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EYESTRAIN AND CIVILIZATION.¹

BY

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of Philadelphia.

The importance of the organ of vision in every moving animal is shown by the fact that the embryologic force, or, as I prefer, the Biologic Architect, with the foundation of the organism, at once begins the construction of the eye. It is not a question of days, but of hours, when the making of that all-important organ is begun as a differentiation of a part of the wall of the primitive cerebrospinal rudiment or medullary plate of the embryo. A trout embryo is first seen macroscopically by means of the massive pigment-heaping of the eye, that is larger than all the rest of its body. The common barnacle (*Lepas anatifera*) is well outfitted with eyes while it swims about, but when it attaches itself to the rock for the rest of its life the eyes atrophy. The mechanism of the finished vertebrate eye is of incomparable complexity and variability. A hundred evidences are strikingly manifest, all showing that the entire biologic process, so far as it pertains to motile organisms, is dependent upon the function of vision, and every act during the life of those organisms is in fact dependent upon the accuracy of vision and of its instant relation with every other mechanism of the body. Without such a perfection of visual function no animal can get food, preserve itself from enemies, or maintain itself in the struggle for existence.

Not only his physical existence is thus dependent upon seeing, but the intellect of man, and all resultant civilization is literally a product of vision. The greatest victory of humanity, the one thing that has alone made all other conquests possible, is the alphabet. It took almost numberless generations to construct this great *sine qua non* of civilization, and as all know, the letters of the alphabet are the conventionalized images of things seen. All thinking is in pictures or representatives of them. The psychic thing, of course, preceded its tools, but without the eye there could never have been vertebrate beings on the globe.

There is no way so good to picture—again to picture—the essential mechanism of the external organ of sight as to sup-

¹ Read before the Cleveland Academy of Medicine, June 19, 1903.

pose that a blind man should have millions of tiny fingers and that he should hold them up to a scene—again a picture!—like the sensitive plate of a photographer's camera. If a figure, a square, a circle, star, etc., made up of warmed iron rods, should be laid upon those million fingertips, the blind man could tell its shape and size by the warmth he would feel in his fingers. The objects of the external world reflect the warm rays of sunlight from themselves upon the million fingertips of the retinal rods and cones in precisely the same way. And back from each fingertip runs a nerve for transmitting the impulse to the mysterious brain center where nerve-impulse is made into sensation. We must also remember that the crude material out of which the eye creates color and light is nothing but ether-waves slightly varying in length reflected from the different parts of objects to be photographed on the retina; these ether-waves are about one fifty-thousandth of an inch long, and from 412 to 790 millions of millions of them strike the retina every second.

The incomparable delicacy of the process, the almost infinite slowness of the light-and-color stimulus, is also not appreciated. The retinal fingertips must respond to a stimulus lasting less than a thousandth of a second, and with but a millionth of a millionth of the energy, for instance, of the sound-waves to which the ear responds. Conceive, or, rather, attempt to conceive, the subtlety and fineness of the retinal and entire ocular mechanism which responds to such a slight stimulus as that. When one tries to think of it, one gets a hint, and only a hint, why it is that in death from starvation there is no stored nutriment, *i. e.*, no fat, in any part of the body except in the orbit of the eye, the blanket of fat about the all-important retina. The higher organism, biologically, that is without an eye is not worth life!

And not only an eye of some kind, or of any kind, but one whose mechanism is as unerring as the light ray it receives; one in instant connection with every other function of the body, especially of motility; one upon which the safety of the body and life depends a thousand times a day. There is a true passion of accuracy in its nature that is marvelous. The almost unconscious avoidance of objects in the way by horses and other animals, the superb perfection of eye and organism of a bird thridding through brush or alighting, the precision of the athlete, the juggler, etc.—such things, it is forgotten, are all first, and far more excellencies of eye than of muscle or nerve. I have read somewhere of the astonishing feat of monkeys running over the tops of African forests faster than a horse could run in the open, and looking back at their pursuers, while dashing from tree to tree. The ability of the ocular mechan-

ism to make all of that possible fills one with awe of the ocular mechanician.

Let us now carry the thought on from physiology to pathology. Let us remember that in all nature there is no perfect organ or organism. No leaf of the numberless billions in the forests of the world is faultless. No face is symmetric, no finger perfect. And so, speaking absolutely, no eyeball is mathematically or optically perfect. Great physiologists and mathematicians have marveled at the optical imperfections of all eyes, but without any care to correct them. And almost no astronomers or microscopists, profoundly careful as to the perfection of their transits or objectives, have even cared to ask about the optical imperfections of their own eyes. We have at last begun to observe them. The canalizations of the planet, Mars, are finally found to be due to optical defects of the astronomer's eyes.

Such an illogicality, except one, is the most astonishing thing I know in the history of science. But it is explained by the fact that in the evolution of science the study of the most useless precedes all others and only slowly and progressively does the mind come to the real problems of life and to the student's own life. First astronomy, then the earth; when the body is at last reached bones and muscles are studied. Then health and disease, and last of all, the realities and final causes of disease. We are coming to psychology only now. But at every stage of the progress of the voyage of man in finding himself, the reactionaries cry out against the advance, and say, the old truth is all truth.

How amazing it would be without knowledge of this law that men whose life-study is pathology, men, hundreds of thousands of them, whose sole function is the curing of disease, have cared utterly nothing about the diseases of the eye, the malfunctions which precede and beget almost all ocular diseases, and very many systemic ones. Worse than that there are and have been specialists in diseases of the eye who have not cared, and still do not care, about these optical malfunctions of the eye. When one calls attention to these facts, one is accused of "hobby-riding specialism," and of "exaggeration." The very monomania, the true insanity of specialism is to look upon the single organ as if it existed of and for itself. The great dawning truth of physiology and therapeutics, the one which will bring new light into our art and science of medicine, is the functional interdependence of correlated organs, and the unity of the organism. That truth will kill all narrow specialism and bring once more the general physician to his place of honor. The tumor-inflammation-operation oculist is the genuine exaggerator, the hobby-rider, and the one who

shows the systemic relations of malfunctioning eyes, is the true physician, the real scientist. My duty tonight is to harp upon this theme because I know of no greater medical need, no more atrocious professional crime than this which so long constituted our chief sin.

Everybody knows that the success of photographing depends upon definition of the image, the mathematic precision with which the picture images the outlines and the proportions of the fact. This definition is easily disproportioned or blurred. If the photographic camera is only an inch in diameter the securing of accurate definition of all objects in a wide field of view, and situated at all distances, becomes at one time a physical impossibility. And when one sensitive plate has been exposed it has been spoiled. But nature in the normal and emmetropic, so-called emmetropic, human eye has come as near as possible to creating a self-adjusting mechanism which shall secure definition of all scenes, far and near, and has also made the retina a self-resensitizing and single plate, good for all "exposures" at the rate of say a hundred thousand a day. As bad an optical instrument, as much of a makeshift as the eye may be, it is the most perfect of all biologic mechanisms, the greatest art-product of life. And yet after all the count has been made of its necessary and inobviable imperfections there is not, even optically, a perfect pair of eyes. The one pair that had been pronounced "mathematically perfect" by the most expert testimony, I demonstrated had myopic astigmatism, and this defect caused repeated and severe subconjunctival hemorrhages.

What are the optical defects of human eyes that produce malfunction and diseases local and systemic? The camera-eyeball may be too long, or too short to give perfect definition of the image, or the cornea may be abnormally curved, producing distortion and disproportion of the image. If the eyeball is too long there is myopia, and if its fellow has the same degree of over-length, no strain or attempt at strain can be made by the eye to neutralize this, and there are no evil results of a reflex kind. The person so handicapped simply cannot see well at a distance, and in our civilized life no bad results follow if the defect is not increasing, excepting that certain occupations cannot be pursued without glasses. But not one pair of eyes in a thousand has the same degree of myopia in both eyes, and at the same time is without corneal malcurvature (astigmatism), so that some eyestrain, of a low degree at least, exists even in myopic people. But it is inconsiderable in comparison with the pathogenic results of the defects which demand constant and morbid innervation of the compensating and accommodation mechanism. The retinal image in myopia, and even in myopic astigmatism may be far worse in definition

than that in hyperopic astigmatism, but as no effort can be made to neutralize it, the pain of morbid and excessive effort is usually avoided, and the eye alone is harmed, and the person limited in function.

When the eyeball is too short the image is poorly defined, except when the ciliary muscle can temporarily give better definition. If both eyes have an equal degree of over-shortness then, up to a certain degree, and for a certain length of time the compensatory mechanism can overcome the trouble. But as no one of the schoolboys who have tried it can hold his arm out straight for 10 minutes, so no ciliary muscle can compensate for high defects, or for low ones long at a time without resting. But the over-shortness of both eyes is hardly ever alike, and almost never without some astigmatism.

Then astigmatism, or malcurvature of the cornea, in the vast majority of cases, exists in some degree in the eyes, and over this defect the compensating mechanism has almost no power, and in a sphincter muscle like the ciliary muscle, two-sided action even of a low power, is, of course, essentially morbid. I have elsewhere described 12 mechanisms by which the same spot of the retina is relieved from a constant stimulus every instant. I should have shown that this accommodation and muscular tiring is a thirteenth, so that even this morbid fatigue seems designed to prevent greater harm by a lesser, and demonstrates the need of the prevention of severe or continuous use even of perfectly normal or emmetropic eyes.

If the incorrectness of measurements of the camera eyeball is as great as $\frac{1}{300}$ of an inch there is a lack of definition of the retinal image. To overcome this the eyes in hyperopia and astigmatism must struggle ceaselessly. Both retina and muscles are tired by this effort to neutralize; persistent innervation, coupled with abnormal action of muscles, is impossible and harmful, as every physiologist, every schoolboy even well knows. They know it leastwise of other muscles, but they ignore it of ocular muscles. To this complication of defects must also be added the frequent presence of imbalance of the external ocular muscles, 12 of which must act in fine adjustment and harmony to keep the two eyes properly directed upon a given object at any given instant. Another important error is that the evil reflexes, except in the case of the developing criminal, are the worst in the low defects, those that the eye can overcome by intense effort, but only for a short time. A third of a diopter of asymmetric astigmatism is a hundred times worse for the general system than high defects. The high defects produce criminals, or ruin the eye itself; the low defects, unrecognized by bunglers, produce the thousand morbid reflexes.

The chances thus grow more and more certain that no pair of eyes will be optically and muscularly perfect, but these chances are tremendously increased, becoming as thousands to one, when it is remembered that evolutionally the eye was developed under the sole need of seeing distant objects from say three feet to the horizon clearly. But now comes civilization in the last 300 years, and demands of the eyes a new work for which the history of millions of years has made no demand, and for which the eye has been outfitted with no mechanism. Printing, sewing, schools, and handicrafts cannot be carried on even by normal eyes except through persistent and abnormal functions. These excessive and morbid demands made upon the unfitted mechanisms of the eye thus tremendously heighten the difficulties preexisting and constitute the inobviable source of eyestrain with which civilization has henceforth to deal with all the seriousness which disease may command and science can consider. The "exaggerations" of the most enthusiastic "exaggerator" that has so far arisen cannot equal the importance of the awful facts. Brutal indifference and ignorance may not longer continue the cynical smile at the "exaggerator."

A great and famous "ophthalmic surgeon," for whom I have a proper respect, told me he had examined large numbers of patients who complained of the same troubles as Darwin, Wagner, Parkman, and the rest, and he found that they had no optical defects whatever. I answered that I had never seen a pair of eyes with no ametropia. I could not tell him that he had never tested a pair of these eyes by accurate and scientific methods, and that the refuse of his office was the best material for all the refractionists of his own and adjacent cities. I could not say to him that with his mental makeup no refraction, mathematically correct, was possible; that conscience, scrupulous carefulness, and keen intellect were necessary to do such work, and a painstaking subtlety in searching out the slight and long continued causes of malfunction and of organic disease. I did tell him that all history is full of instances of the failure of the official leaders or representatives of religion, art, and science to recognize the new truth which finally supplanted the pitiable truth they stood for. It is the law of life, seemingly, but what an expensive one! Beware of officialdom in all its works and ways, and in any walk of life, but especially in medical science. In ophthalmology today it will often know nothing of the greatest truth, the most wonderful alleviator of human suffering. The blindness that is blind to it is the most amazing illogicality I know. In nearly every city of the land there are quiet, almost unknown refractionists who are making great practices, who are doing far more good to

their fellowmen than the nationally and internationally famed presidents of all the medical societies. It pleases some of these great and famed ones to ignore these quiet men and to belittle their work, but the sin of doing so will some time become clear. There is a perfectly sound reason why the search for success and the attainment of it kills the love of new truth. Even in the few and best instances fame and presidencies and LL.D. degrees only come as rewards of what has been done. Then the poor recipient of popular favor is interested only in this past truth, plus himself and his connection with it. Patients' lives are sometimes mere pawns in the game for success. But in the vast majority of cases, as we know, the presidents and LL.D.'s secure the coveted honor after long and careful "still hunts" for it, and the secret plotter unconsciously kills the only thing that makes the reward of any value, *i. e.*, honor of self and the spontaneous honor given by others. It is an open secret nowadays that the colleges conferring the degrees called honorary do so for their own sakes, *i. e.*, to get honor while seeming to give it. Their motive is to attract attention and to advertise themselves, and to get endowments. But as an astute observer said of marriage, it is a game that two can play at and neither win. Neither of the schemers gets honor, because neither is honorable. In refusing such a degree in his old age, Spencer told the honorers that it could have been of great use to him when he was young and striving for the recognition of his truth, but that it was now useless to him. Knowing he was not an erudite man, Cleveland, greater than erudition could understand, also refused a false degree. Truth bids good-bye to the hunter and parader of the LL.D. degree.

The sooner the scoffer is silenced the better, and the sooner the role of eyestrain in civilization is recognized the better for the nation, and the greater its progress. How slow, how amazingly stupid we have all been in the recognizing is shown by the history of the finding of the pathogenicity of astigmatism. Clearly pointed out over 25 years ago, and demonstrated since then by proofs offered by a hundred clinicians, the great body of physicians and even of ophthalmologists of the world, especially of the European world, still ignores it. Pick up the programs of the highest official ophthalmic societies and notice how the whole subject of eyestrain is almost utterly ignored. In the great national and international medical societies it is usually not even mentioned. In our best and latest textbooks on general medicine the subject is not recognized, and the conditions which make the diagnosis and cure of these ocular and reflex diseases are not put in practice. There is a fine book written by a most capable man, bearing the date

1903, devoted to the teaching of the prevention of disease. It speaks well and scientifically of many common diseases and their causes, of the effects of study in schools, but in the whole book there is not a word as to the eyes, or the troubles that arise from ametropia. So careless of technic are we that not even Merlin's ingenuity could estimate astigmatism with the ordinary trial frame in common use. The average optician knows nothing about his true business, and the average physician does not care to see to it that he shall know about it. Patients from 40 to 55 years of age are refracted without a mydriatic, or worse-refracted with it, in half the clinics of the world, and the best national medical journal¹ says that anybody can test such eyes with any ophthalmometer. It is precisely the weakening eye during the establishment of presbyopia that needs the most accurate refraction, because it is then that compensation by means of the elasticity of the lens is becoming progressively less and less. There are a hundred neglected requirements of accuracy that condition success. Without the least doubt, and weighing well what I say, I am sure that no discovery of modern medicine, except vaccination and the germ theory of disease, is of so great importance as this of eyestrain. Directly and indirectly this functional disease is the cause of more suffering than all the organic diseases combined. Incredulity cannot do away with the fact, and poohpoohing the "hobby-rider" will only disadvantage the poohpooher and postpone the day of relief to millions of sufferers.

It is a curious fact that, closely inquired into, the knowledge of the relief of the disorders of eyestrain has largely come from the lay world and from patients themselves. But not, as the *Lancet* contends with justice, not from the opticians. While the professional world has been ignoring the facts, publishing its textbooks on gastric and nervous diseases, etc., patients have been finding out that their ills are curable by proper spectacles. The few general practitioners and nerve specialists who much longer ignore the fact will find themselves stranded by the superior diagnostic skill of the nonmedical. I show you a circular issued by a quack optician, but one of a thousand, who is appealing direct to the lay world for patients, and over the heads of the regular and honest opticians, and, of course, in defiance of the physicians. Such men are organizing, supplying themselves with ophthalmometers and machines galore. Traveling spectacle peddlers, even traveling doctor-oculists are all over the land, ruining eyes often, but in spite of that gaining organization and power. Their vogue is due

¹See an otherwise capital editorial article in the *Lancet* of May 9, 1903.

solely to professional neglect of eyestrain! There is no professional duty greater than to stop supporting this quackery. Many otherwise regular physician-refractionists are learning the lesson that they may also ignore the official leaders of the profession, the referrers of cases, and without their aid or sympathy may win success by going straight to the people themselves. The tons of "headache powders," and lakes of "bitters," "tonics," and "appetizers," and the rest that are annually sold, teach, or should teach, a no less suggestive reprimand. To encourage a greater revolt of the lay world into antimedicalism is neither good professionalism nor sound policy. We have need to walk heedfully in this dangerous road! For the unexaggerated and brutal fact remains that at least 25% of modern civilized people are today suffering from the ocular and systemic effects of eyestrain. Most all of the headache in the world, and of sick-headache, is absolutely due to that cause. A very large part of the neurasthenia and of the hysteria also springs from it, and of "biliousness," anorexia, "nervousness," etc., it is one of the most active of all causes. Every one of a hundred different lethal and organic diseases which finds foothold through the vague but awfully real fact called denutrition, may and frequently does find that foothold through the eyestrain that almost always lessens vitality and begets denutrition. We are making a wise, a splendid crusade against tuberculosis, but the ground in which the tubercle bacillus finds place and food is one prepared by general denutrition, and of all the modern producers of a general lowering of vitality none is more frequent and persistent than eyestrain.

Because of the value of the eye to the organism and life, the results of morbid ocular function cannot be borne by the eye itself. So nature has been forced to shunt these results elsewhere, and to obviate ocular injury at the expense of other organs. To this reason is added the power of sexual selection. The beauty, as well as the usefulness of the eye, requires that it be kept from inflammations and abnormal appearances. Such in part is the explanation of reflex ocular neuroses. This is the reason that the great influence of eyestrain is not recognized. The effects are so infinitely various, so far removed from the eye, and so subtle, that the ordinary mind is incapable of realizing the truth. Any other organ may suffer instead of the eye. Bound up as is the eye with every psychic and physical function the reflex vicarious suffering takes the line of least resistance and exhausts itself upon innocent cerebral, muscular, or nutritional organs elsewhere. "Nervousness," whether hyperesthetic or hypoesthetic, is the almost constant symptom of all eyestrain sufferers. Chorea, petit mal, insomnia, are frequent consequences. Being the creator of the intellect and the instru-

ment as well of all mental activity, the mind and disposition are speedily and frequently morbidized by ocular malfunction. I really believe that eyestrain is one of the greatest of all causes of "domestic infelicity," and that many a divorce has been due to it. If a woman becomes a scold, a gadabout, or everlastingly ailing, the probability is, of course, that hers is another case of the very common disease called "new woman," but it may also be one of eyestrain in the "old woman." Even the noble animal, man, may display "incompatibility of temper," go to the saloon or club evenings, or drink too much, from the same reason. It will some time be shown that the abuse of coffee-drinking and tea-tipping is not seldom due to the attempt to whip up a tired or irritated nervous system, and a rebellious digestive system, hurt by the inhibitions and worries of eyestrain. Almost every eyestrain sufferer complains of sleeplessness, and that deadly trouble is at the bottom of a deal of woe in the world. I am sure that the tobacco dealers and trusts should combine against all opticians and oculists, for smoking is frequently encouraged by the desire to allay the cerebral irritation of eyestrain. It is striking that in the progress of civilization the consumption of tobacco and of coffee goes on rapidly increasing, and that those peoples which use the most of one are also the greatest users of the other. The connection is more than accidental, and the cause is not entirely dissociated with the great increase of nervousness, headache, biliousness, etc., among the hand-workers, the readers, the students, etc., of the more civilized nations.

But one of the most frightful facts of our modern life is the growth of the drink habit. A competent authority has calculated that the people of the United States spent last year \$1,172,565,235 for alcoholic drinks. If I should guess that one-tenth or one-thousandth of this worse than waste was caused by an unconscious attempt to undo the evil effects of eyestrain on the nervous system and digestive organs I would be smiled at as a man overexcited in advertising his hobby. Yet I honestly believe that over one-tenth would be a low estimate. In the Bulletin of Iowa Institution for April, 1903, Dr. Applegate finds that of 150 inebriates examined, 63 had serious ocular lesions, muscular, optical, or nervous.

As to the production of crime and of criminals there is luckily an important bit of testimony. A large, an amazingly large, number of the young criminals of the State Reformatory at Elmira, N. Y., have such enormous defects of the eyes that as children and youths they could not possibly study, and could not even do handwork without danger to themselves, without botching it, or without such injury to the nervous system as would make truancy and a life of vagabondage inevitable.

Eyestrain is a great teacher of crime. Nothing can be more certain than that De Quincey, Darwin, and Parkman had intolerable eyestrain, and that as schoolboys they were driven to truancy against every inborn taste and external influence. Their high moral natures kept them morally straight at an expense of suffering that was most tragical. Look out for the eyes of the nonstudious schoolboy!

Very nearly 100% of epileptics have some considerable eyestrain and of these about 50% have that otherwise rare and most unbearable variety, unsymmetric astigmatism and anisometropia. A number of cases of cure of epilepsy have been made by competent oculists, but it is probable that even when caused by eyestrain the large majority of patients with the established disease cannot be cured by glasses, because of the deep injury that has been done the nervous system. The same may be said of chorea. Prevention is the great word in medicine, and especially in nervous and mental diseases. The human brain is fundamentally a great storage battery, capable of secreting and then releasing great reserves of force in any way at the direction of the will and circumstance. Epilepsy and chorea, and nervousness are the useless, unmotivated, and morbid releases of these stored batteries of nerve force. To meet the exigencies of life the storage must continue. The disease is the pathologic release. The cure is preventing the over-storage and the weakening of the sluice-gates, which allows the epileptic, choreic and nervous drowning of the lower valleys with the disastrous flood.

A similar line of reasoning and observance of facts will finally reveal the ocular origin of a portion of the insanity of the world. The eye, again to be noted, is at once the creator, influencer, and instrument of mentality. Intellectual action cannot be spoken of or described except in optical terms, images, or representatives of these. A morbidly functioning pair of eyes will almost certainly, therefore, render the dependent intellect morbid. If superposed on a predisposed neurotic or unstable cerebral mechanism, they will almost infallibly end in "queering" or unbalancing the psychic or neural equipoise that constitutes sanity. Here again cure will consist largely in prevention. When mental imbalance has become chronically habitual, or even positive insanity, then the irreparable has been established. But look out for the eyes of the odd child, the developing crank, the acute monomaniac, the one with latent, but progressive, insanity. There never was a saner, wholesomer or more clear-headed intellect than that of Francis Parkman. Yet read how the insanity horror was before the minds of his friends (not of his own), and how he speaks of the study in his own case by the expert in neurology.

In this connection I cannot forbear allusion to an awful effect of eyestrain, when the eyes and all the rights of the irritated brain are ruthlessly trampled on by the most cruel of over-use and abuse. Once in Darwin's life when this was done, he made his solemn will, in view, as he believed, of soon oncoming death. Many times in Carlyle's life a similar shuddering seized him, and Wagner contemplated suicide many times. The tortured mind saw no other escape from the misery which haunted it with over-use of the eyes. Yet naturally these men were lovers of life, and even cheerful-minded. Even Carlyle was not inherently a pessimist, and his natural faith and hopefulness were constantly breaking through the gloom which use of his eyes threw over his mind. The greater the number of school hours demanded by a nation of the children the greater is the number of suicides and of child suicides. And especially where, as in Saxony the correction by glasses of the small optical errors, upon which the chief troubles of eyestrain depend, is scorned.

The reason of the fact that the organism itself must be wrecked rather than the organ of vision lies in this passion for accuracy of which I have spoken, concerning its physiologic aspect. The longer an organ has been in evolution, the more fundamental its function for the safety of the organism, the more imperiously it persists in struggle for existence and in normality of action. The ontogeny repeats the phylogeny. This failure in accuracy of curvature of the cornea by so much as $\frac{1}{300}$ of an inch means the contradiction of the history of the race, means the unsafety every hour and minute of the day, of the individual, means the inheritance of the abnormality and ruin of future organisms. Biology and the preservation of the race hang for perpetuity upon the extinction of that $\frac{1}{300}$ of an inch. See how that works out in fact, and then see how the sneer of the cynic at the "exaggerator" is contemptible and criminal, how unscientific is such science. Take an instance in organic pathology, as more striking than the functional pathology which the pathologic pathologist affects to scorn. He cares nothing for the astigmatism which is a most profound concern of the God of biology; but he must recognize that a life of morbid function, never for an instant physiologic, usually and hopelessly renders other organs than the eye irreparably morbid, hopelessly incurable. Tie an arm up and it is soon paralyzed and withered. Stop speech for 20 years and the vocal bands renounce their function. But an eye will wait for 50 years for an astigmatic lens, and in an instant it is functioning normally. And for the same 50 years an eye that has never seen a thing, will wait for the removal of the cataract, when in a moment its function is perfect, far more perfect than the mind

that must still learn how to judge of what the new-made eye tells it. This everlasting waiting for relief, this preservation of the possibility of normal action, this utter refusal to be turned from its right and healthy activity is absolutely exceptional in the eye, and is most amazing.

This brings me to the mention of the role of eyestrain in our schools. Dr. Johnston, of Washington, D. C., enumerates a very large number of cases of illness and disease, and of physical and mental injury, and in particular to the effect of school life on the eyesight, the frequency of headache, and resulting sleeplessness, affecting, in some instances, from 38% to 48% of the children, and he instances the experiences of the Cleveland Public High School, where 25% of the girls and 18% of the boys had been compelled to withdraw in one year for various reasons mostly on account of bad health. It is an absurdly low estimate to place the proportion of the 17,000,000 of American school children, students, etc., whose characters and health are being injured or positively ruined by eyestrain at 10%. Myopia, as all know, increases with each added year of school study—and myopia usually means the eyeball stretching from lack of proper glasses. The “nervous,” “backward,” “stupid,” and unhealthy pupil is usually so from eyestrain. The State has no right to demand that every child should attend school without also stipulating that its eyes shall be made capable of study.¹ Glance at your arrangements in eye clinics for refraction; this most difficult and skilled of medical work is left to students, and in comparison with operations and inflammatory diseases and ophthalmoscopy, is held to be of so little importance that instruments, lights, etc., are neglected and good results made impossible. And yet eyestrain creates the greater part of the local diseases of the eye. Of course, such refraction cannot have any effect upon systemic and cerebral reflexes except to increase them. No refraction at all is better than inaccurate refraction. The endowment of refraction schools is as necessary as that for any other branch of medical study.

If one looks out over history there is seen to be no condition of human life wherein ametropia did not play a great role, and always one of evil. Eyestrain is the greatest cause of inflammatory diseases of the eye itself, including cataract. The only one of all the great ocular troubles it does not cause is presbyopia—the failure in sharp near vision that comes on at about 40 or 45 years of age, and is completed at about 60. This

¹ Among a thousand good and blessed charities, among all selfish and wasteful ones, among others that harm instead of help, and that increase instead of lessen the evil, there has never been found one, as much needed as any of the best, which should help the poor to secure proper spectacles. I know of no charity, except that for crippled children, which commands our sympathy more acutely.

failure, parenthetically noted, is one of a dozen striking proofs of the tremendous difficulty encountered by the Biologic Architect in making the eyes. The nourishment of the transparent lens without red blood-corpuscles and nerves is such an almost impossible feat that in a large proportion of cases, if ametropia heightens the difficulty, it is only possible to maintain transparency for the first fifty years of life. But whether or not complicating eyestrain adds to the difficulty, the elasticity of the lens begins to fail at 45.

Even in savage and semibarbarous life eyestrain, conjunctivitis, presbyopia, and cataract must have been the cause of a vast amount of suffering. Any beautiful oriental rug, carving, or other art-work, may have been created by aching brains. Many of the weavers, the basket-makers, arrow-chippers, etc., must have been sufferers; the punishments personal and tribal must have been great, and all such workmen and workwomen came to grief when presbyopia set in. In peoples emerging into civilization the morbid ocular factor becomes still more felt. In the millions of negroes of our country, many striving for education and expertness in handicrafts, at least 10% are sufferers from eyestrain; only the fewest can now have scientific correction of their ametropia.

In the creation of the alphabet, millions of bad faulty eyes must have brought tragedies into their owners' lives. In battle and chase, victory and life were often on the side of the perfect seers, and defeat and death on that of the imperfect eyed. A myriad mysteries of history could undoubtedly be cleared up if we but knew all the influences direct and indirect about the defects of the chief of the senses. Who could imagine the results of this factor in the hundreds of millions of Chinese throughout thousands of years in which all offices, honors, and power have been and still are dependent upon scholarship and written examinations. Similar griefs must have afflicted vast numbers of the self-restrained and dignified Japanese. I suspect that eyestrain has been the cause of the melancholy type of Chinese and Japanese faces, and especially of the peculiarity of the eyelid contours. A similar result in Europeans begot the term "blue blood," as applied to the castle-dwelling and aristocratic women, across whose pale temples ran the veins produced by eyestrain, which oculists now find in unaristocratic sewing women and others of the slaves of civilization. There must have been sad consequences of faulty eyes among the monks of a thousand years of medieval life, who were busied in study and copying manuscripts as they passed down to us the literary treasures of Greece and Rome. I have read somewhere of the pathetic lives and ruined eyes and health

of the present-day sewing women in convents, especially in the Latin nations of Europe.

Pascal, I think it was, said that man's troubles arise from his inability to sit still in a room. He meant that lack of reflection and planning plunged men and nations into ill-judged activities. A correlated truth is implicit in the saying, for when one nowadays sits still much he or she does not reflect so much, but soon goes to doing something—reads, writes, makes something with the hands, etc. The musician, Wagner, expressed the same thought when he spoke of the "damnable organ of sitting still," and to none did this "organ" bring more suffering than to him. The doing something while sitting means eyestrain in at least 25% of the doers. Eyestrain means irritation and suffering only relieved by doing something outside, as all eyestrain sufferers have learned. Hence the frightful avidity in vast numbers of people for war, sports, athletics, and wasted activities of a thousand kinds. The nations of the world are at present crazy with securing "undigested territory." The financial world is suffering from a similarly frightful dyspepsia from "undigested securities," as Mr. Morgan dubs them. Well, the medical world is suffering in the same way from undigested knowledge. The deathrate is twice as high as it need be, if the knowledge gained were put in practice. Of all the undigested knowledge of the profession the greatest quantity of heavy food on our stomachs is that of the knowledge of eyestrain. The pylorus is even bound down and closed by a constriction of ignorance and prejudice, which permits no food to pass, whether digested or not. And volvulus and appendicitis or other intestinal obstruction awaits below!

The great philosophers, writers, historians, artists, these are the most valuable assets of a nation. How they are treated is the most important of the financial and governmental matters of that people. It is politically, socially, and personally due that after-generations shall hold up to view the ancestral carelessness and errors and prevent similar ones from going on. Responsibility for the care of genius is the most solemn responsibility in the world. And yet, "Genius go hang!" is the judgment of the past and still continues to be the judgment of the present. The ancient criminal idiocy is not yet dead of supposing that the physical and emotional sufferings of men of genius were the cause of their genius and that we should make all such men suffer the most possible in order that the long-eared aftercomers may enjoy the results of their work. It is a diabolic theory, but the long-eared both consciously and unintentionally bring it about that way.

When Beethoven was writing the Ninth Symphony he was

squarely in the middle of the presbyopic period, and he was a martyr to pain in his eyes; he feared his ailments would cut short the thread of his life, his "bowels were in the most wretched condition," he had "the trouble with his eyes," and in brief, "his organization was entirely shattered." Fifty-seven years, most of them years of misery, was Germany's order as to Beethoven.

Banishment from the country; hideous poverty; worse than either, absolute nonrecognition; worse than that, malignant hatred of his musical work; worse still than all, the most atrocious personal cerebral and physical suffering—this is what Germany ordered for Wagner. And of all the doctors who wrapped him in wet-packs not one noticed, or would have cared if he had noticed, that Wagner's left eye was turned up and out, and his forehead concentrically wrinkled to get the lid away from the pupil. Frequently he could not write another line of a letter because of the added torture that the writing of that single line caused. And this was in the land of von Graefe, and in the fatherland of modern medical science!

England told one of her greatest literary geniuses to deaden his horrible pain with opium and walk, walk, walk. De Quincey had to obey—and hold one eye shut in his late years to rid his brain of its harassing image.

Another, a still greater child of England, was turned into a terrible dyspeptic and misanthrope, made to suffer as only genius and eyestrain and pseudomedicine, when combined, can make men suffer, and was also commanded to walk, walk, walk, ride, ride, ride, and waste, waste, waste both time and talents of infinite value, in order to rest his eyes, his eyes that needed only a pair of appropriate spectacles. Carlyle obeyed his unloving tyrant.

Huxley was also ordered to walk, walk, walk, and to suffer, and to quit his great work just when he was best fitted for doing the best of scientific labor. And Huxley was a physiologist most exacting as to microscopes, but knowing nothing, caring nothing, for the eye that looked through his fine microscope. Medical science had not a hint to offer Huxley.

Medical science told Browning his headaches were inherited, told him to go to bed—and to read, if he wanted to. Browning would read a minute or two and get the headache, then close his eyes, turn toward the wall for a minute or two to get rid of his headaches, and so on! The poor poet was also commanded to walk, walk, walk, and idle the rest of his life away. Browning obeyed.

The greatest of England's modern sons, if by greatest we understand that his work has had the greatest effect, was Darwin. His work was limited to an average of an hour or so

a day with his eyes, and the rest of his life he was ordered to spend walking, walking about "the sand-walk," or shivering in wet-packs. With the possible exceptions of Parkman and Wagner no man ever suffered more from eyestrain. Poor, patient, glorious Darwin!

Spencer still has a loathing of doctors and opticians, and his life could have been made a very different one, far more useful, far more productive, if he could only have had a pair of spectacles neutralizing his myopic astigmatism. With such a help he could have learned German, could have done the reading he should have done, could have avoided the mistakes, scientific and philosophic, which he should have avoided. Luckily, he has been too astute to suffer as others have done. It is England's loss and our loss, not that of Spencer. It is our fault, not his.

And Parkman! We put him on the gridiron to be tortured and gave him his gridiron to work with, and we would not let him walk in the day because the light blinded him. We refused to let him write but a minute or two at a time, and refused him even that pleasure for 14 years, and set him to raising roses. Finally, as if still vindictive, fate refused him the right to walk day or night. We forced him to carry on his gathering of 70 odd volumes of historic notes, and of writing his few volumes by the aid of the eyes of others. He asked only for a pair of lenses, correcting his unsymmetric astigmatism, but we said, "Go to! Astigmatism is the hobby of hobbyriders!"

When we read of the sleepless Parkman nodding familiarly to the Boston Common policemen in the late hours of the night we are at once reminded of the sad De Quincey appearing at midnight to workmen far from his home like a ghost out of the darkness, and also of the tormented Carlyle, seeking, as they, ocular and mental rest, by riding in the night among the loneliness of the Scotch moors. A common origin of their ills adds to the pathos of their lives, and that they were unconscious of it accentuates the fatality all the more.

One of the greatest women that America has produced, Margaret Fuller Ossoli, was made to suffer martyrdom during her short life, by eyestrain—the sickness and the poverty it produced. Her incomparable intellectual powers were palsied by it, and it was the final cause of her accidental death in middle life.

All the newspapers that Whittier edited had to be abandoned because the editor could not carry on his literary work. He had to renounce the great duty of antislavery reform, for which his heart and head had fitted him, and his predestined role of statesman had also to be abandoned. Retiring to the

farm and the life of a valetudinarian, even his beautiful poetic endowment was denied proper outlet because he could not write and study as he should have done.

Mrs. Carlyle's life and happiness were wrecked by sick-headache, due solely to eyestrain; and ignorance and malice have made a sad mess of it in writing of her and her husband.

One of the greatest of European men, with a splendid equipment, physical and intellectual, one of the most erudite of men, a professor of philology at 24, was martyred, literally, while he lived, his intellect morbidized; he was finally driven into insanity, all simply because he had not a scientific pair of spectacles. And Nietzsche's pious students are today organized into a society to study each day's living and thinking of their master. They would do much more good for the world if they would study the science and doings of each day's living of the oculists of their native land.

For—

“These old, unhappy far-off things
And battles long ago,”

are being repeated every day and everywhere. There are millions of such patients in civilization. If for some of the old ones we may, as a profession be half excused, it is in our time a double crime, when ignorance in a scientific man is, indeed, a crime against science and against humanity.

But it is not only and not chiefly its geniuses that concern medicine and a nation, when we consider the total effect of this factor. Civilization has tremendously and suddenly increased the eyestrain by a thousand occupations, which demand “near-work” with the eyes. Printing, schools, and city life, give the matter an entirely new aspect. Sewing women, artisans, artists, machinists, musicians, clerks, typewriters, engineers, pupils, all the professional and business classes—these are the workers, spurred also to a continuousness of labor, such as has never been demanded, upon whom the obligation rests. The nation and the national medical profession that forgets or ignores this, overlooks a highly important element of progress. And it is one that is all the more effective because it conditions the peculiar means whereby modern civilization advances.

Why it was that some stupid and obstinate old architect should have scorned a splendid piece of quarried rock sent to him by his workmen, is one of the most incomprehensible things of history. But better minds and eyes finally came and it was said, as it may now be said, “The stone which the builders refused is become the headstone of the corner.”

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