

saddle-bags, he took out his needle and reclined the lenses as the former servant turned his face upward in perfect confidence in his old master. The old servant, delighted with the result, expressed his gratitude, and master and man went their respective ways. Fifteen years later the aged and now decrepit negro came to Dr. Risley's clinic almost blind. The opaque lenses were bobbing about in a fluid vitreous which was full of opacities. When these subsided somewhat a study could be made of the fundus which showed one of those always remarkable pictures of atrophic choroiditis. Dr. Risley believes that this is what usually takes place from the presence of a reclined lens in the globe. He has seen it over and over again after dislocation of the lens as the result of accident. There is a slow choroiditis and gradual destruction of the eye through degenerative processes caused by the lens acting as a foreign body.

DR. F. T. ROGERS said that he appreciated as well as anyone the dangers from glaucoma and other secondary changes, but if called on to decide what is to be done for a man in this condition he is sure that nearly all would consider this operation seriously. He thinks that Dr. Risley's case of the old negro is not a good argument, because the man might have had a choroiditis before the operation and the immediate vision might not have been much better than when Dr. Risley saw him. The patient's statement can hardly be considered as accurate.

EYE STRAIN.

LEWIS S. DIXON, M.D.

BOSTON.

The subject of eye strain, including the need for wearing glasses, has for some years been rapidly forcing itself into prominence and has assumed an importance far beyond any expectation. It is in no sense a fashion or fad, though there are many such in medicine. The eyes are, and have been in the past, the unsuspected cause of a great variety of nervous disturbances that were never understood and never satisfactorily explained. Modern methods of study, which have lately accomplished such wonders in all branches of science, when applied to the eye have brought order and truth out of what had been a tangle of theory, supposition and uncertainty. The eye has always been studied simply as a part of the body, under physiology; it needed to be studied as an optical instrument, under optics, a branch of science in which our knowledge is mathematically accurate. Strange to say, it has always been considered a satisfactory explanation, when eyes are painful, weary, dreading light or close work, to say that they are weak, and that the proper treatment is to rest and to avoid using them.

No organ of the body should fail to perform its own particular function or show difficulty in its performance unless something is out of order; the proper thing to do is not to give up its use, but to find the trouble, to correct it if possible, and to restore the organ to usefulness. Many people use their eyes almost constantly on fine, close work without a thought or a twinge of pain; they have normal eyes. Many others find more or less fatigue or trouble, even from very moderate work, and are compelled to give up the use of their eyes, even though they may see well. These people have abnormal, imperfect eyes, even though they have good, clear vision. It is not, therefore, the amount of work done that causes the pain and fatigue, it is the kind of eyes with which the work is done.

The value and usefulness of every optical instrument is well known to depend primarily on the exactness of shape of the lenses and on the accuracy of their position; and every instrument, though built to be correct

for general use, has to have some means of adjustment, to focus or to adapt it to the varying conditions of light and distance. The eye is a camera, with its lens inside; the pupil the stop, or diaphragm; the eyelids the shutter; but instead of a plate or film to take each picture, it has the retina, or expanded optic nerve, ever ready to feel and to convey to the brain countless pictures in constant succession. It also has its adjusting power; not a screw nor a draw tube, but the delicate ciliary muscle, which acts on the lens and changes the focus according to the nearness of the object looked at, but which is not needed for distant vision. Being an optical instrument, the eye can not escape the fixed law of optics, the necessity for extreme accuracy in the original shape and position of its parts.

We know that all parts and organs of every living body vary much in size and shape and that many differ greatly from what is known to be the typical or perfect shape. Unfortunately, the eye is no exception. Since instruments have been invented to make accurate measurements, it has been found that the eye varies as much as everything else. Each person is born with his own pair of eyes; sometimes they are correct, oftener not so; often they are not alike and can not work together properly. If the eyes are not optically correct they are made correct so far as possible by using the ciliary muscles. The baby rapidly learns to do this, and grows up seeing very well because he works and corrects his errors. Since the errors are always there, however, and must always be corrected before he gets any clear vision, he is compelled to keep his muscles at work all the time if he wishes to see clearly. Though muscles are made for work and grow strong and healthy from it, rest in proper quantities and at frequent intervals is equally essential to their health and strength. Muscles tire if kept at work too long, and the more tired they become the greater the amount of nervous force required to keep them at work, and the sooner they become exhausted. The normal eye rests when looking at a distance, but eyes of faulty shape have their errors to correct even in distant vision; so they get no rest anywhere. It is not, therefore, the reading, writing or sewing (which is proper work for good eyes) that is responsible for the fatigue and eye strain; it is being compelled to do this work with imperfect eyes.

If variations in eyes are so common, and constant strain is present in so many people, why do they not all break down and show serious trouble? Because there are secondary influences that also have to be considered. First, muscles tire much more quickly with hard work than with slight work; one can carry ten pounds much longer without fatigue than a hundred. It is a law of optics that the work required of the adjusting power increases very rapidly as the object we look at comes nearer. A certain amount of effort of the ciliary muscles is necessary to adjust the eyes if an object twenty-five feet away is moved twenty feet nearer. It requires just as much increase of effort if an object three feet away is brought one foot nearer, or if an object one foot away is brought one inch nearer. It depends, therefore, very much on whether the owner of the faulty eyes is occupied chiefly in looking at objects several feet away, involving very slight effort, or whether he is reading, drawing or writing. Second, it depends greatly on the nervous system that has to supply the energy to the muscles. If the health is perfect and the supply of nerve power abundant the amount needed for the necessary correction of errors may not be felt for a

long time, perhaps it may never be noticed; but if the nervous system is not strong or if any other conditions arise which draw heavily on the available supply of nervous energy, illness, worry, overwork, anxiety, over-excitement, then the little errors may prove a heavy burden. With a good income, little expenses may be disregarded; but with a small one they become of serious importance.

To this extent only, eye strain is conditional on the general health and constitution, and on the high tension of modern life; but the cause once there is always there, a fixed tax on one's powers, ready to grow into a burden at any time. It is not difficult, therefore, to understand that the demand for clear vision all the time, and near vision most of the time, may cause severe strain on imperfectly shaped eyes. It is not quite so easy to realize that with keen vision and free use of it, without any eye symptoms, eye strain may be responsible for results, which appear far off, in some other place. But since we insist on having clear vision all the time, we are obliged to borrow the extra nerve power from elsewhere; and, while the sight may be all right, some other place suffers. It is found to be an actual fact that eye strain is often the principal factor producing nervous debility, hysteria, melancholia, vertigo, nausea, insomnia, nervous dyspepsia, palpitation, general nervousness, irritability, faintness, weariness, headaches, constipation, and dozens of other annoying conditions. Eye strain is not a temporary condition due to some recent extra eye work, though that may be the occasion that brings it into notice.

Eye strain is a permanent waste of nervous energy in correcting the slight congenital and permanent errors in the shape of the eyes. This waste is not felt by a strong, healthy system, but is ready to become a decided tax whenever the system gets below par, and its effects are intensified immensely by continued close work.

When once the muscles have been taxed to the point of exhaustion, and nervous reflexes or disturbances set up elsewhere, then any effort to force the eyes to continue their work may cause actual physical damage requiring a long time to repair. It is like the breakdown that comes from overwork in any other way, repair is slow and sometimes never perfect.

Generally, the first effects of eye strain draw no attention to the eyes, for it may not affect the vision and very often does not interfere with the use of the eyes, but it fatigues and taxes the nervous system and compels one to pay dearly for it in some other way. The great misfortune is that it is not usually discovered, nor even looked for, until the trouble is well established. All grades of disturbances may result from eye strain, from the slightest smarting or weariness of the eyes after close work to confirmed invalidism. It may show itself in the youngest child, as irritability or nervous excitability, or it may not appear till the burden of old age forces it into notice and uncovers the cause of many an unexplained fret and disability. It may be an unsuspected factor aggravating and intensifying some other weak spot or ailment, and may take different forms at different times; it may excite a weak heart, dull the mental powers, or put the whole system out of balance.

Now that the cause of eye strain is known, we have the choice of two methods of relief: we may remove the conditions that make it a burden, or we may correct, but not remove, the cause. We can stop using the eyes

for reading and for all kinds of near-work; stop doing the things which have been using up our energy, and then the tired muscles will slowly recruit and be able to get on very well, so long as the eyes are used very moderately. This method gives relief, but at the cost of permanently giving up near-vision to a great extent. On the other hand, we can search out and measure the errors in shape and by using correcting glasses, obtain relief, so long as we submit to their use, sufficiently to avoid the accumulation of fatigue.

Both these methods are very unpleasant. One does not wish to give up near-work; it is always a pleasure, usually a necessity. One does not wish to wear glasses most of the time, they are an annoyance and a cross; and yet there is really no other way, except to bear the strain and its increasing results—one never gets a new pair of eyes. This, then, is the second, very unpalatable fact: there is no way to prevent the bad effects of eye strain that is not unpleasant, and, since the cause is permanent, the prospect is very discouraging.

Theoretically, glasses should be worn constantly, since the errors are fixed, but if the eyes can once learn how to rest, they are usually able to bear their overwork a fair share of the time without bad results; but they must have rest, and at frequent intervals. The dislike to wearing glasses is so great and universal, the reason for wearing them so little understood, and the temptation to the oculist to avoid forcing such an unpleasant remedy on his patients is so strong, that they have been worn generally, for close work only, or for temporary relief, and as little as possible. Wearing glasses for near-work simply, makes that work as easy for imperfect eyes as it is for good eyes without glasses. But good eyes, having done their work, look off at a distance and rest; imperfect eyes can not look off and rest unless they keep the correcting glasses on; and rest is the most important thing. Rested eyes are able and willing to work hard; weary eyes that are not permitted nor taught to rest are unfit for work. This is the reason why so many people get such unsatisfactory results from wearing glasses; they wear them to aid them on their hard work, but fail to wear them so as to get any rest.

The third unpleasant point is that if glasses are needed at all they are really more beneficial when worn for resting or distant vision than for close work; but that is exactly opposite to what people wish to do or find agreeable. Too many people decide to follow their own inclination, but are sure to find later that the cost of so doing is much greater than they had expected. Much study and experimenting, with the aid of skilled workmen, have succeeded in producing instruments and methods wonderfully accurate for measuring optical defects in the eye or elsewhere. With these, it seems as if the oculist ought to find it an easy matter to immediately correct the slight variations in the eyes, which may be the source of so much annoyance and nervous wear and tear, if patients would consent to wear the hated glasses.

Experience has brought out another troublesome fact that till recently baffled investigation and thwarted the best endeavors of the oculist and the expectations of those who looked for relief. It has long been realized that the eyes seem to vary very much and change as time goes on; that different observers, or the same observer, get different measurements at different times. Mydriatics have been used to paralyze the muscles, but it has been found that the eyes will generally refuse to accept as much correction as seems to be needed under

such examination; and only temporary relief is obtained from the correction they accept. Confusion results and confidence in oculists' measurements and opinions, naturally, is much shaken. But carefully kept records, following cases for years, and study of final successes, have brought out clearly the reason for all this. The fault is not with the instruments, the oculist nor the patient; it is the life-long habit of the ciliary muscle that prevents it from fully relaxing and exposing the whole error. It can not relax fully, because it is not under the control of the will; it acts automatically, from a habit, too strong to be given up all at once. It must be remembered that the child was born with its errors, and in every act of vision, during every waking hour, he has been obliged to use this muscle to get clear vision; he never saw without making an effort, and it has become as natural to make this effort, if he opens his eyes, as to speak his own language if he talks. So, when a child or a man is asked in the oculist's office to open his eyes and see small letters without correcting his errors, as he always has done, he is asked to do an impossible thing. He simply can not. He does relax partially, but he can not let go and rest. The error is measured by the instruments, just as far as he relaxes and lets it out; but they can not measure the part he still, involuntarily, continues to correct. It follows, therefore, that glasses have to be changed from time to time as fast as the patient learns to relax. No one can accept the correction of the whole error at once, for old habits can not be given up suddenly. Nor do the eyes accept full correction willingly, for they are so much more familiar with their own way.

It is, of course, the first and natural thought of every one (oculists also, till they learn by experience to the contrary) that the glasses which give the sharpest, clearest vision, and which can be worn immediately, without annoyance, are the proper ones. But such glasses must always permit the ciliary muscle to retain part, at least, of the old habit. The muscles can not give up their habit suddenly or easily; they have to be urged, against their will, to learn to rest. Of course, the patient naturally objects to wearing glasses much if he thinks he can get on without, or to be hurried out of his old familiar way; he prefers to relax a little at a time, and to retain clear, sharp vision everywhere. And, of course, it is much easier, perhaps more profitable for the oculist, to yield to the patient's earnest desire, and let him wear the glasses but little and make them weak enough to please him. This way usually involves many examinations, and slight changes of glasses, perhaps spread over many years and give, meanwhile, only partial relief. Rest and ease can not come without the use of glasses for distant vision, nor until relaxation of the tired-out muscles is complete. If decided, speedy and permanent comfort and ease in the use of one's eyes are desired, it is the duty of the oculist to urge the patient to accept as much correction as he can, not what he likes, and to learn, by much practice, to relax completely and as soon as possible. What reason or sense is there in correcting only a part of a known error and leaving the rest to keep up the strain. One does not rest a weary, uplifted arm by dropping it a little or a good part of the way; it is the letting go that gives ease; once rested, the muscles are ready to work again. We judge of a surgeon or a dentist by the thoroughness and permanence of his work. Why not judge an oculist in the same way? The work is not done till the eyes are taught to rest. The prevailing idea, that to

use glasses too much, or to wear glasses seemingly over-strong, weakens and impairs the natural power of the eye, is a mistaken one. It is perfectly true that the eyes ought to do their own proper work themselves without assistance; just as it is true that a man should use all his muscles freely and even work hard with them, for he would be better and healthier for it. But it is not true that he is strengthened by using them all the time without any rest. Glasses which correct the optical imperfections of the eyes, when worn all the time, simply remove the abnormal tax on the muscles, resulting from the imperfect shape of the eyes, remove the constant strain, render the eyes normal and give them a fair chance to work and rest, just as much and under the same conditions as do perfect eyes. The glasses do not do a bit of the work the eyes ought to do; they simply correct imperfections, oil the machine, remove unnecessary friction and prevent waste of power. If, by chance, we should put on a little too much oil, no harm is done, the machine is not injured, no power is lost. It is vastly safer for the welfare of the eyes to err on the side of giving a trifle too much aid rather than leave them compelled to work a trifle, with no chance of ever resting. So, contrary to the general idea, sharp, clear sight, so highly prized and the boast of many, is not the proof or the test of a good eye; for many who have the keenest vision can not use their eyes much or with any comfort.

Easy vision—vision that can be used and enjoyed freely, without thought or fatigue—is the proper test of a good eye. The normal and the imperfect eye may see equally well; the imperfect eye may actually see the better; but one can be used with no consciousness but pleasure; the other wearies and has to be carefully guarded from bright light and from overuse, and may make its owner conscious of a lack of nerve power somewhere most of the time.

When the fact is realized that congenital and natural variations in the shape of the eyes are the cause, not only of so-called weak eyes, but a very large part of the nervous frets and weaknesses which mar the ease and comfort of so many lives, it will be considered wise to hunt for errors in the child. None can be found if they do not exist, nor can strain on the nervous system be avoided, if they do exist, by leaving them uncorrected. The child, who begins early, has no strong habits to break, easily learns to accept full correction, and by wearing glasses a few hours a day, at home in the house, keeps out of all trouble, and is not confined to the glasses, for he never gets exhausted and knows how to rest if he is tired; yet he should never discard them entirely, for his errors remain as long as his eyes do.

232 Clarendon Street.

SOME FALLACIES IN THE AGGLUTINATION TESTS;

A PLEA FOR THE EMPLOYMENT OF A MORE UNIFORM TECHNIC.

OSKAR KLOTZ.

Fellow in Pathology, McGill University.
MONTREAL.

The increased attention which has of late been extended to the serum agglutination of bacteria has brought into prominence certain fallacies which arise in the experimenter's hands, and which must have been noted, to a greater or less extent, by everyone working in this subject.