am induced to circulate these papers among my professional brethren in the New England States.

Respectfully,

B. JOY JEFFRIES,
15 Chestnut Street, Boston, Mass.

ENUCLEATION OF THE EYEBALL.

I HAVE found among my patients a perhaps natural horror in reference to removal of the eyeball, no matter how useless this organ may have become as respects sight, and even when it has been the seat of severe or lasting pain; and I have also found my medical brethren, when bringing their patients to the specialist, shrinking from advising them to submit to the removal of a sightless globe. There seems to be a sort of vague sensation among the laity, and I have found it also among physicians, that enucleation of the eyeball is a formidable and dangerous operation, only to be resorted to in malignant disease, and as a dernier resort. The laity also do not distinguish between the comparatively trifling operation of enucleation of the globe, and the, at present, rarely necessary and more formidable one of evacuation of the contents of the orbit. I propose, therefore, to fully explain the anatomy of the operation, prove its simplicity and show its application, and thus, I trust, place before the members of the Society some of the advances of my specialty, which may not have been brought to their immediate notice.

The foundation of surgery rests, of course, on pure anatomy, and the instance before us is one of the many where anatomical points have been forgotten and only recalled when the requirements of surgery have brought them again into notice. The capsule of the eyeball, which now bears the name of Tenon, was known to the students of anatomy

hundreds of years ago. Galen knew it but imperfectly, for he says (*De usu part.*, cap. 2), "Sexta quædam tunica extrinsecus prope accedit, in duram tunicam inserta." Reald. Columbus, in his "*De re Anatomica*" (Venet. 1559, lib. 10), calls it *tunica innominata*. The first correct anatomical description, however, of this, to us ophthalmologists so important membrane, was given by Tenon,[1] before the French Institute in 1804, and the capsule is now known by his name. Hyrtl[7] calls it *tunica vaginalis bulbi*. Richet,[6] *aponeurosis orbiti ocularis*. Budge[8] and Arnold make some further subdivisions of this fascia, not affecting, however, our present operation. A most careful subdivision and description is given by Henle.[10] I would refer also to Linhart,[32] Hélie[13] and to Richet,[14] and of course to the various recent compendiums on ophthalmology, particularly Pilz.[31] Mr. Dalrymple,[2] of London, described it in 1834 as the cellular capsule of the eye. Malgaigne has the credit of first pointing out its surgical importance; he considered it an aponeurosis, and called it *albuginea*. In 1840 Mr. Lucas,[9] of London, and in 1841 O'Ferrall,[4] in Dublin, and Bonnet,[3] of Lyons, redescribed this membrane, each independently of the other, and therefore naturally individually considered themselves the discoverer. This was one of those circumstances still too often occurring, where anatomical and physiological truths are claimed as novelties, without a previous thorough search through medical literature, which would often prevent the critic from the disagreeable necessity of showing that there is in reality nothing new under the sun.

I will here give, in order, a brief account from each of these last three authorities mentioned, because their investigations were made in special reference to the pathology and treatment of affections of the eye, and lead directly to the substitution of enucleation of the globe for extirpation of the contents of the orbit.

Mr. Lucas called Tenon's capsule the *submuscular fascia*, and thus explains its demonstration:—"The eye and its appendages, with half an inch of the optic nerve, should be removed from the orbit and placed upon a plate, the cornea being downwards. The masses of fat, together with the loose cellular tissue and bloodvessels, should be carefully dissected away, and the muscles be turned forward towards their insertions, not dissected as if with a view of exposing their appearance, but merely expanded on the surface of the plate. If the neurilemma of the optic nerve be now examined, it will be found covered with a fine fascia, which can be easily raised with the forceps, and with little difficulty can be traced off the neurilemma to the sclerotic coat at the point where the nerve enters. It will now be found to cover the posterior aspect of the sclerotica, and to advance as far as the insertions of all the muscles of the eye; at these points it turns upon itself, lines the ocular surfaces of the muscles, and passes backwards along them to where they surround the optic nerve. This fascia possesses a high degree of elasticity, and forms rather a membranous sheath for the sclerotica than an expansion for the muscles; it takes the form of the eyeball, and acts the part of a membranous cup for the organ to move in, separating it from the bellies of the recti muscles, and covering the ciliary nerves as they pass onwards to pierce the sclerotica. In the dead eye, more or less fluid will be found to exist between this cup-like membrane and the eyeball, which always enables the anatomist to separate one from the other with the greatest facility."

Dr. O'Ferrall has the merit of a pathological application of the capsule. Mr. Haynes Walton[11] gives a print of his own dissection, and a condensed account from O'Ferrall, who says, "It is a distinct tunic of a yellowish white color and fibrous consistence, continuous in front with the posterior

margin of the tarsal cartilages, and extending backwards to the bottom or apex of the orbit, where its consistence becomes less marked; the sharp end of a probe or a director will be sufficient to separate it from the eyeball, by breaking the fine cellular tissue which connects them. Within, where the eye glides over it, the surface is smooth, the external or orbital part loose and cellular. The muscular portions of the recti muscles lie outside of this tunic, which isolates and protects the eye in the most perfect manner possible. Half an inch posterior to its anterior margin are six well defined openings, through which the tendons of the muscles pass to their insertions in the sclerotic coat, and over which they play as through a pulley."

Bonnet, in his treatise on "Section of tendon and muscles," says, "When I meet with a case favorable to the application I would thus proceed to enucleate the globe. Distending the lids with suitable instruments which I employ, I would cut the internal rectus with the same precautions as for the operation for strabismus. Then sliding the scissors along the wound I have made, between the sclerotic on one side and the subconjunctival fascia and muscles on the other, I would cut in turn all the recti muscles near their ocular insertion. We need then only divide the obliqui as near as possible to the globe, and afterwards the optic nerve. The globe will then be removed without my interfering with any vessel or nerve, and without penetrating the orbital fat." By not touching vessel or nerve, of course he means as in the old operation for extirpation of the contents of the orbit.

Stöber,[5] of Strasbourg, first performed this operation in 1841.

Here I think it worth while to go back to Tenon's description, which, as it has been so often misquoted, I translate from his own words:—

"A little behind the tendon of each of the recti muscles around the eye, there is formed a tendinous fascia, which proceeds from the fleshy fibres of each of the recti muscles and the membranous sheath surrounding and penetrating them. These tendinous fasciæ separate from the tendinous muscles which they arise from; they are a continuation of the fleshy fibres of the muscles, and spring from the membranous sheath enveloping each of the muscles. The largest and thickest belongs to the *abductor* muscle. It springs from the external side of the muscle, and is attached to the external angle of the orbit near the lower edge of the lachrymal gland. It acts as a counter brace on the muscle, and prevents it while contracting from pressing on the eye. The fascia of the *adductor* (rectus internus) is shorter and not so thick as that of the *abductor* (rectus externus). It commences at the point of termination of the fleshy fibres, and is implanted on the inner angle of the orbit at the edge of the nasal canal. It acts also as a counter brace. The tendinous fascia of the *elevator* of the eye *(rectus superior)* forms an aponeurotic band extending from one side of the orbit to the other, to the depth of the upper lid. The tendinous fascia of the depressor *(rectus inferior)* is lost in the lower lid." Tenon called it, "the new tunic of the eye."

For the surgical purposes of our operation we may regard it as a membranous sac on which the globe rolls, and which is pierced by the tendons of the muscles, the cutting of which tendons in front of the capsule at their insertion into the globe will leave this membranous sac as a basis or support for an artificial eye, and the muscles being still attached to this capsule will therefore move it and the glass eye lying on it in nearly as great degree as when an artificial eye lies against a stump of the globe left by disease or surgical interference.

This so simple operation, recommended by Bonnet, is in

such contrast to the former one, really to be dreaded, of extirpating the whole contents of the orbit, muscles, nerves, fasciæ, gland, &c., that it is a wonder that ophthalmic surgeons did not sooner practise it, but not more wonderful than that even to this day, perhaps, unfortunate patients are undergoing extirpation of their orbital contents, much as certain bivalves are their contents, and with not very dissimilar instruments.

I would dwell upon this, because one of the purposes of this paper, as I have said, is to prove to you how simple and little to be dreaded this present operation is, and that it has no relation with extirpation of the orbital contents, an operation only applicable to certain tumors in the orbit. The method of operating for enucleation of the globe, taught me by Prof. Arlt, in Vienna, is the following:—

Dilating the lids with a speculum and holding in one hand a pair of toothed forceps and in the other a small pair of curved scissors, the tendinous insertion of the rectus internus muscle on the globe is seized and cut through. Retaining the grasp with the forceps the conjunctiva is cut around the cornea, and the tendons of the other three recti divided at their insertion. The scissors are now passed in behind and the optic nerve severed close to the globe, which will then start forward, and we have only to cut the tendons of the two obliqui muscles to free the eye from the orbit and leave intact the capsule of Tenon with the muscles attached to it.[35] This operation I have done, and it is comparatively easy, when inflammation has not bound down the conjunctiva or fastened the globe to the capsule, but under anæsthetics, at least, I would advise the following:—Raise with forceps a piece of conjunctiva near the corneal edge, pass in the curved scissors and separate the conjunctiva all round the cornea. With strabismus hook lift up and cut all four recti tendons as carefully as in operating for squint. Steady the

globe with fingers and thumb, and pass a large pair of curved scissors behind it and divide the optic nerve, which releases the globe from the orbit, and then we can sever the obliqui attachments. There will be but little bleeding. A piece of ice in the orbit is all that is required, and filling the latter with sponge or charpie and applying pressure is not only absolutely useless, but apt to be painful. A glass eye may be inserted, often within a week, and always should be as soon as possible to avoid shrinking of the soft parts, which it certainly does.

Perhaps some one will here say to me, there must be something wrong about all this, for I certainly was taught and learned, that removal of the eye was a severe and dangerous operation. Moreover, I remember the first proceeding was to enlarge the palpebral aperture in order to have room to work in. My reply is, I desire only to remove the useless and now offending organ, namely, the eyeball, and would as soon think of slitting up the lids, as a dentist would of enlarging a man's mouth to extract a molar tooth.

Yet the following is from the American Edition of Erichsen's Surgery, 1866. "Extirpation of the eyeball is also occasionally called for, when in consequence of injury or disease one eye has become disorganized and the vision of the other is sympathetically affected, and can only be preserved by the removal of the globe that is already useless. The operation may be performed in the following way:—The surgeon standing in front of the patient, makes an incision through the outer commissure of the lids as far as the edge of the orbit. The eyelids are then well everted and held apart with a wire speculum. The surgeon next passes a double hook into the globe and draws it well forward; then with a curved, broad pair of scissors he divides the conjunctiva at its upper part, and then proceeds to cut

across the several muscles of the orbit, and lastly the optic nerve."

The operation of enucleation has been found so simple, so effective when needed, and so perfectly adapted to its ends, that we may well wonder at its having been neglected so many years after Bonnet proposed and Stœber performed it. What was called *sinking the eye*, namely, cutting out a piece and letting the contents of the globe escape, was formerly the operation practised where now enucleation is in place. Pathology and experience soon taught that in the operation of sinking the eye, exactly that portion of the globe was left which was most often the source of trouble, namely, some part of the ciliary region. Hence soon came from one and another the improved method of removing the anterior part of the globe up to the edge of the retina or *ora serrata*, leaving the rest to form a stump. Dr. E. Williams, of Cincinnati, especially, proposed at the Ophthalmic Congress, at Paris, 1862,[15] to remove a portion of the anterior part of the eye instead of enucleation, for the purpose of having a better stump for the eye to move on. He cut *through* the ciliary body, the only part of his operation I would object to, as we must remove all of the ciliary region to avoid sympathetic trouble of the other eye, as time has since proved. This operation, when done with stitches passed behind the portion to be removed, now has Mr. Critchett's name attached to it, as he introduced it for staphylomata.[16] Four or five curved needles are passed through the globe just behind the part to be cut off, and the wound brought together, an operation which might be in place in certain cases, rather than enucleation, and we must then decide between the two. The disadvantages are the long time consumed in recovery, the probable subsequent pain, great swelling during suppuration, and the possibility that even *then* enucleation of the stump must be practised, as I

have been obliged to do where I have found traumatic or artificial sinking has occurred. On the other hand, we may get good union of the sclerotic and no great pain or swelling. But the stump remains a doubtful source of irritation.

Prof. Knapp,[36] of Heidelburg, has quite recently proposed a modification of this operation which may prove of very great service. He passes the needles through the conjunctiva *alone*, above and below, and by drawing it together closes the sclerotic wound, thus avoiding any chance of sympathetic irritation of the other eye, which the continued presence of stitches in the sclerotic may produce.

I will at once answer the question which may arise, by saying the false eye will move nearly if not quite as well and sometimes even better, bedded on Tenon's capsule, than if resting on a stump *which it may possibly irritate.* I may say, I have seen the muscles move the capsule sufficiently to deceive at first glance, even an oculist, as to whether the eye was false or not. But the point is just here, and it must be kept steadily in mind. The capsule will move the artificial eye well enough, and the stump, if composed of any part of the cornea or ciliary region, is never safe from the danger of producing sympathetic irritation.

In the adult, when the features, the bones and soft parts have reached their fullest development, an objection to enucleation does not apply to the same extent as in the young. The objection is this, and I would dwell upon it because little if anything will be found in regard to it in the ophthalmic literature which you will meet. After enucleation of the globe by the method proposed by Bonnet, the orbital fat seems to become absorbed, allowing the muscles and Tenon's capsule to sink in more than natural, and more than when a stump or portion of the globe remains. When done in youth before the bones are perfectly formed, or perhaps even afterwards, the osseous tissue about the orbit seems also to

shrink, giving a different outline and feature to this compared with the other side of the face. The expression is peculiar, making the patient on that side look as if thinner or not in good health, to which the bright cheek and lips give the denial. This I have seen so marked, that it always arises to my mind in deciding whether to enucleate the globe or abscise the anterior portion of it, and I have in the young chosen the latter simply on these cosmetic grounds, otherwise enucleation is greatly to be preferred, removing as it does all source of irritation which has called for the operation.

That the laity may better understand the necessity, simplicity and effectiveness of enucleation, by being taught through you to no longer dread it as something terrible, to be avoided till the last, is, as I have said, the purpose of this paper. It remains, therefore, to show when and why we ophthalmologists employ it.

Enucleation may be needed simply to get rid of an enlarged or staphylomatous globe which the lid will not cover, or which we desire to remove to give place to a false eye; or, as a prophylactic operation, to subdue or prevent sympathetic inflammation in the other eye. Years ago (1802) Beer, and afterwards especially Himly in 1843, noticed and laid stress upon the fact, that continued irritation or chronic inflammation of one eye caused its fellow to sympathize. Græfe,[18] Arlt,[19] Bader,[20] Muller,[21] and Augustine Prichard[22] of Bristol, have since then given us their special studies of sympathetic irido-choroiditis, so that at present it is as recognized as dreaded by the ophthalmologist. Trouble in the sound eye does not commence, as you might suppose, in the retina or nerve or choroid, but in the uveal tract, and gradually extends back from there towards the posterior part of the globe. A patient with an injured or inflamed eye will have, in the other sound one, intolerance of light, sensation of fulness, even perhaps perceptible to the touch,

inability to use the eye, fatigue of accommodation and contraction of the range of accommodation, long before he may apply to the surgeon, who at once recognizes this insidious sympathetic irritation from the other eye. I do not propose here, however, to discuss sympathetic inflammation, except so far as regards the removal of the injured or inflamed eye, to control or avoid it.

It is rather curious that the idea of destroying an injured or inflamed eye to prevent its acting on the other, comes from veterinary surgery. This in the horse was at first done by pushing a nail into the globe or putting lime between the lids; afterwards by Wardrop, in a less cruel manner, by opening the globe. Credit is due the English for first having proposed destruction of one eye to save the other from sympathetic trouble, and formerly the same method was used as in the horse by Barton,[23] Crompton and others. Græfe destroyed the eye by passing a thread through the sclerotic and cornea, or through the ciliary body. Walton and Taylor, as Dr. E. Williams, of Cincinnati, above quoted, preferred to cut away more of the cornea, to remove if necessary an old cataract, results of exudations, foreign bodies, &c. Now it is curious to see, that notwithstanding the knowledge which then existed of Tenon's capsule, its being repeatedly brought into notice, and even enucleation within this membrane having been distinctly proposed and to a small extent practised, yet ophthalmic surgeons did not commence the employment of this method of removing an injured or inflamed eye to save its fellow, till Mr. Critchett[25] in 1851, probably from seeing how successful enucleation was when practised for tumors, staphylomata, &c., and how well the false eye set and moved in the cup of the capsule, proposed and carried out this operation in preference to others for sympathetic irritation, and, as Prof. Græfe said in 1857, its practicability and success were at once established.

Again, in 1860, he says, practitioners ought to understand enucleation better than they do, for they seem to have a sort of dread of it, as if dangerous to the other eye, and as though it was a severe and bloody operation. The success attending Mr. Critchett's operation of course led other English ophthalmic surgeons to follow him, and enucleation soon became so frequent in London practice as to astonish the French and German schools, and naturally excite their opposition, which was perhaps fortunate, as the whole subject of enucleation for sympathetic trouble has in consequence been now thoroughly discussed, and the results carefully weighed and considered, so that we already have some definite laws to guide our decision.

The more this operation has been used by surgeons at the great centres of ophthalmic practice and clinical study and teaching, the more strongly do they speak of its value, simplicity and necessity. A few quotations from the highest authorities in the English, French and German ophthalmic schools will here be directly in place, and probably have their due weight.

Dr. Bader,[26] of London, says, "The facility with which enucleation is performed, its great freedom from risk, and the adaptability of an artificial eye, ought to make us consider a disorganized eye, which is the seat of pain or annoyance, as a foreign body whose removal the sooner it is accomplished the better. If not painful at the time it is a deformity, and is liable at any time of ill health to become the seat of inflammation, and affect sympathetically the opposite organ. It is not only unwise, but incorrect to bring before the patient's imagination the idea of 'taking the eye out,' and omitting the scientific advantage of excising; medical men must soon learn to value the operation."

Mr. Jonathan Hutchinson[27] says, in regard to enucleation of the eyeball even during the acute stage of traumatic pan-

ophthalmitis, "Whenever I am satisfied that an injured globe is utterly lost, I always advise its excision without loss of time. By adopting this course the patient's suffering, often extreme, is at once put an end to, and I think, also, the risk of sympathetic inflammation of the other eye is avoided. I have excised globes in all stages of inflammation, and have never seen the slightest ill consequence, whilst the patients have invariably been most grateful for the complete relief afforded."

Mr. Critchett, at the Ophthalmic Congress at Heidelburg, in 1863, says:—1st. That injuries which cause sympathetic ophthalmia are those which occur in the ciliary region. 2d. The effects of such inflammations differ in important points from those dependent on the other forms of iritis. 3d. Local or constitutional remedies have as little beneficial effect on the eye as surgical interference. 4th. Operation must be suspended till all inflammation is gone by, and even then a doubtful prognosis must be given. 5th. In view, therefore, of the uncontrollable inflammation and the danger of total blindness, it may be perhaps safer, when injuries have affected the ciliary region and threaten long irritation, to enucleate the injured eye before signs of trouble appear in the other."

From the Franco-German school Wecker[28] says, "It is vain to attempt to substitute iridectomy or section of the optic nerve for enucleation. There is no longer any doubt of the necessity of removing an eye which is lost, as soon as it becomes dangerous to the other. The only question arising is in reference to the case itself and the time when recourse must be had to enucleation. We are forced to enucleate: 1st. Whenever one eye remaining sound, the other is the seat of intolerable pain which, not yielding to remedies, makes us fear for the sound one. 2d. In every case where a lost eye has given rise to sympathetic irido-choroiditis in the other, no matter how slight, for this is our only means

of controlling it. 3d. In every case where the eye, till now sound, has become in any degree amblyopic, its range of accommodation rapidly diminished, intolerant of light, or incapable of prolonged use; these symptoms often being the precursors of irido-choroiditis. Enucleation will be all the more urgent when careful examination cannot find for these troubles, either in the eye itself or in the general condition, other cause than this sympathetic influence in question. Under all circumstances when in doubt, it is better to operate too early than too late, for we may find enucleation useless after sympathetic irido-choroiditis is fully established."

From the various ophthalmic clinics of Germany we also have concurrent testimony. Græfe's[18] and Arlt's[19] results and observations I have already quoted. Pagenstecher, at Wiesbaden, found enucleation necessary from the following causes:—

1st. Traumatic irido-choroiditis occasioned by
- (a) Lesion of the iris, resulting from its being nipped between the edges of the wound.
- (b) Lesion of the choroid.
- (c) Suppurative choroiditis, or suppuration in the vitreous.
- (d) Presence of a foreign body in the eye.
- (e) Lesion of the capsule of the lens.
- (f) Choroiditis after reclination, or depression of the lens.

2d. Incipient exudative irido-choroiditis and hæmorrhage from the choroid.

3d. Processes leading to staphyloma (choroiditis serosa).

4th. Extensive separation of the retina.

5th. Tumor developing from the choroid or sclerotic.

6th. Formation of bone within the choroid.

Let me here add one more testimony from Dr. Mooren's[30]

clinical experience for eleven years with 32,000 patients in Düsseldorf. He says, "The causes of sympathetic disease, according to my observation, may be divided into three distinct groups. 1st. Direct injuries of the ciliary region. 2d. Mechanical irritation of the ciliary body, whether by the action of a foreign body (wearing an artificial eye), or by the lens turned into a foreign body by displacement, reclination, luxation, staphyloma, etc. 3d. Every inflammation of any part of the uveal tract, when by cyclitis it has reached its culminating point." And finally, as do all other authorities, Dr. Mooren gives, "pain upon pressure in the ciliary region as the never-failing symptom which pointed to and proved danger from sympathetic disease. When this is present, the only possibility of saving the second is by enucleation of the first affected eye."

To the above I would add the testimony of my own experience in ten years of ophthalmic practice in this community. In the medical literature of this country you will find reports of successful cases of this operation, coming from the scientific ophthalmologists of our larger cities, who strive to avail themselves of the sound sense of the English, the élan of the French, or the patient industry and scientific attainments of the German surgeons in this specialty.

I trust, therefore, my efforts have succeeded in proving to you that enucleation of the eyeball from within the capsule of Tenon, is un anatomical possibility, a surgical necessity and a powerful prophylactic remedy.

Note. This paper having been intended for a large State Medical Society, will explain to my brother ophthalmic surgeons why no comparison is made with simple iridectomy, section of the optic nerve, or of the ciliary nerves.

THE accompanying wood cuts are from photographs of a diagram and dissection exhibited to the Society when the paper was read.

Fig. 1. The lids are slit up vertically, and the four flaps turned back. The conjunctiva dissected off and strings passed under the tendinous insertion into the sclerotic of the external, internal and inferior recti muscles, just as they would be lifted on the hook to be cut in operating for squint. A needle is passed under the tendon of the superior rectus, which is seen to pass to the capsule of Tenon, showing itself between the upper half of the globe and the upper lid, from both of which it is freed. In a single wood cut it is of course difficult to give a more definite view of a minute dissection.

Fig. 2. Represents in *diagram* a vertical section through the orbit and eyeball. The heavy dotted line shows the fibrous lining of the orbit, which at the anterior upper and lower edge passes off to the lids, and also backwards to the globe which it surrounds to the optic nerve, thus forming Tenon's capsule. A layer behind runs over the nerve to form its sheath, and in front a prolongation extends forward to the conjunctiva. The superior and inferior recti muscles are represented, and where their tendons pierce Tenon's capsule to become attached to the globe. It will thus be seen that cutting the tendons of the muscles at their insertions, and the optic nerve, releases the globe and leaves Tenon's capsule like a cup for an artificial eye to rest on and be moved by the muscles.

Fig. 1.

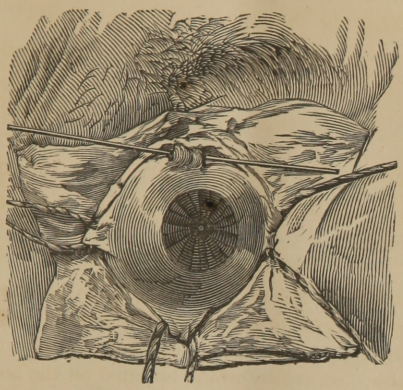
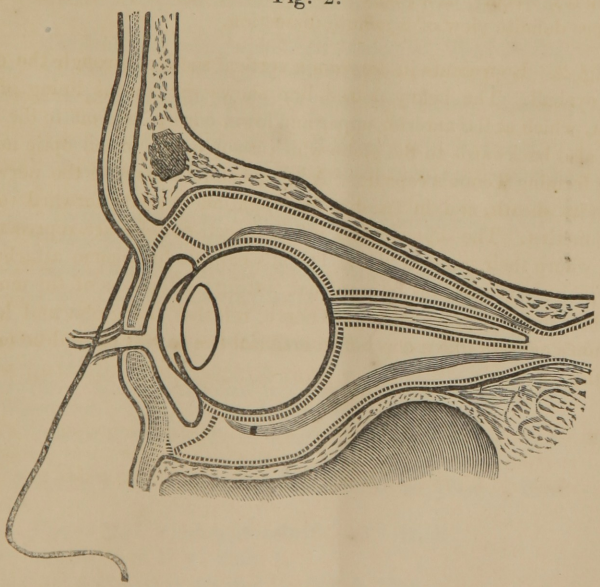


Fig. 2.



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SECTION OF THE CILIARY NERVES AND OPTIC NERVE.

Dr. Rondeau, in a pamphlet published in 1866,* on sympathetic ophthalmia, says, in concluding:—"In studying the pathology of the secondary lesions which occur in an eye subsequent to injury of its fellow, in considering the intractable nature of the affection, its insidious and intermittent march, we notice the striking analogy between neuralgias and so-called sympathetic ophthalmia. No affection is so rebellious to medical treatment, and when in facial neuralgia all our therapeutic remedies are exhausted, we often have recourse with success to section of the nerve, and if this does not suffice, to excision of a piece of the nervous trunk. Not yet having clinical facts to rely on, I can but express the opinion that the same treatment is applicable to sympathetic ophthalmia. It is often difficult to make the patient comprehend, in an affection so slight in appearance, the danger of his situation and the necessity of removing the eye. He hesitates, and, waiting till the eye becomes enfeebled to the last degree, re-appears to confirm the surgeon's prognosis. When, finally, he decides upon an operation, the changes in the globe have often so far advanced as to insure but a limited advantage from enucleation of the injured eye, if he is not already condemned to incurable blindness. The first indication in this disease is to act as promptly as possible, in order to prevent the changes of secretion and structure consecutive upon reflex troubles of the circulation."

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* Des Affections Oculaires Réflexes, et de l'Ophthalmie Sympathique. Paris. 1866.

"Break the nervous chain necessary to the accomplishment of the changes which constitute reflex action; divide the sensitive nerve, or destroy the ganglionic centre, or divide the recurrent nerves (électromoter), any one of these lesions, the breaking of the chain at a single point, is sufficient, and all re-action, all sympathy between the organs ceases."*

Dr. Rondeau then goes on to say :—"Nothing is easier than this operation, which I have several times practised in the amphitheatre. It consists in making a small opening through the conjunctiva at the upper and inner part, and introducing a slightly curved tenotomy knife, to be kept close to the globe. We divide, at the same cut, the ciliary nerves, the optic nerve and the central artery. The advantages and disadvantages of this operation are these: It is very simple, and as the patient has much less dread of it than enucleation of the globe, he is less reluctant to submit to it earlier. It serves the same purpose as enucleation in breaking the continuity of nervous tissue. Section of the optic nerve, it is true, destroys vision in the eye; but as in the majority of cases vision, if not lost, is greatly reduced, it is better at once to sacrifice the eye becoming useless, and which may endanger the other.

"In animals, this section of the nerve does not cause hæmorrhage to be dreaded; we only cut vessels of small calibre, the ciliary arteries and the central artery of the retina, the hæmorrhage ceases quickly, so that the blood does not exercise any injurious pressure on the nerves we have cut.

"If this section does not avert the progress of the reflex trouble in the sound eye, we must at once enucleate the affected one. Experience will decide on the value of this operation."

In the Memoirs of the Vienna Academy, 1864, Dr. B. Rosow gives two ophthalmoscopic pictures of the eye of a rabbit, before and after section of the optic nerve. From

* Leçons sur le diagnosie et le traitement des principales formes de paralysie des membres inferieurs. Par Brown-Séquard.

his experiments carried out in the Physiological Institute of the Vienna University, he draws the following deductions: 1st. "Section of the optic nerve (in rabbits) when unaccompanied with accidents (disturbance of the retinal circulation, severe inflammatory reaction), does not cause, as formerly supposed, such rapid fatty degeneration of the fibrous layer of the retina. In one case, he found the largest part of the fibres perfect after one hundred and forty-two days. This is more than time enough for fatty degeneration to take place in other nerves separated from the central system. In another case, after one hundred and seventy-eight days, well-preserved nerve-fibres were found, although few in number. 2d. The causes which destroy the fibrous layer of the retina have no injurious effect on the other retinal elements; from which we may conclude that the vitality of these elements is entirely independent of that of the fibrous layer."

We mention these results of Dr. Rosow because they may throw some light on the question of the usefulness of section of the optic nerve in man. The Journal has lately noticed this as a new operation spoken of by Prof. Graefe as a remedy for subjective luminous sensations, and as he has changed his views as regards its applicability in sympathetic ophthalmia, we quote the following from the report of the Ophthalmic Congress at Paris last year:—"I have at times recommended the substitution of this operation for enucleation to counteract sympathetic ophthalmia, but experience and more mature judgment of the subject have soon shown its inapplicability. It is undoubtedly through the *ciliary* nerves that sympathetic ophthalmia is communicated, and section of the optic cannot therefore serve to cure it.

But there is another order of symptoms besides pain, and which in the class of special sensations is also dependent upon the optic nerve. I mean the subjective luminous sensations remaining after the loss of the eye, and accompanying certain forms of blindness; for instance, in detachment of the retina after irido-choroiditis, and when there is calcareous deposit within the globe, we often have subjective sensations

very distressing to the patient. They have spectral coruscations (photopsia) tormenting them day and night, and we even find these followed by cerebral hallucinations, due to irritation of the brain from communication with the optic nerve.

Section of the optic nerve seems indicated under other circumstances also than these photopsic phenomena observed with the blind. I mean where there are intraocular tumors. It is well known that the trunk of the optic nerve is particularly liable to propagate degeneration (sarcomatous or carcinomatous) to the parts outside the eye. Microscopic examination of the cut surface of the nerve after enucleation often shows us that it is already here affected, although the interior of the globe may be but partially filled with the tumor. In such a case the insufficiency of the extirpation will be apparent, and we shall soon have a return or the development of the tumor from the orbital part of the diseased nerve. If we are prompt enough in ascertaining that the cut surface of the nerve is diseased, the free end of the nerve must be cut off immediately after enucleation. This, however, is very difficult to do, and we cannot reach the remaining portion of the nerve in the orbit without extending our dissection in a dangerous manner. It is, therefore, more prudent, in cases of intra-ocular glioma, sarcoma and carcinoma, to first divide the optic nerve beneath the conjunctiva, and this as far back as possible, then proceed to enucleate. We shall thus have some third of an inch of the nerve with the globe, which we shall be glad of having effected if the cut surface proves healthy, whilst nearer the globe the nerve is found diseased.

Method of Operating.—We penetrate the orbit, or rather the cellulo-fatty tissue, by puncturing the cul-de-sac of the conjunctiva at its outer side, whilst the globe is drawn forcibly forward. The instrument used is a very strong tenotomy knife, moderately curved, which must follow the external wall of the orbit till the point is far enough advanced to cover the optic nerve. The latter being stretched by the position

given to the globe, is readily presented to the concave cutting edge of the knife, and divided according to the rules for subcutaneous section. The distance of the section from the globe may be greater or less, as we choose. It is more readily made about one fourth of an inch behind the sclerotic, but can be carried within a few lines of the optic foramen.

I performed this operation with success in a case where blindness had lasted fourteen years. I observed, at the time, the difference between the character of the *retinal* hallucinations, as we notice them, and the *cerebral* hallucinations properly so called. In the first, simple figures are seen, geometric, so to speak; in the latter appear all the products of the imagination and the memory."

It seems pretty definitely settled that sympathetic irritation is conveyed by the *ciliary* nerves and not by the optic; section of the latter, therefore, would be confined to such cases as Graefe speaks of. The knife sent me by Lüer, of Paris, for this purpose, has a shaft about two inches long, and the blade, but slightly curved, five sixths of an inch long. Its use, of course, necessitates perfect familiarity with the anatomy of the orbit and the relations of the soft to the hard parts.

Prof. Graefe, having convinced himself of the action of the ciliary nerves in conveying sympathetic irritation, proposed, in 1866, in the *Archiv für Ophthalmologie*, the section of these nerves locally, where pain was produced by pressure on the sclerotic over them. The operation was, however, practised for the first time in May, 1866, by Dr. Ed. Meyer, who translated into French Graefe's "Clinical Ophthalmology." In the September number of the *Annales d' Oculistique*, Dr. Meyer reports three cases operated on, the method of doing which latter I translate from this piece. "Having determined on the place, painful to the touch, where section of the ciliary nerves is to be performed, we lift up and cut a fold of the conjunctiva near the edge of the cornea, just as in the operation for strabismus. Then, with blunt-pointed scissors, we separate, to the extent determined n in the plan of

our operation, the cellular tissue uniting the conjunctiva and sclerotic. The eye is now fixed by a strabismus hook passed under the nearest rectus muscle; we thereby also determine the place of insertion of the tendon of this muscle. Holding the hook in the left hand, we puncture with Graefe's narrow knife the sclerotic in the ciliary region, obliquely to its surface, avoiding the crystalline lens. The counter-puncture is made so that when the cut is finished we shall have a linear wound parallel to the border of the cornea, in which the vitreous immediately presents. We then carefully remove the hook, and turn back the conjunctiva towards the cornea. Suture of the conjunctiva has not seemed to us of any real advantage; there is, however, no difficulty in applying it. The edges of the sclerotic wound remain several days ununited, and in one case we were obliged to cut off the vitreous on the third day, and apply the compressive bandage more than a week. There is very moderate reaction after the operation, and only rest needed, unless pain or sleeplessness call for subcutaneous injection of morphine on the temple, and the compressive bandage. Of three eyes operated on in this manner, one, which had already commenced to atrophy before the operation, continued to do so completely afterwards; the other two retained their normal shape."

Time must prove whether this section of some of the ciliary nerves, namely, those shown to be implicated by pain upon pressure over them, will not supersede enucleation of the globe otherwise indicated to prevent insidious sympathetic ophthalmia. Being forced to wear an artificial eye entails considerable expense upon the patient, and I have too often seen constant trouble from the best made and most perfect fitting one. I therefore look with much interest for the results of the operation as now practised at home and abroad. When, however, this is unsuccessful in preventing or subduing sympathetic ophthalmia, we have still left the certain remedy of enucleation of the globe, as I have fully shown in a late paper before the Massachusetts Medical Society.

SOME UNNECESSARY CAUSES OF IMPAIRED VISION.

It is already several years since Professor Donders unhesitatingly declared that a near-sighted eye was a diseased one. His studies of refraction and accommodation are now, so to speak, the classical literature of this specialty. It is the duty of all ophthalmic surgeons to render them of service to the communities in which they live, by continually bringing before their professional brethren the necessity and value of a thorough scientific investigation of the refractive condition of every eye not perfectly normal. For it is in this way alone the laity can be brought to recognize the need of applying to the professional specialist, to have errors of refraction or accommodation corrected by the means modern science has placed within our reach. This seems so self evident that it might at first sight be regarded as needlessly said; but how many people here in New England, either of their own accord or perhaps directed by their family physician, purchase spectacles at the village clockmaker's, the village toy-shop, or of the travelling pedlar and the peripatetic quack oculist! Naturally it will be a long time before our community learns that it is not a necessary part of every watchmaker or repairer's business to keep on hand and sell spectacles, which, according to his degree of honesty or "brass," he advertises as "helps to read," or "restorers of sight," &c. The amount of injury done by this special form of quackery is not generally known, but abundantly proved by the daily records of the eye infirmaries of our larger cities. Oculist and optician are regarded as synonymous terms by nearly all classes of the community, and ophthalmic surgeons fail in their duty

if they do not teach their medical brethren and through them the community that an ophthalmic surgeon alone can make a proper and correct examination of the human eye, and decide what glass, and whether any, should be worn by the patient, and the *optician's* business is confined entirely to preparing and setting in a proper frame the glass directed by the former; exactly as an apothecary compounds and puts up the medicine prescribed by the physician. An honest and intelligent optician would no more think of substituting another for the glass written for by the surgeon, than the druggist would of altering the physician's prescription. Now we do not suppose that any amount of teaching or explanation will ever prevent a certain class of the community from applying to those who sell spectacles and allowing them to choose for them, any more than we suppose that apothecaries and druggists will cease to be applied to for "something good for summer complaint," "a cold," "children's fits" or "liver complaint," or cease to sell the applicant the last quack compound. But that apothecaries *should* prescribe quack medicines we do not admit, any more than that watchmakers and jewellers, as a class, know anything about physiological optics or are competent to select proper spectacles for those applying to them. Moreover, we would unreservedly say from others' as well as our own personal experience, that the community would *save money* by *first* applying to the ophthalmic surgeon, and where that cannot be done, to the charitable eye infirmaries now established in our larger cities.

If the condition of things is such, as will be seen from what follows, in the land of Graefe, Arlt and Jäger, what is it likely to be in our country, where German scientific culture, its adherents and promulgators, are so commonly ignored, if not positively disbelieved, by the *family doctor?* So far as relates to the amount of light, the public schools of this city in particular, and of New England in general, are perhaps free from the evils to be spoken of. This is not, however, the case with the private schools which have increased in number so rapidly within the last few years. School committees

look after the former; but no one but *convenience*, and now and then an intelligent parent, after the latter. The public schools in this very city are, however, not free from defects that should be remedied, as we shall see further on.

The results of the investigation of the ophthalmic diseases of school children have appeared from James Ware, in Chelsea, England, in 1812; the authorities of Grand Duchy Baden, 1840; Sczokalski, 1848, Paris; Jäger, 1861, Vienna; and Rüte, 1865, Leipzig. Beger, in Saxony, has also studied the development and increase of myopia, and Farhner, in the *Wien. Jahrbucher Kinderkrankheiten*, 1863, vi. 3. But scientific research in this direction has lately been followed out so thoroughly and with such important results, as to merit the attention of every one connected with the education of the young, as well as the special interest of the ophthalmic surgeon. Vide also Guillame, Nuenburg, *Hygiène*, v. ii., Genève, 1860, and Coccius, *Der Mechanismus der Accommodation des menschlichen Auges*, Leipzig, 1868, p. 67.

Dr. Cohn, of Breslau, has recently carefully examined the refractive condition of the eyes of 10,060 children in the lower, middle and upper schools of Breslau and other places in Silesia. Besides this, he has examined 410 of the 964 students at the Breslau University in the winter of 1866–67, and from his publications of the first at Leipzig, 1867, the second in the *Berliner Klinische Wochenschrift*, 1867, No. 50, we gather the following results. We should premise by saying that Dr. Cohn was induced to undertake the task from finding, whilst at work on the statistics of some fifteen thousand patients of Prof. Förster's clinic, that out of the 750 near-sighted people who presented themselves within four years, 400 had applied on account of severe trouble dependent on myopia. Desirous of finding whether the refractive and other troubles of the eye were not induced by inadequate and improper light, badly arranged and badly planned school-desks, &c., he first examined the schools in Breslau, and, to avoid errors, afterwards those of other places in Silesia, not content till his lists contained over 10,000 records. His

example is fortunately now being followed by competent observers in various parts of Germany.

Dr. Cohn chose five village schools in Langenbielau, with 1486 scholars, and 28 city schools in Breslau, with 8574 scholars; of these latter, 20 were *elementary*, 2 *intermediate*, 2 *girls' high*, 2 where languages and science were taught (Realschule), and 2 *gymnasiums*. Among the ten thousand children, he found 1730 with defective vision, making 17·1 per cent., the average number *increasing with the degree of demand upon the eyes at school*. In the city schools there were four times as many children with defective vision as in the country. With regard to sex, boys 18·8 and girls 14·3 per cent. The relation of defective vision to abnormal refraction is shown by the following table:—

Normal eyes,	8330 =	83.
Abnormal refraction,	1334 =	13.
Other affections,	296 =	4.
	10,060 =	100.

Thus showing three times as many cases of abnormal refraction as other ophthalmic troubles in youth.

Of these abnormal refractions,

1004 were near-sighted.
10 myopes (parents also).
58 myopes (after previous disease of eye).
81 hypermetropic.
158 hypermetropic, with convergent squint.
23 astigmatic.

Hence we have myopia 12 times more frequent than hypermetropia, and 6 to 7 times more frequent than hypermetropia with convergent squint.

The following are deductions from his data in reference to near-sightedness.

1st. No school was without myopic scholars. 2d. The number varied greatly in the different schools. 3d. In the village schools very few (1·4 per cent.). 4th. In city schools eight times as many (11·4 per cent.). 5th. In the city ele-

mentary schools 4 to 5 times as many as in village (6·7 per cent.). 6th. Girls' high school more than the elementary (7·7 per cent.). 7th. In the city schools there is a steady increase of the number of myopes from the lower to the upper (elementary 6·7 per cent., middle 10·3 per cent., *Real.* 19·7 per cent., gymnasiums 26·2 per cent.). 8th. In the middle one tenth and more, in the *Real.* one fifth, and in the gymnasiums more than one fourth of the children are near-sighted. 9th. The number of myopes varies in the number of different village schools, never more than 2·4 per cent. (varying from 0·8 to 3·2 per cent.). 10th. In the several middle schools the number of myopes varies scarcely 3 per cent., in the *Real.* scarcely 2 per cent., in the gymnasiums not 4 per cent. 11th. In the girls' high school, however, the difference in number of myopes varies 7 per cent. 12th. This difference varies most in the elementary schools, from 1·8 to 15·1 per cent.

Let us follow now these young persons as they grow older.

As we said above, Dr. Cohn examined 410 of the 964 students at the Breslau University, without selection, however. Among these 410 not *one third* had normal eyes, and nearly *two thirds* were short-sighted. His data showed myopia to be the most frequent affection of the eye among students, and that it increased with the age, and number of terms of student life. The following table gives the average degree of myopia at the different schools, showing how steadily it increases. (The denominator of the fraction represents the focus of the concave glass required to correct the near-sightedness.)

In 5 village schools,	M. $\frac{1}{24 \cdot 4}$.
" 22 elementary "	M. $\frac{1}{22 \cdot 7}$.
" 2 middle "	M. $\frac{1}{21 \cdot 9}$.
" 2 real "	M. $\frac{1}{19 \cdot 6}$.
" 2 gymnasiums,	M. $\frac{1}{18 \cdot 7}$.
" 2 prima	M. $\frac{1}{17}$.
Among the students,	M. $\frac{1}{14}$.

The relation of myopia to *staphyloma posticum*, or bulging of the posterior pole of the eyeball, is shown by the follow-

ing, and confirms Prof. Donders's views above expressed. Of the 1004 myopic children, 200 had *staphyloma posticum*, the number increasing with the age. The *greater the degree* of myopia the more *frequent* is staphyloma, as this table shows :—

M. $\frac{1}{3\,5} - \frac{1}{2\,4}$	: 3	staphyloma posticum.	
M. $\frac{1}{2\,3} - \frac{1}{1\,6}$	: 17	"	"
M. $\frac{1}{1\,5} - \frac{1}{1\,2}$	: 48	"	"
M. $\frac{1}{1\,1} - \frac{1}{8}$	: 65	"	"
M. $\frac{1}{7}$	: 71	"	"
M. $\frac{1}{6}$	: 100	"	"

Yet exceptional cases occur, such as M. $\frac{1}{2\,6}$ *with* staphyloma, and, on the other hand, M. $\frac{1}{7}$ without it. M. $\frac{1}{6}$ was always accompanied with staphyloma.

With regard to hereditability, 24 boys and 4 girls = 28, had father or mother near-sighted—the mother 11, the father 17 times. The mother's myopia seems to affect the daughters, the father's the sons. From this it would seem that myopia is by no means so hereditary as it has been thought.

These data led Dr. Cohn to endeavor to ascertain what there was in the schools which originated or increased near-sightedness. He had taken the bodily measurement of these 10,060 children, and measured in comparison the school desks and seats, from which he found that all school furniture was badly constructed, so as to readily induce or increase myopia. From the furniture not being adapted to the body of the children, they are obliged to bend the head over forward, thereby hindering the return of the blood from the eye, and keep the print so near (3 to 4 inches) as to too greatly task the power of accommodation. Both of these, as we know, induce near-sightedness. Inadequate light and misplaced windows Dr. Cohn found greatly affecting the amount of myopia amongst the pupils of the school, as also inadequate and badly arranged artificial light where used.

Let us see now how it is with the *spectacles* of these near-sighted youths of both sexes, even in the land from which almost all our knowledge of refraction and accommodation of the human eye comes. Dr. Cohn found only 107 wearing

glasses. Of these only 8 had been ordered by a physician, the other 99 bought by the children upon their own selection. Some had changed the glasses prescribed for them by a physician for stronger ones. Of the 107 only 26 neutralized the myopia, 41 were weaker, 40 stronger than the myopia. But 11 out of the number had concave glasses that were not injurious. Well might Dr. Cohn say, "If I accomplished nothing else by my whole labor than that hereafter no scholar wore a glass except by the ophthalmic surgeon's advice, I should feel amply rewarded."

Now let us see how it is with hypermetropia or over-sightedness, comparatively recently recognized as a fertile source of impaired vision. Only the manifest, namely that which could be ascertained without the use of atropine, was determined. Of the 10,060 children, 152 boys and 87 girls =239 were over-sighted. Very differently from myopia, no increase of hypermetropia was found with increase of age or number of school terms. It varied between $\frac{1}{60}$ and $\frac{1}{8}$. Only 9 children wore convex glasses, generally strong ones, by physicians' directions. One hundred and fifty-eight of the 239 hypermetropic children squinted inwards. Among the students examined Dr. Cohn found only 15 hypermetropic, varying in degree from $\frac{1}{60}$ to $\frac{1}{8}$.

Dr. Cohn also found convergent squint in 64 children who were not hypermetropic, in 19 of whom it was complicated with other troubles which may have produced it. But in 45 cases it was unassociated with any anatomical or refractive anomaly, and 35 of these children squinted periodically, the other 10 permanently. These facts especially excited Dr. Cohn's attention, and he sought the cause. The amount of squinting struck him at once upon entering the rooms of *certain* classes. In one of the elementary and one of the girls' high schools there were quite a number of hypermetropic scholars who squinted in consequence, and Dr. Cohn thought whether or no others who squinted periodically did not do so from imitation. This, as it seemed very doubtful and is disbelieved by many competent observers, he was not disposed to admit, till observation showed it to be true. In examining

one of the girls' schools he could find no explanation of the large number of scholars who squinted without cause, that is, who were not hypermetropic, &c. One of the teachers, however, he found, squinted periodically, although her eyes were normal. She attributed the cause of it to a game much in vogue in the school, which she herself had but lately ceased playing. Many of the children every day in the recesses amused themselves by holding the fore-finger at a distance and then bringing it up close to the nose to within two inches, keeping the eyes fixed upon it. Then they removed the finger and strove to see which one could longest keep the eyes turned in. Upon further examination he found that those who squinted without cause had in this manner actually acquired the habit.

In a hundred cases of strabismus convergens, Dr. Cohn found 71 hypermetropic, 8 with other affections, and but 21 without other trouble. Granting these latter to have perhaps acquired it from imitation, we have out of 100 cases of squint, 71 dependent upon hypermetropia, thus confirming Prof. Donders's expressed views. It is with the medium degrees of hypermetropia that squint becomes associated.

How is it now with another cause of impaired vision which properly constructed glasses can correct, namely astigmatism or unequal curves of the different meridians of the cornea? Dr. Cohn found 23 astigmatic children, and only *one* wearing a cylindrical glass to correct the trouble, ordered of course by an ophthalmic surgeon.

Now then comes the question, whether any of these causes of impaired vision can be prevented or removed. If so, certainly it is our duty to teach the community what they ought to do, and how. First, then, in regard to near-sightedness. Prof. Donders said, "the cure of myopia belongs to the *piis desideriis*. The greater our knowledge of the causes of this anomaly, the less seems even any future hope of our curing it." For Dr. Cohn says, we cannot shorten the too long axis of the eye, or reduce the bulging of the posterior pole of the globe. But we can do a great deal to prevent near-sightedness developing in those prone to it, and check it where pro-

gressive; by adequate illumination, natural and artificial, not forcing the scholars, proper type and impression, and, most of all, by seats and desks appropriately constructed. We sent from America with considerable pride our school furniture and appurtenances to the World's Fair. These were carefully examined and measured by Dr. Cohn, and like *all the others, found so arranged as to produce these evils we are speaking of,* as he has shown in the Berliner Klinischen Wochenschrift, No. 41, 1867, under title, "The school-houses at the Paris Exposition from a hygienic point of view."

With reference to the necessity of wearing proper glasses to correct near-sightedness the community seem totally ignorant; and as little appreciate that the ophthalmic surgeon *alone* can choose these properly. We regret here to add that our experience proves that a large number of practising physicians share the ignorance and prejudice of the laity.

Dr. Cohn found 9 only of the 239 hypermetropic or oversighted children wearing glasses. Yet as he says, the sooner (even at six years of age if necessary) we give the hypermetropic a proper convex glass, the less will his power of accommodation be strained and injured. And here we cannot resist quoting the following, for it is perfectly applicable to our community:

"The hypermetropic child who has found his seeing difficult, or almost impossible, and notwithstanding repeated injunctions laid his head again upon his book, puts on unwittingly his grandfather's or grandmother's spectacles, and suddenly can now see clearly and without effort the finest print at the usual distance, asks therefore to be allowed to wear them. But the parents' fear of spectacles for young children prevents his having these so very important assistants for his work, no physician is questioned, and the child is forced to compensate for the refractive error of his eye by calling upon his whole power of accommodation."

Probably 90 per cent. of the cases of convergent squint are due to hypermetropia. But we know, as Dr. Cohn says, "An eye which squints a long time gradually loses its power of seeing, because it does not exercise vision with the other,

just as the left hand is generally weaker than the right because it is less used. This is a long-known fact that should induce every teacher to prevent the scholar's squinting. Among 135 cases of permanent squint, the power of vision in the turned eye was reduced in varying degrees. We call V. (Vision) equal 1, when a type, which a normal eye can read at 20 feet, can be deciphered at this distance. If it can only be read at 10 feet then $V=\frac{10}{20}=\frac{1}{2}$, &c. Correcting any near or over-sightedness with proper glasses, and then letting the eye armed with them read the type where it can, and we shall, if this distance is less than normal and there is no disease of the several parts of the eye, have proof that the retina is less sensitive to impression, *which is exactly the case with squinting eyes.*"

"So surely as squinting is caused by hypermetropia, so surely is it alone cured in the first stage, periodic squint, by wearing convex glasses, which neutralize the over-sightedness. If, however, the squint has become permanent, the internal straight muscle of the eye that caused the convergence becomes shortened, and soon the antagonistic muscle which turns the eye in the opposite direction is weakened and no longer able to perform its function. Hence an eye which has long turned in, finally cannot be turned out again.

"With permanent squint the correcting glasses no longer avail. Only an operation can help the patient, namely, cutting the shortened muscle of the squinting eye, when it becomes attached further back on the globe and acts then as if it had been lengthened. This operation is so perfectly safe, simple and rapid of performance, that the earlier done the better, not only to remove the deformity of the squint but to *improve the power of sight.* For as soon as the eye which has squinted resumes its motion with the other, it wholly or in part recovers its power of vision. Of the 114 permanently squinting eyes *not one had been operated on.* And not one of the 44 periodically squinting wore a convex glass. These eyes will therefore, if nothing is done to prevent the squinting, assuredly lose a considerable power of vision."

Still further, Dr. Cohn found 23 astigmatic children, only

one of whom was wearing cylindrical glasses, and he says, "The astigmatic patient who after long searching at the optician's does not find any glass to suit him, is rejoiced to suddenly see everything clear and plainly through a cylindrical glass." A distinguished ophthalmologist, Dr. Emile Javal, of Paris, who has specially studied impaired vision from astigmatism, and is himself the subject of it, said in the *Annales d' Oculistique*, 1865, "Cylindrical glasses have completely changed my existence; before using them I was obliged to forego all work at night, but now I read, so to speak, indefinitely by the light of a single candle." Now astigmatism does not increase with age and is almost always congenital; proper glasses, which can only be selected by a scientific ophthalmic surgeon, correct the difficulty and greatly improve vision. It is true, such selection requires long and patient examination, but the improvement of sight amply repays the time given by both physician and patient.

Finally, does all here said in reference to school children and students apply to our community? We believe from personal experience that it does, and that such extended researches as Dr. Cohn has made, if here undertaken, would prove it beyond doubt. A higher standard of education is being steadily demanded and striven for, and can be gained only by taxing the eyes more severely. It would certainly seem therefore the duty of parents, as well as all interested and occupied with the education of youth, our Boards of Education and School Committees, to assure themselves that they are doing all in their power to avert what even the community generally recognize as a growing evil, namely, the graduation of a large number of highly educated young men and young women with permanently impaired vision from unnecessary causes.