supernatural as is any work written in our own generation.

John Ware, who died as late as 1816, about this time wrote voluminous works on various ophthalmic subjects, most of them published by his son in two volumes, 1818.

Two features particularly distinguish eighteenth century therapeutic literature, viz., long, complicated prescriptions and the search for cure-alls. Examples of these are furnished, for example, by Sir Hans Sloane—him of the Museum in Lincoln's Inn Fields—physician to His Majesty, etc., in a pamphlet, dated 1745, and entitled "An Account of a most Efficacious Medicine for soreness, weakness and several other distempers of the Eye." Thompson's eye water and Petit's eye salve of our day, with a number of minor contestants, now hold the field of popular favor, but the idea of the panacea is the same.

As we approach the beginning of the nineteenth century the first writing on eye diseases by an American of which I can find any account appeared, according to Harry Friedenwald, in the *Medical Repository*, Volume VII, page 28. It is entitled "An account of a case of Fistula Lachrymalis, with reflections on the different modes of operating in that disease." The author is Dr. Pierre Chatard, who settled in Baltimore in 1797, but who does not appear to have made a specialty of eye diseases. From this time forth comparatively frequent and important additions were made to ophthalmic literature, not only in Great Britain, but in America. The British and French ophthalmologists were then the best known in the medical world, although they were soon to be rivaled and eclipsed by the brilliant labors of Barth, Beer, Schmidt and other German surgeons. I have time to mention only a few of the more important.

Sir William Adams wrote during the first two decades of the last century. Following him were many others, authors of complete treatises of goodly proportions, which, as a rule, were well illustrated and especially replete with reliable descriptions of diseases of the eye. I wish to mention particularly J. C. Saunders, the first edition of whose celebrated treatise was published about 1811; G. J. Guthrie's "Lectures on the Operative Surgery of the Eye," which were published in London, 1823; John Vetch, "A Practical Treatise," London, 1820; A. Watson's "Compendium," Edinburgh, 1828; Wm. Lawrence, "A Treatise on Diseases of the Eye," 1833; Benjamin Travers, a deservedly popular text-book, with several editions, first issued in 1820; Middlemore's treatise, two volumes, published in 1835; Morgan's volume of lectures in 1839; F. Tyrell's two-volume treatise in 1840; Walker's "Vade-Mecum," in 1843; Haynes Walton, and Wharton Jones. Last, but by no means least, we note the appearance of the first edition of the greatest of all the British text-books, by Wm. Mackenzie, in 1830.

The works of most of these ophthalmic writers—and I have by no means given a complete list of them—ran through several editions, and a few of them were translated into foreign languages. The treatise of Jno. Cunningham Saunders is of especial interest to us because it was the first complete work on disease of the eye published in America, having issued from the press of Benj. Warner at Philadelphia in 1821. It was very appropriately dedicated to his teachers of anatomy (of which Sir Astley Cooper was one) and to the officers of the London Infirmary for Curing Diseases of the Eye, whose legitimate descendant is the Royal London Ophthalmic Hospital, better known as Moorefields. Saunders was undoubtedly the first to propose a special hospital for eye diseases, and was the founder of this one, which was

opened for the reception of patients in March, 1805, although the Royal Westminster Infirmary was formed and established a few months previously. Saunders was not fated to enjoy, for any length of time, the practice of the house he had builded. Symptoms of organic disease of the brain developed in the beginning of 1809. Although the disease interfered greatly with his work, he refused to take the needed rest from his arduous labors. The description of the eye symptoms in his case is interesting, one might say almost pathetic, viewed from the standpoint of our time. "He was affected with an imperfect amaurosis of the right eye. The eye was carefully examined, but the pupil was found to be of its proper size and figure—objects, besides being obscured, were diminished in size and deranged in position, the accurate distinction of colors was lost." After nearly a year of suffering he died in January, 1810. The first edition, most of which was written while barely able to hold pen in hand, was edited by his friend J. R. Farre, illustrated by colored engravings and published at the expense of the infirmary for the benefit of his widow.

(To be continued.)

Original Articles.

A MODIFIED FORM OF TEST-CARD AND TEST-LETTER.*

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The importance of painstaking care and accuracy in determining the refraction of the eye is well understood by the ophthalmologist of to-day. Indeed, in America, those in the front rank in every department of medicine recognize the great value, for the relief of many disturbing conditions, of accurately correcting refractive errors. Any suggestions which may render results more certain are of value, and the careful ophthalmologist will spare no effort to reach a decision as nearly correct as possible, well knowing that what appears to be a slight error in the measurement of any eye's refraction may render valueless the work of making the measurement, and cause a failure of his attempt to relieve a patient of some distressing condition.

The question of illumination, the position of test types with reference to patient and light, and even the arrangement of the case of test lenses, all are worthy of attention. Since, with few exceptions, our final determination of the refraction is made with test lenses and test types or letters, these occupy the place of chief importance in this work. No great change, in the way of improvement, has been made in test-letters since the classical work of Snellen in 1862. He investigated the problem thoroughly and gave us the geometric letter of definite size and proportion of line. For general use the letter must still be the best form of test-object, as it best serves to indicate the accuracy of the patient's judgment as shown by the correctness with which he names the letters. Much of the difficulty experienced, and the uncertainty of results reached with this, the final method, depends upon lack of careful and accurate observation on the part of the patient; and much of the "refractor's" success depends upon the aid which he gives the patient, in educating him to observe nicely;

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for few persons observe comprehensively when subjected for the first time to a test of this kind.

That there are objections to the test card, as ordinarily employed, I have long been convinced. One of the most serious of these is that it quickly produces retinal fatigue, a result which is caused by the glare of light reflected from the surface of its white background. This is a very important factor in causing fatigue of the eye and lessening its sensitiveness to slight changes in distinctness of outline of the small test letters. Dr. Gould of Philadelphia has devised a card which is free from this objection, by making the ground black and the letters white. In this form of test card there is, however, an objection and that is the effect of irradiation seen about the letters, an effect observed when a small white body is viewed against a large dark background. The effect of irradiation is to increase the apparent size of the small object and at the same time to lessen the sharpness of its outline. Except in intense illumination, the effect of irradiation is not observed with a small dark body on a light ground. Another imperfection in the ordinary test-card is shown in the fact that with nearly all eyes, save those having very acute vision, the decision regarding the glass which gives sharpest outline to the letters is often uncertain within $1/4$ d., and in low amounts of astigmatism the position of the axis is uncertain within an arc of 5 to 10 degrees.

While it is evident to any one at all familiar with the subject, that no device can make the task of measuring the refraction a simple or easy one, yet I think that some of the difficulties encountered may be eliminated or lessened. As the result of an attempt to avoid some of the objections to the ordinary form, I have devised a series of letters which I here show. Some of the letters, it will be observed, are in color on a ground of another color, while others are built up of two colors and are on a ground of neutral color. The two colors used are, in both instances, yellow and blue; colors which are complementary. The reason for using these two colors will appear later on. By using a background of color, the glare of light and retinal fatigue resulting therefrom is lessened, and we are enabled to take advantage of, and utilize, the phenomena of contrast of colors in such a way that the lessened illumination is not a disadvantage as would be the case with a test-card of black letters on a white ground. It is well known that a color can be materially changed in brilliancy and saturation by altering the color which lies adjacent to it. Without entering into a detailed examination of the laws which govern the result, it is sufficient to say that when a colored object, such as a letter, is seen on a ground of complementary color, the color of the letter is strengthened and made more saturated and brilliant. That this must be so is evident when we reflect that the after-image of a colored object is always in complementary color. This phenomena is most noticeable when two colors are contrasted successively in the following manner: A small square of black paper is placed on a sheet of yellow paper (any other color might be used) and the attention is directed to the edge of the former. If now the black square be suddenly removed the observer sees in place of it a luminous spot which in this case will be yellow, but what is remarkable is the fact that this yellow image or ghost will be more intense and saturated in color than the rest of the ground. The rest of the yellow paper will appear as if gray or white had been mixed with it. This experiment succeeds with paper of any bright color, and Helmholtz has shown that the same effects are obtained with the use of pure spectrum

colors. If instead of employing a black square we take one which has a color complementary to that of the ground, in this case blue, the result is much the same as before, except that the yellow ghost is now still more intense and brilliant in color.

These phenomena are cases of what is called successive contrast, because we look in succession from one surface to another. When colored surfaces are placed in juxtaposition and viewed in the usual way, successive contrast still plays an important part, and the appearance of the colors is still modified according to its laws; for although we attempt to confine our attention to only one of the colored surfaces, the eye involuntarily wanders to the other; for absolutely fixed vision is quite opposed to our common habit, if, indeed, it be not an impossibility.

Yellow, being the most luminous color in the spectrum, is selected for the ground and blue, its complementary, the color for the letter. Not only is the blue letter more sharply defined, by contrast, but the yellow field also gains in brilliancy, in the same way. By filling in much of the field with black, leaving the background of yellow only sufficiently large to give the proper effect of contrast, we still further diminish the amount of harmful light which can reach the eye. In practice it is found best to have the yellow ground for each letter about three times the diameter of the letter, in the small letters. All else may be black. By this means we still further increase the brilliancy and contrast of the yellow and blue. The letters are of the proportions of those generally used. In practice I find it advantageous to employ letters of a slightly smaller angle than $5'$ in measuring the refraction, as in this work the aim should be to get the best possible vision—not to be content with 20/20, or what is commonly designated "normal vision."

Referring now to the letter built up in two colors, I will say that the object aimed at in thus making a compound letter is to produce a more sensitive test object than we have in the solid letter; something which will make more evident any lack of perfect focusing of the retinal image and, therefore, make it easier for the patient to be accurate in his decisions regarding the effect of different test lenses. The letters are made up of two colors which are complementary, one-half of the letter being blue, the other half yellow. The colors are laid longitudinally on each line of the letter, and the background is gray.

A mixture of complementary colors produces gray, and a letter which is built up, in this way, of complementary colors, will look gray to an eye which, through lack of proper focusing, receives the mixed colors on its retina. If, now, the letter is on a gray background as described, the eye can not distinguish the outlines of the letter, and with proper adjustment of colors the letter will be quite invisible. A slight overlapping of the colors, from imperfect focusing, gives the letter a gray appearance, like its ground, and a lens which corrects this overlapping and brings each color sharply into focus produces a much greater contrast than is the case with a black solid letter on a white ground.

Theoretically, any two complementary colors might be used, but practically, I find blue and yellow the most satisfactory, as they each offer the greatest contrast with gray and allow of a smaller letter being used than is the case with any other two complementary colors. It is important that the blue and yellow of which the compound letters are built up be true complementary colors as otherwise a pure gray does not result from their mixture. The proper colors must be determined by actual test with the rotating disc of Maxwell. The colors here used are, for the blue, cobalt blue mixed with a weak solution of gum arabic, just sufficient gum being used to bind the color to the paper; and for the yellow, a thin wash of gamboge mixed with water. These colors when mixed by a rotating disc produce a gray known by paper dealers as platinum gray or platina. Red and green, when mixed, produce a very light gray, but they offer a poorer contrast, separately, with gray, so that the retinal image must be increased in size by increasing the size of the letter to such an extent as to destroy its value as a test for visual acuity, and to greatly lessen its value for purposes of refraction. A letter made up of yellow and blue must be larger, but not greatly so, than a letter of solid color, to still be visible at the normal distance and when properly made is a very sensitive test object. In practice, I find it advantageous to combine the two forms of test-objects here described. The solid letter is the better index of visual acuity and the bi-colored letter is the more sensitive test-object for use in measuring the refraction.

DISCUSSION.

DR. GEORGE M. GOULD, Philadelphia—Speaking of his very ingenious device, Dr. Starr alludes to a test card which I have used for several years, which is black with white letters, and finds that the effects of irradiation trouble him. I illuminate my cards very brightly, and place them at such angle that there is no sheen. I have nothing to complain of as to the irradiation. The card is devised according to the physiologic principles of the eye, the black being a non-stimulant of the retina, does not fatigue the eye, especially when the accommodation is paralyzed. So with this card I often put down normal vision as 20/15 and very often patients can read 20/10. I can read 20/10 easily with it, because the retina acts physiologically. I think Dr. Starr's ingenious device deserves further consideration, but it seems to me that the greatest contrast between stimulation and non-stimulation must be between black and white.

DR. B. A. RANDALL, Philadelphia—It seems to me that the prime conception as to test-letters is often lost sight of, and this is partly to be laid at Snellen's door, since in making the 5-minute letter he did not make more plain that he was testing the vision with its parts and interspaces of 1 minute. Therefore, a letter, whether of 5-minute angle or less, is not a test if its parts are not such as to make the interspaces 1 minute. In using the simple letters, as in the card of Dr. Gould and Dr. Starr, everyone finds that 20/20 is not the normal, but that lower lines can be read.

The matter of irradiation is a factor in the construction, as noted 20 years ago by Giraud-Teulon and Javal, and the doing away with this is of importance in our work and is well secured in a great many of the letters in general use, the best being that of John Green of St. Louis, where the terminal additions are half-blocks. The irradiation which is reduced by this can be made almost nothing by having the card, not the bright yellow, but merely a cream color or India tint. To those of you who are going to construct letters, I would say do not make the common error as to the size of your letters, for 99 out of 100 make the letter according to the tangent of the angle, while twice the tangent of one-half the angle is the proper thing; and see that each part and interspace subtends 1 minute. We can not be too precise in dealing with this subject.

DR. E. J. GARDINER, Chicago—I would like to ask Dr. Starr if the irradiation that troubles him may not be due to uncorrected astigmatism?

DR. STARR, in closing—In reply to Dr. Gardiner, it is certainly worse in such a condition, but I get it at all times with my own eyes. In regard to the form of the letters I can hardly agree with Dr. Randall. I prefer to test by means of the lines, rather than by the interspaces of the letters, and to use a line subtending a smaller angle than 1 minute. I want the patient to be familiar with the letter under observation, and to carefully observe which lens gives the sharpest outline of the letter.

METASTATIC SARCOMA OF THE CHOROID.*

MEYER WIENER, M.D.

ST. LOUIS.

Next to glioma of the retina primary sarcoma of the choroid is the most frequent intra-ocular growth. Metastatic, on the contrary, is extremely rare and has only been authentically reported by Shieff-Gemusens, Pflüger and De Schweinitz. In Norris and Oliver's System of Diseases of the Eye (1898), Hill Griffith, in his article on sarcoma of the choroid says: "Sarcoma of the choroid is always primary, always single and generally more or less deeply pigmented; it never affects both eyes." We are all familiar with the saying of Virchow that in those organs which show a special disposition to nurture new growths, metastatic foci are seldom seen. Thos. Axenfeld, in a review of "Tumors of the Eye," published in 1897, says: "We know of only two positive cases of metastatic uveal sarcoma; those of Pflüger and Shieff-Gemusens and Roth." In Pflüger's case one eye became blind while in the other a tumor formed in the anterior chamber, with episcleral nodules following an enlargement of a nevus in the region of the right parotid. A microscopic examination was not made. Uthoff seems to think these two cases were metastatic carcinoma. A. V. Meiggs and Dr. de Schweinitz report a case of "Double-sided, flat choroidal tumor on posterior pole in a case of sarcoma of the anterior mediastinum" as follows: "A 21-year-old laborer had tumor of anterior mediastinum (which is described as round-celled sarcoma); numerous metastatic nodules in the brain, especially on base; marked tumor thickening of optic nerve as well as motor oculi and orbital muscles. Double-sided independent tumor of choroid." This case, according to Axenfeld, seems to correspond with one of three cases of metastatic "malignant lymphoma," which began also in the mediastinum but in these three cases there were no intra-ocular growths. Cases have been reported by Mitvalski, Esching, Uthoff, Kamoki, Schulz and others, of metastatic carcinoma of the choroid. In not a single text-book of ophthalmology that I possess is metastatic sarcoma of the choroid even mentioned.

In the case which I have to report both eyes were affected, and I procured one of them. The eye was removed from behind, the cornea, lens and ciliary body being left in the orbit. Only the posterior half of the globe was removed. The retina was completely detached, during the removal most likely, as it seemed to be of normal microscopic appearance when stretched out.

In this eye I find sarcomatous patches which are visible on macroscopic examination, and all varying in general appearance as to size, color, etc. The largest and most prominent lies just below the optic nerve entrance and apparently just including it. This patch is of oval

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