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IN

SOME OF THEIR MEDICO-LEGAL ASPECTS

BY

JAMES T. RUDALL

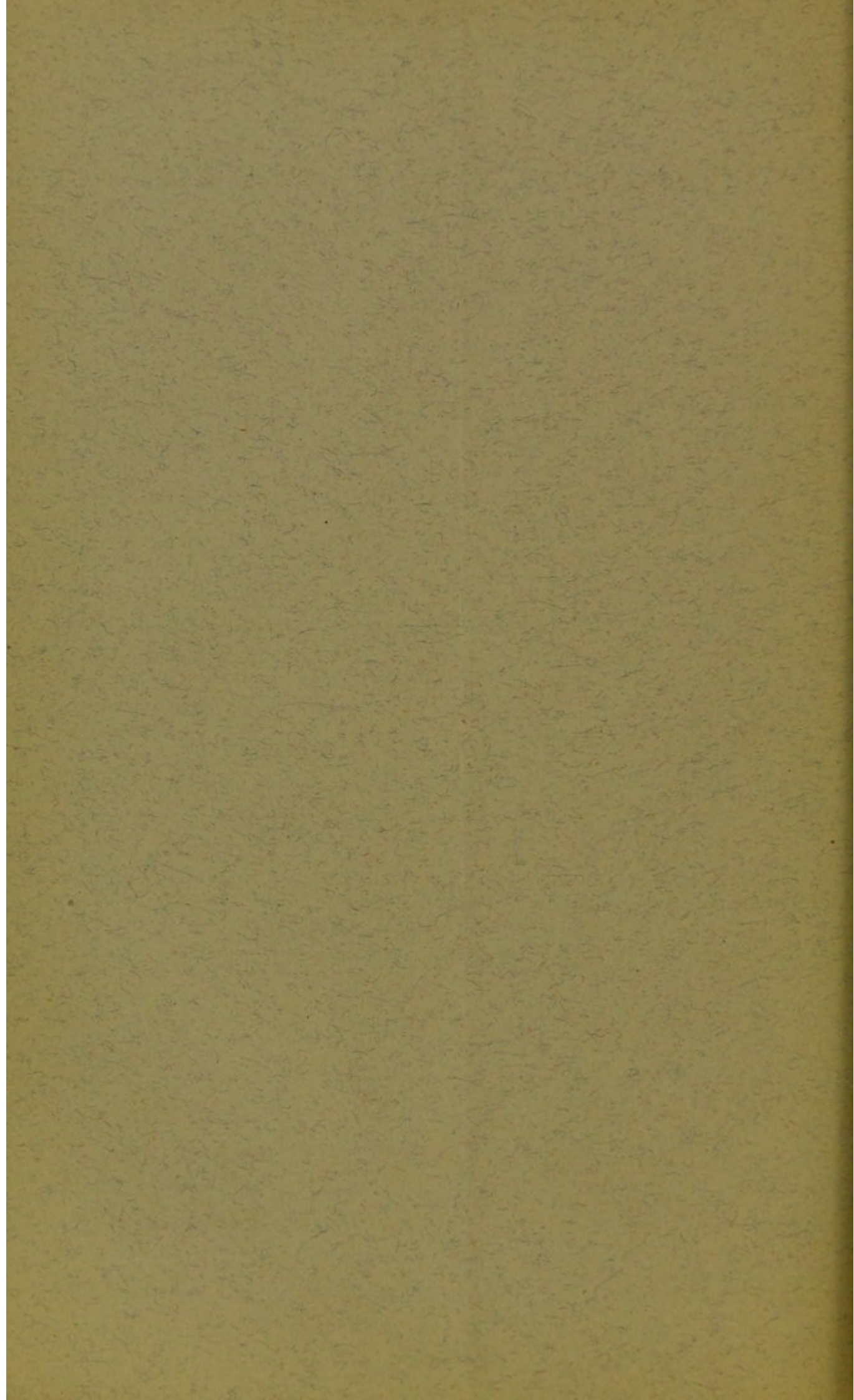
FELLOW OF THE ROYAL COLLEGE OF SURGEONS OF ENGLAND,
SURGEON TO THE ALFRED HOSPITAL, ETC.

GEORGE ROBERTSON AND COMPANY

MELBOURNE, SYDNEY, ADELAIDE, & BRISBANE

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BY DR. W. M. WHITTAKER, F.R.S.

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COLOUR-BLINDNESS

AND OTHER DEFECTS OF SIGHT

IN SOME OF THEIR MEDICO-LEGAL ASPECTS.

THE effect of a paper which I lately read before the Victorian Branch of the British Medical Association has been to call forth rejoinders and articles in the public press, in which the real questions at issue were so much obscured that there is no small probability of their being more or less completely lost sight of. That paper was entitled "Colour-Blindness and other Defects of Sight," and the intention of it was to show that the Government of this country, while making petty, meddlesome, and irritating regulations, neglected one of its more important duties, by non-interference in the matter under consideration. Certain public bodies were also mentioned as having failed to fulfil their obligations in the same direction. It may be that the Legislature itself declines to admit any direct responsibility to insist that all candidates for posts on railways and passenger ships shall possess sight enough to make them, in this regard, safe to the public in the performance of their duties, and that it rests satisfied with having given power to the different departments (railway and marine authorities, &c.) to make their own regulations as may seem good to themselves. To me it appears that the people have a right to expect the direct protection of the law in all those cases where, by reason of the necessities of modern civilization and of our dwelling together in more or less large communities, personal forethought and carefulness are inadequate to ensure personal safety. If Government finds it a duty to prevent the sale of unwholesome or adulterated food or spirituous liquor, to take measures against the introduction of infectious disease, and against its spreading among the population, how can the same Government divest itself of the respon-

sibility of legislating for the prevention of such railway and marine disasters as are quite sure to arise with more or less frequency if officials with defects of sight are not excluded from all those posts in which they are obviously dangerous to multitudes of other people as well as to themselves? When a tradesman sells bad food or drink, with the object of fraudulently increasing his profits, even if the law lets him alone, there is at least the possibility that a compensating reaction in a falling off of his customers will help him to consider and ask himself whether honesty may not be the best policy. But if the law here steps in (and, as I think, rightly does) to punish the man who instead of bread sells a stone, why does it leave exposed to avoidable danger the traveller on the railway or steamer? If the law tries to protect us from catching scarlatina in an omnibus, it should not apathetically allow us to be drowned in a preventable steamboat collision between Melbourne and Geelong.

It was on these and similar grounds that I contended, and still contend, for precise and definite legal enactments, as conducive and necessary to public safety. Limitations of space and time prevent me from further expanding and illustrating the argument, which, if at all required, might easily be done. But, if the Legislature disclaims any more responsibility, the railway and marine authorities cannot, and do not. Communications of a more or less official character, which have appeared in the daily press, enable me to prove that, as I said before, neither the Railway Commissioners nor the Steam Navigation Board have been moved to take measures ensuring the public safety in travelling. I neither said nor contended that they had not instituted some kind of examination for defects of sight. Had the above-mentioned authorities availed themselves to the utmost of the powers which they already possess, there would still remain, in the case of the Steam Navigation Board at least, no small justification for my calling attention to its shortcoming in not applying to Government for extension of power, so that it could compel all sailors who are employed as look-out men, as well as masters and mates, to undergo the tests for form and colour. So, also, would there still remain occasion to demand the establishment of a definite degree of sharpness of sight for form and colour, and a limited amount of errors of refraction, and an exclusion of every kind of progressive disease of the eyes.

It may be convenient for those who choose to oppose my views to throw dust in the eyes of the public by characterizing these matters as useless scientific refinements, but no person who is acquainted with the physiology of sight and the pathology of the eye can for a moment be deceived by any such statements. Medical or other officers who have to examine candidates for the army are not vaguely instructed that such candidates in order to pass shall be "tall" and "broad-shouldered," but that they shall be not under so many inches high and so many inches in girth round the chest, and if they are an inch too little then they are not allowed to pass. Similarly, a definite standard can and ought to be established as to sight. Slipshod regulations leave the door very widely open to both carelessness and corruption. As before said, it was not asserted in my previous paper that *no* examinations of sight are made, for it is known that years ago there was an examination for colour sense more or less frequently employed on the Victorian Railways. It is now admitted that that examination was "not of a reliable character," and the railway Medical Inspector says that the naming colours test (which is, or at least recently was, the only one employed by the Board of Trade) "is utterly useless, and should have long since been done away with." It is not "utterly useless," inasmuch as a small proportion of the colour-blind fail even with it, but it is untrustworthy, and therefore may become dangerous by deceiving both examiner and examinee. I am not aware that anyone has stated that a special oculist should be appointed for the purpose of conducting colour examinations in the railway service, although I believe that a special oculist would be less likely to make mistakes than an ordinary medical practitioner, but I do say that, as appears from the statement of the railway Medical Inspector himself, the present examination for sight and colours is "not of a reliable character." It was no object of mine to enter into the theory of colour-blindness, nor did I endeavour to show the best methods of testing the colour sense. Holmgren's wool test is very good as far as it goes, but, as we shall afterwards see, the fact that a person can match wools on the table before him is no proof that he can distinguish coloured railway signals or ships' lights at a long distance. For reasons which he does not specify, the railway Medical Inspector almost ignores every part of the examination of the eye except the colour sense. And for the

colour sense testing, according to his own showing, he relies entirely on Holmgren's wools. If it is on this system, "by order of the Commissioners," that for two years past the railway Medical Inspector has examined the colour sense of all railway *employés*, and if he has failed to employ other controlling tests, then it is certain that if any large number have been so passed there are some among them whose colour sense does not reach the standard which it ought to do. In giving this opinion, I am in accordance with what has been indicated or expressed by such authorities as Donders and Bowman, and by Ole Bull, and many others who have had large experience in testing the colour sense.

But the sharpness of sight and the refraction, although officially ignored, are far too important to be passed over, even in these brief remarks, without some further consideration. The sharpness of sight is usually tested by requesting the candidate to name the letters of six Snellen, at six metres, or just about twenty feet.* If he is unable to read the letters we have to do with diminished sharpness of sight (*amblyopia*), or with an error of refraction (*ametropia*). Either of these conditions, beyond a very slight degree, *which should not be left to the discretion of the examiner*, ought to absolutely exclude candidates from any duties requiring very good sight, either on railway lines or on steamships. The next thing is to distinguish between the two forms of imperfect sight, and to ascertain which we are concerned with in the case in hand, or whether there is a combination of the two. We therefore examine the refraction, and here it is useless to argue that any but a skilled examiner can be efficient, and he therefore, whatever his denomination or his practice, must be to all intents an expert. The chief methods employed for this purpose are retinoscopy, or the shadow test; ophthalmoscopy, or the examination of the retina and of the optic disc in the inverted and upright image by means of the refraction ophthalmoscope; and the (usually complementary) testing by spherical or cylindrical lenses. Other means occasionally employed, such as pin-holes, slits (vertical, horizontal, or oblique), &c., hardly need mention. If the candidate is the subject merely of *ametropia*, he may yet be competent for most offices where accurate sight for distance, without the use of spectacles, is not essential. There are difficulties in the use of spectacles in rain, mist, and fog,

* If accomplished, generally indicated thus : $\frac{6}{6}$ or $\frac{20}{20}$.

although their employment is allowed in the German and some other Continental armies. By the practised examiner these forms of examination are made use of, often in much less time than is required to describe them, and they are not to be considered as mere unpractical scientific trifles or refinements. The hard names soon lose their formidable look when the things are understood, and the difficulties lie much more in learning the use of than in applying the instruments when practice has been acquired—perhaps much after the principle on which it has been said that “easy speaking means hard thinking.” Suppose, however, that the candidate did read the test types at the requisite distance, is he then to be passed? Certainly not. His refraction may have been deficient, and he may have supplemented it, and thus made up for the deficiency, by an increased and abnormal use of his accommodation, or focussing power. If we could depend on his always doing that, we might still not reject him, but we know very well that sooner or later (and it may be very soon indeed), a time must come when he will no longer be able to maintain the necessary degree of increased accommodation, and when the distant (and still more the near) vision must break down.

The field of vision is also to be tested. If a person were to try to walk through the crowded streets with the lens tubes of an opera glass before his eyes, he would attempt the performance of a difficult task. Yet the tubes would not interfere with his reading at a distance, nor with his perception of colours; they would, however, cut off from him more or less of the periphery of the field of vision. A look-out man at sea in this condition—that is, with loss of the periphery of the field of vision—would only see a light which very nearly coincided with his axis of vision, and would not see it if it were to the right or the left of the direction in which he was looking. The integrity of the visual field is, therefore, an essential requirement. In a still worse condition would that person be whose central vision was abolished, and who, to see an object straight ahead of him, had to turn himself so as to get a side view. Yet, in each of these conditions, the persons might be able correctly to match Holmgren's wools. After this it is necessary to exclude every kind of progressive disease, whether affecting the membranes or humours of the eyeball itself or any of its accessory appendages. Polar or other kinds of cataract, nebulæ of the cornea, affections of the iris, and what are, for

the unpractised observer, still more inscrutable and undetectable, affections of the retina, choroid, posterior part of the sclera, and the optic nerve. It is not to be supposed that every possible affection requires to be specially looked for in every case; but it is necessary for the examiner to make himself sure that none of them are present in those whom he passes. When examining the refraction by the ophthalmoscope we take care to see at once if any of these morbid states exist, and a pretty full acquaintance with both physiological and pathological conditions of the fundus is, therefore, well-nigh indispensable to the examiner. Such objects and methods of examination being necessary—and they are essentially those recommended by the International Medical Congress of 1881—will the assurance be given by the railway authorities that anything like them has been carried out in the 6,000 examinations made by the railway Medical Inspector and those who have been called to his assistance? If that assurance cannot be given, then the public may be quite certain that the examinations have been imperfect proportionately as the methods have been unused, and no assurances on other points, by the Medical Inspector or anyone else, will free the authorities from the imputation of dereliction of duty if, after the risks arising from imperfect examination have been set forth, they allow the lives of railway travellers to be thus imperilled. On the other hand, if it be proved that these methods have been always employed, although most, if not all, of what I have before stated will remain valid, I shall readily admit that the examinations have been more nearly complete and reliable than I have had any reason to believe. If a great railway smash occurs through mistake of signals, and the engine-drivers and look-out men are not among the victims, it is sincerely to be hoped that those who may sustain injury, or their friends, will insist on having the sight of the railway officers concerned thoroughly tested by a surgeon who is up in the work, and who will take care not to overlook defects of sight or colour sense, if any exist. In such case, if defects of sight were proved to be the cause, a jury would, I think, feel bound to award exemplary damages.

As a counterblast to my paper, and in defence more particularly of himself and the Railway Commissioners, the railway Medical Inspector read a paper before the Medical Society of Victoria. In his reply, at the end of the debate

he is reported to have said—"The character of the discussion sufficed to prove the absurdity of the contention that a special oculist was required for the detection of colour-blindness. The other assertion, that every examination concerning the acuteness of vision should be entrusted to an oculist, was equally untenable. If any candidate was willing to see as well as he could any medical man could test his powers of vision by Jaeger's or Snellen's types." The Medical Society having thus become responsible for accepting these opinions, let us see how far they will be found right. If the examiner is not capable of measuring the colour sense—the refraction—and sharpness of sight—it stands to reason that there is no use in laying down for each of these a standard below which the candidate shall not be passed. If he cannot detect deviations from the normal or physiological state of the eye—if he cannot discover disease, and determine whether it is progressive or stationary, important or unimportant—then, taking a common sense view, one would be inclined to believe, not that these matters are therefore unnecessary and irrelevant, but that the examiner (like a recruiting sergeant who could not measure his men in feet and inches) was incompetent for his work. Against this natural conclusion the members present at the meeting of the Medical Society, by implication, lodged a demurrer. If the railway Medical Inspector and those associated with him in the examination of 6,000 railway *employés* HAVE carried out careful examinations on all the above-mentioned points, why do they not at once tell us so? To give such proof of the efficiency of the examination would be much better than to attempt to defend their present position; for, no matter how completely non-professional persons may be misled, it is of no use—except as displaying the ignorance of those who make the assertion—to tell ophthalmic experts that visual acuity, near approach to emmetropia, and absence of pathological conditions, are insignificant factors. Ignorance, however, is a very imperfect excuse for the reckless hardihood which allows persons to assume the performance of important duties for which their previous study and training have little, if at all, qualified them.

At first look, one would be apt to think that the man who has studied the clinical pathological conditions of the eye, and its functions and derangements as an optical instrument, would probably be a more competent examiner than he who has done nothing of the kind. Here, again, the Medical

Society, in effect, declines to support such an opinion. What force does this decision, even emanating from a multitude of counsellors, really possess? On the face of the matter, it is a little unusual that the more one studies a subject the less he knows of it. Perhaps the best way to counteract such dicta will be to advance, on the other side, the expressed opinions of a few men whose names are not altogether without respect in the medical world of Europe, and that shall soon be done. Meanwhile it is apparent that the remaining part of the case of those who are in disagreement with me rests on the sufficiency of Holmgren's test and on the expressed, or implied, contention that further examination of the eye is unnecessary. On the other hand, I maintain that, although the colour perception is important, yet it is not the most important of the defects of sight; and I am also of opinion that, even for testing colour sense in the class of persons with whom we are here concerned, Holmgren's wools do not always give an entirely reliable result.

To show that the colour sense is not the main part of the required examination, Dr. W. A. Brailey says:—"We shall not be beyond the mark if we estimate that eight per cent. of the English people suffer from refraction errors which diminish vision to this extent"—that is to say, two-thirds of the normal form sense, and less than half the normal amount of colour sense—"whereas not more than two per cent. of males are liable to mistake red for green"—and a corollary of this statement is, that such persons, who could accurately match the wools, would not be able to distinguish the signal lights at anything like the proper distance. So a considerable percentage of candidates for railway appointments may have matched the wools perfectly, and some may even have read $\frac{6}{6}$, or thereabouts, without an error, and yet be unable to distinguish between a white, green, or red signal at half, or even much less, of the distance required in their duties. On the very day when I am now writing I have seen a person whose accommodation enabled him to overcome an induced hyperopia of four dioptries, while his distant colour perception was diminished by at least one-half, yet he had no true colour-blindness. How far are the Railway Commissioners or the Steam Navigation Board informed on these matters? It will hardly be assumed that the percentage of refraction errors in Victoria is *nil*; indeed, from my own experience, I have no reason to think that it differs much from the estimate of Dr. Brailey in England. What, then, becomes of this eight per cent. or so

of persons with refraction errors? Have they been detected by the examiners, and prevented from entering the railway service? If so, nothing of the kind has been stated. If they have not been detected we must suppose that there is now employed on the Victorian railways a very large number of persons with defective sight, and therefore, in the very words of the railway Medical Inspector, "liable to occasion the most fearful calamities." Why should it have been concluded that because a person can match coloured wools, which he may hold six or twelve inches from his eyes, he can also of necessity distinguish coloured railway signals at eight hundred yards, and ships' lights at two miles distance? It does not seem probable, and, moreover, it is not the case. Dr. Brailey has shown that an error of refraction of only one dioptré may diminish the distance at which coloured lights can be distinguished, by one-half, and I have repeatedly made similar observations myself. Within a few days, I have seen a person (A), the subject of slight hyperopic astigmatism, who read nearly $\frac{1}{3}$. Donders's spots were only distinguished at five feet, and a $2\frac{1}{2}$ mm. diameter green disc by transmitted light was scarcely made out at ten feet. With a correcting convex cylinder (+ *cy.* 1D), the spots were made out well at ten feet, and the green light at fifteen feet. Another case (B) was the subject of a myopia of ten dioptrés. The spots were made out at eighteen inches, and the green light at three feet. Nearly corrected with a concave lens, the spots were seen at three feet, and the green light was well perceived at twelve feet. So important, then, is the refraction as concerns the colour perception at a distance.

Again, it would appear that the railway Medical Inspector leaves quite out of account all cases of acquired colour defect. What says Dr. Brailey?—"The various conditions requiring spectacles, defects of form and colour arising from the use of tobacco and, perhaps, of alcohol—those due to nervous diseases, too many of them of syphilitic origin, are at least as common among sailors as among landsmen. When we add to these, congenital defects of colour, and also such conditions as glaucoma and cataract, we become impressed with the gravity of the subject. How common are these defects we shall never know exactly till the authorities wake up from their present apathy, and step in with some legislation." These remarks and quotations will fail of their purpose if they do not lead some persons, at least, to perceive that the practical testing of sight does not

so completely lie in a nutshell as they may have been inclined to imagine. It is, however, better to have to face known danger than to believe in a false security.

Now let us revert to the Steam Navigation Board. This Board has instituted an examination which it has only the power to compel masters and mates to undergo. How far will it be a consolation to the friends of those who may be drowned through the blindness of a steersman or look-out man to be told that the captain and mate had excellent sight? Surely the Steam Navigation Board knows well enough that masters and mates are not the only persons concerned in navigating ships. Why, then, have its members not felt it a duty to apply to Parliament for power to enable them to examine all persons who look out in navigation? Next, as to the character and sufficiency of the examination. In November, 1883, I had the honour to submit to the Steam Navigation Board a short account of colour-blindness, more particularly as it concerns navigators and look-out men at sea. I pointed out, also, that there are other visual deficiencies which have to be guarded against in such persons, and I enclosed and commended to their attention a copy of the "Resolutions on Tests of Sight" adopted by the International Medical Congress of 1881, and a paper "On Railway and Marine Signals" read by me before the Royal Society of Victoria. The Steam Navigation Board had thus the opportunity of becoming acquainted early in November, 1883, with the means for avoiding danger from defects of sight, as far as concerned their own department.

In the *Argus* of 8th December, 1883, a paragraph appeared to the effect that the Steam Navigation Board found "nothing can be done with the view of improving the present examination until information has been obtained showing what course has been adopted by the London Board of Trade." No information was given *why* nothing could be done, and so this very remarkable statement remained quite unsupported. I immediately wrote a letter to the editor of the *Argus*, and pointed out that the examination of the Board of Trade ought only to be taken as an example of what to avoid; and I again insisted on the authority of the "Resolutions as to Tests of Sight," and their sufficiency and fairness if the tests were properly carried out. The Steam Navigation Board, however, from the first seems to have made up its mind that no examination could be devised which should improve upon that of the Board of Trade,

although I had shown the inefficiency of it. Since they still hold fast to the same idea, as proved by a letter from their secretary in the *Argus* of 16th February, 1887, a little more evidence shall be given on the subject. To quote again from Dr. W. A. Brailey :—" Mr. Chamberlain, answering last year in the House of Commons a question put by Mr. Gibson, stated that ' all persons applying for certificates as masters or mates had to undergo an examination for colour-blindness.' " He did not state that any officer failing to pass such an examination was still perfectly free to become captain of a steamer of the greatest size and speed, trading in the most crowded waters of the world. Nor did he state—for how should he, with his engagements and temporary tenure of office, know—that the examination for colour is little more than a farce, and that there is no guarantee whatever that the persons appointed by the Board of Trade to conduct it know one tittle about the subject. " This is a matter that cannot be left to private enterprise. Sailors, who are the victims of mishaps at sea, are uninterested in, and also prejudiced against, anything appearing to them to be scientific. The whole English mind is so conservative as to have a bias in the same direction. Shipowners will make no move till they are touched in their pockets. They are apprehensive that an examination may be the means of raising the wages of the better class of sailors. So long as their money-losses are covered by insurance, some of them can bear with equanimity the loss of their ships, and even of the lives of those manning them. The people of this country should know the exact circumstances of the case. A few instances may be of value. For one I may refer to a case which I last year brought before the Ophthalmological Society, that of a captain to whose short-sightedness the loss of two ships in as many voyages was clearly due. He is now in command of a large sailing vessel. His defect was known neither to the legal authorities nor to the Board of Trade, because it was not spoken of at either of the inquiries. It was, however, perfectly well known to all his friends. Another gentleman, a patient of my own, the second officer of a ship of 2,000 tons burden, was so short-sighted as not to be able to see the details of the rigging of his own vessel. His scruples on the subject of his sight were, however, ridiculed by his owner, who also called the captain an " old woman " in that he shared the young officer's apprehensions. Another officer, who had just received his certificate from the London examiners of the

Board of Trade, immediately after being rejected, on account of colour-blindness, by the Liverpool examiners, was, in the hands of other and more competent examiners, found so defective as to match green wools with scarlet. He is now at sea. Early this year a Gravesend pilot came to Guy's Hospital on account of his sight. He was found totally incapable of distinguishing a red from a green spot, a quarter of an inch square, at any distance, and his vision was moreover defective in other respects. And similar cases have been recorded by Morton and others. . . . One of the colour examiners of the Board of Trade told me that he himself, when in command of a vessel, shipped a sailor, who, after doing the usual duty for some time—including his turn as look-out man and helmsman—was discovered to be nearly blind, by his falling, in broad daylight, down an open hatchway, which he had not sight enough to avoid." Professor Snellen, of Utrecht, says:—"It is clearly necessary that any man should have his colour sense ascertained before he is put to observe coloured signals. The practical way of examination for such purpose seems the method of Donders. . . . But it is not only impaired colour sense that will prevent from discerning coloured signals. All decrease of general vision will do as much." Mr. M'Hardy "would direct attention to the fact that the use of visual tests, applied by other than ophthalmological experts, was encompassed by two distinct dangers—dangers to those whom the tests were intended to protect at the expense of candidates with impaired visual powers, and danger to ambitious, absolutely normal-eyed and sighted youthful candidates." He gives an instance of a lad rejected for the Royal Navy in consequence of simulated myopia, the real condition being temporary spasm of the accommodation from overwork. It was afterwards demonstrated that he had a total hyperopia of scarcely half a dioptré, a singular absence of astigmatism, and a visual acuity of $\frac{7}{8}$. Mr. M'Hardy considered that the present medical examination of candidates for cadetships in the Royal Navy, so far as it concerned the fitness of their eyes for navigating purposes, was altogether delusive, and that great care should be taken in insisting upon the essential necessity of allowing none but ophthalmological experts to pronounce a final verdict regarding the fitness of any pair of eyes for any particular calling in life. "The profession should be first educated to an appreciation of the facts, then the same should be done with the public. . . . Even on shore railway

directors and officials allowed the fastest trains to be driven by men whose defects of vision precluded them from distinguishing any form of signal. . . . Two dangers needed to be avoided—1. The obvious one of permitting the admission of candidates with such visual defects as might be overlooked by not specially trained (or expert) examiners; 2. The more cruel and less obvious danger of candidates with perfectly normal acuity of vision and colour perception being finally rejected because of a temporary failure to respond to a routine test applied by any but an expert examiner." Dr. M'Keown (Belfast) thought that the testing of vision was a matter of so much importance that it should not be entrusted to any person but a competent oculist. Some other conditions and affections of the eyes besides colour-blindness or defects of refraction were attended with great danger. For example, in cases of double vision occurring in seamen or railway drivers it was quite obvious there was no little risk of collision. He instanced cases of diplopia, retinitis pigmentosa, and colour-blindness which had come before him. Mr. Shadford Walker (Liverpool) mentioned some cases. One was that of a Welsh captain (who had been in one or two collisions), who was so myopic that he could not see a load of hay 250 yards off, and would not admit that he was short-sighted. There was no system of testing sight on board the training ships. This was illustrated by a boy who was disqualified from being a seaman, after being on the *Conway* two years, on account of his myopia. Boys tested imperfectly, after education in the nautical school, were often rejected when they wished to join the Royal Navy. Hence there was a necessity for proper examination by competent persons."

The discussion terminated with the adoption of the following resolutions :—

"1. That in the opinion of this section (Section H, 'Ophthalmology,' fifty-first meeting of the British Medical Association, held at Liverpool, 1883), it is of international importance that a proper system of testing the sight of seamen be adopted.

"2. That the system comprise an examination, by competent persons, of the sharpness of sight of both officers and able seamen; this being at present entirely neglected.

"3. That the imperfect examination for colour-blindness to which the Board of Trade at present submits candidates for

officers' certificates be revised, and be extended also to able seamen.

"4. That pilots be subjected to the same tests, under some central authority, in place of the present varying and ineffective system of examination.

"5. That anyone failing to pass such examination be excluded for the future from the responsible navigation of a vessel.

"6. That in case of all accidents at sea which may be due to defective sight the vision of all concerned should be made the subject of inquiry by competent persons."

It was afterwards resolved—"That if information be required by the Board of Trade with respect to the resolutions, the matter be referred to a committee consisting of the officers of the section, with power to add to their number."

It will be seen, from what has preceded, that several of the examinations of sight in England are still very defective and insufficient. As far as my information goes, it is almost only in some of the smaller Continental states that a really good and efficient examination, carried out by competent examiners, at present exists.* In the mother country the dead weight of resistance to change, of whatever nature, is relatively much greater than in a colony like our own, which has in the past rather affected the reputation of being a go-ahead place. And yet, *parva componere magna*, can we fail to be struck with the near resemblance between the answer given by a Minister in the House of Commons and that given by the Minister of Railways in Victoria, which appeared in the *Argus* of 6th December, 1882? Mr. Bent was there reported as having (while claiming credit for taking precautions against railway accidents) replied to a question in these words—"There never had been such strict examinations as to the sight of applicants for employment, and some gentlemen had told him that they understood he had made such arrangements with the Medical Officer that he would not let one pass." If it were not for the serious aspect, this would be amusing, when we know that for years after this answer was given, there were colour-blind engine drivers doing duty on the Victorian railways. No reply could well have been more misleading than Mr. Bent's, and although it was no

* I may be allowed here to record my thanks to the consuls in Melbourne of the principal European nations and of America, whose response to my letter of queries makes me feel much indebted to them for their courtesy.

doubt given under a misapprehension, it is much to be regretted that he could not find means to make himself better acquainted with the real facts. Obviously, the justification for making much more strict examinations of the sight of new applicants, involved the obligation of re-examining those who had been previously admitted under far less stringent proceedings.

Let us now hear what Dr. Joy Jeffries has to state regarding laws and examinations as to colour-blindness and defective sight on the American railway lines:—

“In the Massachusetts Statutes, chap. 194, as amended, is an Act relative to the employment by railroad companies of persons affected with defective sight or colour-blindness, which reads as follows:—

“SECTION 1.—No railroad company shall employ or keep in its employment any person in a position which requires him to distinguish form or colour signals unless such person has been examined for colour-blindness or other defective sight by some competent person employed and paid by the railroad company, and has received a certificate that he is not disqualified for such position by colour-blindness or other defective sight.

“SECTION 2.—A railroad company shall be liable to a fine of one hundred dollars for each violation of the preceding section.’

“The Act went into force 1st July, 1881. Its wording was designedly made so as to defeat the purpose of a law protective to stockholder, *employé*, and the community. It is practically as dead a letter as the liquor laws, as I recognized that it would be when passed. In my infirmary and private practice cases quite frequently occur illustrating the truth of the above statements. Many more must naturally occur in the practice of my colleagues. Attention should be called to them. The following cases are typical of those I have records of. Any member of the society is liable to be summoned in court as witness or expert in connection with such cases and under the gravest circumstances:—

“AS TO THE FORM SENSE—

“No. 1. A young man wants to go to one of two railroads. Vision of right eye $\frac{16}{200}$, of left eye normal, with D + 1.25, a lack of vision, and hypermetropia, which should keep him from

any position where glasses cannot be worn, which position he does not want. There is nothing to prevent 'any competent examiner' giving him a certificate as engineer.

"No. 2. A foreman at work on a road and desiring promotion to engineer has converging strabismus. In right eye a hypermetropia of D 2.50, and vision $\frac{6}{18}$; in the left, squinting eye, Hm = D 2.50, and vision $\frac{6}{36}$. There being no legal standard set, and no expert appointed to detect the hypermetropia, this man has readily passed such tests as his road made.

"No. 3. A brakeman has no certificate (the fine to the railroad for this is one hundred dollars). He has Hm = D 1.50; V. O. D. = $\frac{10}{20}$; O. S. = $\frac{20}{20}$. He requires + D 2.50 to read. Without glasses he could not read an order or a telegram.

"No. 4. A brakeman has been on a road some three years. Without glasses, V. O. D. = $\frac{6}{24}$; V. O. S. = $\frac{1}{60}$; V. O. D. with + D 4.50 = $\frac{6}{12}$; V. O. S. with + D 1.00 = $\frac{3}{30}$. The only test he had was the train despatcher asking him how many knobs there were on an adjacent telegraph pole, and telling him his vision was as good as anyone on the road.

"No. 5. A brakeman has been on three roads—only tested on one. He has convergent strabismus, great pain, and marked symptoms of cerebral trouble. Only pain and fright keep him from his duty, from which he just comes. No law requires him to be off duty.

"No. 6. A gateman applies to me for certificate for full pension for blindness, contracted in the army. He groped his way into my office. He had white atrophy of the optic nerve in each eye. He says at times he is completely blind in the sun; so he cannot see people on his crossing, which is an important one. He holds a certificate from his road examiner 'that he is not disqualified by defective sight.'

"No. 7. An engineer comes from off his train with a foreign body on the cornea, requiring cocaine to remove, the 'boys' having been at work on it. He refused atropine and cold compress, which were needed, and went back to his train to run some fifty miles. There was nothing to prevent him in his wholly unfit condition. Interference would only have provoked abuse.

"No. 8. A similar case of a conductor, worse off, as it was before cocaine.

"No. 9. An engineer has vision, without glasses, O. D. = $\frac{20}{40}$; O. S. = $\frac{20}{30}$; V. O. U. with + D 1.25 = $\frac{20}{30}$. Not colour-blind. He was fifty-two years old, and his sight too poor for his

position. Another *employé*, testing him, of course certifies to him.

"No. 10. A fireman, with vision normal and not colour-blind, comes to be tested on his own idea, as he has never been tested or certified to by his road, where he has been some time. Road subject to one hundred dollars fine.

"No. 11. Engineer, fifty-six years old, brought by his superintendent, is not colour-blind; his vision, O.U. = $\frac{2}{30}$. The superintendent was frightened and took him off his engine. Under legal standard requirements and legal expert testing this injustice could not have been done the man.

"No. 12. A conductor has lost his place on an *employés'* examination. He is quite hypermetropic, easily corrected by glasses, which there is no objection to his wearing. Another injustice from want of legal standards of requirement and testing. On learning my name his abuse was profuse, though all my efforts have been to prevent such injustice to *employés*. Office-seekers had falsely misled him."

It is unnecessary to quote at length the errors which had been previously made as to the colour sense in the cases which Dr. Joy Jeffries records—errors on both sides—in passing men who were colour-blind and in rejecting others who had little or no defect of colour sense. I submit that ample evidence has been brought forward to show that under the absence of definite standards of sharpness of sight for form, for colour, and of refraction, and under such crude methods of testing as have hitherto been employed in Victoria, as I said in my previous paper, neither the Government, nor the Railway Commissioners, nor the Steam Navigation Board, have yet been moved to take measures to *ensure* the public safety in travelling by land and sea. When we want to know if a man is five feet eight inches high, we do not trust to the accuracy of our judgment, but we simply take a rule and measure him. So should it be with form and colour perception. We know practically the sizes and the shades of colour which the normal eye can appreciate, and we can measure whether the refraction is insufficient, or more than sufficient (and exactly how far too much or too little) to bring parallel rays to a focus on the retina. Similarly with the field of vision and with the strength of the converging and diverging ocular muscles. I therefore say, again, with Dr. Joy Jeffries—"Standard requirements and competent expert examiners can alone insure honesty and fairness to all

concerned." In like manner, as there must be standards for colour and form sense, for refraction and so on, so must there be a standard for "competent examiners." Nor in this matter is the difficulty much greater. The examiner must be able to determine the acuity of vision for form and for colour, to measure the refraction, by retinoscopy, by the refraction ophthalmoscope and by the other ordinary methods, to observe the field of vision, and must have a fair acquaintance with the physiological and pathological appearances of the ocular fundus and the dioptric media, as well as of the external coats of the eyeball. Further, it is in the highest degree desirable that all examiners should be under the control of a central head. When all this has been effected, then, and not till then, will the authorities have a right to say that they have done their duty to candidates and to the public.

