DALTONIANA

NEWSLETTER
OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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(Verantw. uitg.)

Tweemaandelijks Tijdschrift

Nr. 9 - 1st April 1973

LITERATURE SURVEY

The photopic spectral sensitivity of color normal, protanopic, and deuteranopic observers, by D.G. WILDER, Dissertation Abstracts International, 31 (4-B), 2333-2334, 1970

Determined the photopic spectral sensitivity of colour normal, protanopic, and deuteranopic observers in order to provide information on the receptor mechanism of colour vision and colour blindness. If colour blindness is due to the absence or inactivation of one of the normal receptor systems, a colour blind person should demonstrate a loss of sensitivity in the spectral region to which the missing receptors would normally respond. However, if the missing receptors are replaced by receptors of a different type, it might be expected that a corresponding gain in sensitivity would be demonstrable also. Fick proposed a mechanism of this type (termed "fusion") where red and green receptors fail to become differentiated resulting in a double complement of either normal red receptors (deuteranopia) or normal green receptors (protanopia).

Twelve subjects were selected after colour vision evaluation with a modified Hecht-Shlaer anomaloscope and a neutral point test. Subjects were then classified as normal, protanopic, and deuteranopic.

Models of both Thomas Young's "loss" system and Fick's fusion mechanism were used for predicting spectral sensitivity of protanopic and deuteranopic observers. Spectral sensitivity data were obtained with methods of visual acuity and the flicker photometer. An approximately equal energy spectrum and test wavelengths of 416-443-542-601-649 nm were presented to observers for both methods. A 75% response level was acceptable.

Acuity data indicated that protanopes exhibit increased sensitivity in blue and green light, with decreased sensitivity in the red, and deuteranopes show increased sensitivity throughout the spectrum. The increases in sensitivity are

inconsistent with a loss mechanism. Comparisons of the flicker data with the receptor models support the receptor alterations indicated by a fusion mechanism of colour blindness, and follow a complete additivity model : however the interactions among receptors in the perception of visual information indicate a highly complex system which is not always readily described. - Romuald Lakowski.

Acuity-luminance function in achromatopsia and in progressive cone degeneration : Factors related to individual differences in tolerance to bright light, by L.L. SLOAN and K. FEIOCK (Wilmer Ophthalm. Inst. Johns Hopkins Univ., Baltimore, Md. 21205), Invest. Ophthalm. 11/10, 862-868, 1972.

The maximal visual acuities of 6 complete achromats varied with luminance only from 10/100 to 15/100. There were, however, marked individual differences in high luminance at which acuity started to decrease when squinting was not permitted. The dark adaptation curves of two of the complete achromats, measured with white and with blue stimuli, the thresholds corrected for scotopic density of the blue filter, were monophasic and coincided, indicating that there were only scotopic rods at the fixation area. Two other complete achromats had biphasic dark adaptation curves also coinciding for white and blue, indicating that both "photopic" and scotopic rods were present. Four incomplete achromats had significantly higher visual acuity and showed biphasic dark adaptation curves with individual differences for blue and white in the first phase and coincidence in the second phase, indicating the presence of both cone and rod receptors at the fovea. One patient with progressive cone degeneration had extensive central scotomas for red and less extensive for blue, as evidence of complete loss of functioning cones at the fovea. He had low visual acuity. Another such patient perceived red and blue in a small area at the fixation point. He had relatively good acuity and maintained it at high intensities. Intolerance to bright light was particularly marked in those who had only scotopic rods at the fovea : the decrease in acuity in bright light was less severe in patients who had either photopic rods or had cones at the fixation area.- Ingeborg Schmidt.

Inert pigments and the variability of anomaloscopic matches, by J.D. MORELAND (School of Optometry, Univ. of Waterloo, Ontario, Canada), Amer. J. Optom. 49/9, 735-741, 1972.

The effects by colored contact lenses on the G/R ratios of matches made on the Nagel anomaloscope are predictable knowing the lens transmittance. Since colored contact lenses are frequently worn, it is informative to demonstrate that with some tints normal trichromats may pass for anomalous on the Nagel and vice versa. Moreover, the effects illustrate the role of the selective transmission properties of the ocular media. Diverse factors are discussed which may affect the individual deviations of matches from the maximum on the Nagel as reported in

population studies on the frequency distribution (Nelson, Proc. Physic. Soc. London 50, 661, 1938; Schmidt, J. Opt. Soc. Am. 45, 514, 1955). Suggestions are made to decrease the individual deviations, namely : 1) to correct he G/R ration for the age of the individual ocular media 2) to increase the wavelength of the G-primary to 550 nm or more in order to reduce the effect of variations in macular pigmentation. -The ratios B/G in matches on anomaloscopes for detection of tritanomaly are substantially affected by the inert pigments of the eye and in the same direction as by tritanomaly. To eliminate these disturbing effects the author suggests 1) to correct the B/G ratio for the age of the individuals ocular media 2) to choose a pair of primaries which are both affected equally by the macular pigment. - Ingeborg Schmidt.

Colour vision in squint amblyopia (Das Farbensehen bei Schielamblyopie), by M. MARRE (Augenklinik, Med. Akademie, Dresden, DDR), Klin. Mbl. Augenheilk. 160/6, 734-735, 1972

The spectral hue discrimination curve was found abnormal in 4 of 9 eyes with stable central fixation, in 4 of 6 eyes with unstable central fixation, and in all 5 cases of parafoveal fixation. Thus colour discrimination can be abnormal in central fixation, despite the findings of Roth (1966) obtained by means of pigmentary tests.

The spectral saturation discrimination curve was found normal in the four examind eyes (2 with stable and 1 with unstable central fixation, 1 with parafoveal fixation).

Moreover, 9 eyes with foveal fixation showed on the one hand normal spectral luminosity curves when this was measured by a threshold method in darkness, and on the other hand a displacement of the maximum of the spectral luminosity curve from 538 nm to 545 nm when this was measured by means of a flicker method in the light adapted eye. The proposed explanation of this difference is that in scotopic conditions the lateral inhibition is diminished. - Guy Verriest.

Chloroquine retinopathy (Rétinopathie chloroquinique), by J. FRANCOIS, A. DE ROUCK, E. CAMBIE and J.J. DE LAEY (Dienst Oogheelk., Akademisch Ziekenhuis, De Pintelaan 135, B-9000 Gent, Belgium) Ophthalmologica, 165, 81-99, 1972.

The importance of the electrophysiological examinations (ERG, EOG) for the early detection of chloroquine retinopathy is stressed. Among 17 cases, 9 had normal colour vision, 5 a blue-yellow defect, 2 a red-green defect and 1 a total colour blindness. - G. Verriest.

Stargardt's disease; ERG, EOG and colour vision (La maladie de Stargardt; ERG, EOG et sens chromatique), by A. PINCKERS (Dept. of Ophthal., Univ. Nijmegen, Netherlands), Ann. Oculist. (Paris) 204/12, 1331-1346, 1971.

In 32 patients showing the fundus picture of Stargardt's disease ERG, EOG and colour vision were examined.. There was no correlation between visual acuity and function or age. The disturbance of colour vision and ERG indicates a lesion at the level of receptors in the macular area. A DT axis in the F.M. 100 Hue graph agrees with a strong displacement of the Rayleigh equation to the red end of the spectrum. In cases of fundus flavimaculatus combined with Stargardt's disease the functional disturbances are identical to the findings in Stargardt's disease. - The Author.

Fundus flavimaculatus; clinical, functional and genetical study (Le fundus flavimaculatus; étude clinique, fonctionnelle et génétique), by J. BABEL (Dept. of Ophthal., Univ. Geneva, Switserland), Arch. Ophtal. (Paris) 32/2, 109-121, 1972.

Twenty new cases of Fundus flavimaculatus are discussed; in absence of macular alterations no colour vision disturbances are found. If the posterior pole is affected, colour vision becomes disturbed; with 3 examples (F.M. 100 Hue) a progressive deterioration from a tritan axis to a diffuse dyschromatopsia is demonstrated. - A. Pinckers.

The Farnsworth Tritan plate, by A. PINCKERS (Dept. of Ophthal., Univ. Nijmegen, Netherlands), Ophthalmologica (Basel) 164/2, 137-142, 1972.

Colour vision evaluation with the Tritan plate shows that this test is suitable for detecting congenital as well as acquired red-green disorders; the test is, however, not reliable for detecting acquired blue-yellow disorders. - The Author.

Colour related behavior of mentally retarded children with colour blindness and normal colour vision, by J. SALVIA and J. SHUGERTS, Exceptional Children 37(1), 37-38, 1970.

Tested two groups of children (retarded colour blind, and retarded with normal colour vision) in three ways : (a) colour matching tasks (five single and five multicoloured) using a "match to sample" format; (b) the Dvorine Pseudo Isochromatic Plates; and (c) the Word-Colour Association Test. It was found that the two groups did not differ significantly on the number of correct word colour associations or on the colour matching task. Findings imply that in a low educable classroom the beginning performance on word colour association, simple colour matching, and simple colour naming are likely to be similar for colour blind and normal colour vision children. - Romuald Lakowski.

U.S.-Australian Symposium on Vision (Canberra, February, 1972), by B. HOLDEN, Australian J. Optometry, 55, 92-98, 1972.

The symposium included many eminent visual scientists, including Rushton, Hubel, Bishop, De Valois, Levick, Henry, Daw, Gouras and others. The programme was structured as follows - retinal anatomy; structure and inputs to the LGN; structure and connections in the cortex; maturation of visual centres; color vision in the retina, LNG and cortex; structure and role of the superior colliculus; visual psychophysics; eye movements and vision; cyclopean perception and neurophysiology. The papers are briefly summarized and commented upon. (Many papers are currently being published in Investigative Ophthalmology). - Damien P. Smith.

Meeting a Vision Scientist - an interview with Dr. David Hubel, by B. HOLDEN, Australian J. Optometry, 55, 99-105, 1972.

Dr. Hubel describes the history of some of his researches, especially those with Dr. Wiesel, and explains some of his philosophies of scientific researching. - Damien P. Smith.

Visual standards for drivers of motor vehicles, by B.L. COLE, Australian J. Optometry, 55, 135-142, 1972.

Color vision is one of the visual attributes discussed as being relevant to the task of driving (although it is acknowledged that there is no proven association between any visual attributes and driver performance). A case can be argued for the exclusion of monochromats, deuteranopes, protanopes and protanomals from holding driving licences, but because many of the problems of colored signal recognition by color defectives can be overcome by human engineering solutions, it is preferable to introduce these rather than prohibit 3,5% of men. However, because professional drivers are exposed to hazard longer and drive vehicles capable of causing serious human injury or property damage, they should be subject to a color vision requirement. A total exclusion of all color defectives is possible, but this would be unfair to the 5% or so of men who are deuteranomals. Alternatively, color vision could be screened with the Ishihara tables and a test such as the D-15 or a lantern test used to decide whose color vision is unsafe. - Damien P. Smith.

A Disease index for ophthalmic practice, by R.D. SUCKLING Trans. Ophthal. Soc. N.Z., 24, 59-61, 1972.

The author presents his method of indexing case history cards to facilitate data retrieval. In an analysis of 1000 case diagnoses (sexes unstated) he found only 1% had color vision defects (!). - Damien P. Smith.

Study on Visual Sense of Car-Driver and Seaman, by H. MATSUO (Dept. Ophthal., Tokyo Medical College Hospital, 6-7-1 Nishishinjuku, Shinjuku-ku, Tokyo, Japan), Acta Soc. ophthal. jap. 75, 2007-2031, 1971.

Lighting and Na-lamp : Na-lamp has become popular in use as street illuminant and has a good effect on visual acuity, but it must be well considered that it gives difficulties in discriminating the colour owing to its spectral energy distribution.

Changes of the colour visual field during car driving : It is said that when a car is accelerated the driver's visual acuity is fallen and its visual field is narrowed. The same results have been obtained for the colour visual field, but the effect depends on the background colour. This phenomenon is related to brigthness contrast.

New lantern test : Experiments have been made how the abnormal colour visions misconceived the colour during their cruising. Based on the results of those experiments a new type of easy operative portable lantern was produced. It has been successful when above results were compared with that of the anomaloscope and 100-hue tests. - Yasuo Ohta.

Studies on the Acquired Anomalous Colour Vision (Colour vision anomalies in patients with lesion of the retina, optic chiasma and post-occipital center), by Yasuo OHTA, Proc. Intern. Color Meeting "Color 69" Stockholm, Musterschmidt, 88-96, 1970.

By testing the color vision of diverse patients it is found that diseases of the retino-chorioidea generally show a type of acquired color deficiency with a blue-yellow axis, that further diseases located between the optic papilla and the chiasma also show that blue-yellow axis, though also cases with a red-green axis happen. A fairly large number of cases with lesions between the chiasma and the post-occipital center show a red-green axis. - The Author.

Genetic Studies on Defective Color Vision in Junior High School Students, by H. ICHIKAWA, A. MAJIMA, S. KOMATSU and H. TOKITA (Dept. Ophthal., Central Hospital of the Japanese National Railways), Acta Soc. ophthal. jap. 75, 875-884, 1971.

Seven families of genetic interest which had been discovered by pedigree examinations were analyzed genealogically in this paper. In addition to detailed color vision tests of all the members of these families, blood type examinations for the identification of parenthood and chromosome examinations were also done. Furthermore, physical examinations and intelligence tests were performed in cases suspected of chromosome aberrations. The genotypes of the members of each family were reasoned as follows.

Pedigree I : A women with normal color vision had 2 protanopic and 2 deuteranopic sons. She was considered a repulsion mixed heterozygote for both protanopic and deuteranopic genes.

Pedigree II : The father of a protanomalous girl was deuteranopic. Her mother had normal color vision. It was considered that the father was a mixed hemizygote for both protan and deutan defects, the mother a proto-carrier and the deuteranomalous daughter having two pathologic allelic genes and one nonallelic gene.

Pedigree III : A woman with normal color vision had a protanomalous son and a protanopic son. This could be attributed to a "Manifestationsschwankung" according to Brunner.

Pedigree IV : A deuteranomalous girl and a suspicious deuteranomalous girl whose parents were phenotypically normal were discovered in the same siblings. It was supposed that the former was manifest deuteranomaly in a heterozygote (dominance reversal of deuteranomalous gene) and that the latter showed mild signs of defective color vision in a heterozygote.

Pedigree V : The father of a deuteranomalous girl was deuteranopic. In this pedigree her mother was thought to be a carrier of deuteranomalous gene.

Pedigree VI : As the mother of a deuteranopic boy was diagnosed as deuteranomalous, she was considered to have two allelic pathogic genes of deuteranomaly and deuteranopia.

Pedigree VII : The protanomalous girl who had been discovered as a proposita in this pedigree showed normal color vision by reexamination in the next year. Her father was deuteranopic and a younger sister deuteranomalous. It was possible to imagine that this younger sister was also a deuterocarrier or genotypically normal. - Yasuo Ohta.

Roadway Traffic and the Eye, Some problems on disability glare, by I. IINUMA (Dept. Ophthal., Wakayama Medical College), Acta Soc. ophthal. jap. 75, 2032-2056, 1971.

It is considered that defective color vision is a special kind of disability glare due to a lowered concentration of a cone pigment. This consideration is presumed by following results :

(1) Spectral yellow. When a spectrum is showed to the color-defectives, the stronger the luminance or the degree of defectiveness, the wider are the limits of the spectral yellow.

(2) Bezold-Brucke hue shift. The Bezold-Brucke hue shift in the color defectives is studied by an instrument with two same monochromators whose lights are alterable in wavelength and brightness.

The 671 nm (red light is shifted towards the shorter wavelengths, in comparison with 3.2 asb, when the luminance is raised to 3200 asb. In the extreme defectives, it is shifted across the 589 nm (yellow) light, until to be confused with the 546 nm light. The 589 nm light is almost unchanged in hue.

(3) Variation of range in Rayleigh equation by lowering the intensity of light. The Rayleigh equation using the Nagel's anomaloscope I in normal subjects is at 40 of the red-green

scale and at 15 of the yellow scale. The range of the equation in 24 normal subjects is 1.62 ± 0.19 in the red-green scale, but it is increased to resp. 2.54 ± 0.21 and 3,86 ± 0.36, when the intensity of the light of the anomaloscope is lowered to resp. 1/4 and 1/16 by using neutral density filters. The 1 Rayleigh equation of color defectives takes each own situation, and the variation of the range of the equation by lowering the intensity in 70 color defective subjects differs from that of normals. Their range is divided following 3 types ;

(a) in the most part of them (46/70) it is reduced;

(b) in 18/70 (12 extreme cases and 6 mild of very mild cases) it is unchanged;

(c) in 6/70 (very mild cases) it is increased.

(4) Wavelength discrimination. Comparing wavelength discrimination at high intensity (3.200 asb) with that at low intensity (3,2 asb) in the color defectives, the former is worse than the latter in discrimination between about 520-630 nm in wavelength. From these results, the abnormalities of color sensation in the color defectives are considered to be a sort of disability glare. - Yasuo Ohta.

Studies on the Genetic Carrier of Defective Color Vision - 6th Report; Measurements of Luminosity with a Colorimeter for Color Blindness (Subtester), by A. MAJIMA (Dept. Ophthal., Nagoya City Univ. Med. School), Acta Soc. ophthal. jap. 75, 1475-1482, 1971.

Ten protanomalous, 4 protanopic, 10 deuteranomalous and 4 deuteranopic subjects, whose mothers had normal color vision by conventional test and no ocular diseases, were choosen among high school students. Measurements of luminosity at 575 nm (yellow), 635 nm (red) and 545 nm (green) wavelengths were carried out on these 28 defectives and on their mothers (genetic carriers) with the colorimeter for color blindness (Subtester) by means of heterochromatic flicker photometry.

The following results were obtained.

1) All the protans showed a lowered sensitivity to red light. On the contrary, in most of the deutans an increase in sensitivity for red light was observed. Proto- and deutero-carriers showed similar tendencies for red light to protans and deutans, respectively.

2) Thus, the red-green luminosity quotient is the most valuable quotient in separating protans, deutans and their carriers from the normal.

3) Manifest characters of proto-carriers were found in 8 of 10 protanomalous carriers and in all 4 protanopic ones (85.7%).

4) Manifest characters of deutero-carriers were found in 8 of 10 deuteranomalous carriers and 3 of 4 deuteranopic ones (87.6%).

5) Deviation in protans and proto-carriers from the normal was much larger than that in deutans and deutero-carriers.

6) The Subtester is very useful in genealogical investigations of defective color vision and in genetic consultations.- Yasuo Ohta.

The wavelength of the complementary colors, by J. SAWA (Tokyo), Acta Soc. ophthal. jap. 75, 856-857, 1971.

The wavelengths of complementary colors were determined for male subjects, aged 18 and 50 years, using standard white light sources A and C. Helmholtz-König-Bechstein's large color mixture apparatus model 1928 was used. The wavelengths of the complementary colors were determined on the chromaticity chart by connecting the loci corresponding to the standard white lights A and C. The CIE standard observer gives so complementary colors at 483 nm and 583 nm. The 18 year old observer gave 488 nm and 584 nm, and the 50 years old observer gave 492 nm and 587 nm. The differences were significant. The author considered it useful to use wavelengths of the complementary colors in order to express the individuality of the normal color sense. - Yasuo Ohta.

A consideration on the anomaloscope test, by J. SAWA (· (Tokyo), Acta Soc. ophthal. jap. 75, 1487-1490, 1971.

The Helmholtz-König large color mixture apparatus was used in order to carry out a matching test as in the anomaloscope type I. However a red-green mixture was used in the comparison field, and the wavelength of the other field was changed to find out the wavelength matching the red-green mixture. The normal subject gave 589 nm; protanomaly gave a shorter and deuteranomaly gave a longer wavelength. The difference in the color sense is expressed by AQ value with the anomaloscope type I, but by the present method it is expressed by the difference of the wavelength. The same subjects were used for determining the width of the Rayleigh equation and the hue discrimination threshold around 589 nm. In many cases, the narrower was the width of the equation, the lower was the threshold for hue discrimination, but in a few cases the relation was different. It was concluded that it was not possible to express the degree of anomalous color sensation only by the test of anomaloscope type I. - Yasuo Ohta.

Colour Vision Requirements in Different Operational Roles (NATO Advisory Group for Aerospace Research and Development), AGARD Conference Proceedings, 86 p., 1972.

A session on Color Vision Requirements in Different Operational Roles constituted a portion of the Aerospace Medical Panel Meetings held at the Shell Building in Brussels from 30 May to 2 June 1972. Some 60 persons attended the session and 11 papers were presented by Wolbarsht, Kürschner, Perdriel and Chevaleraud, Tredici, Mims and Culver, Liddy, Van de Casteele, Brennan, Bailey, Appleton, Persy, Grether. They covered the relationships between clinical and theoretical concepts of color vision and their relation to color vision testing, the description of color vision testing methods in use, and the application of color vision testing results to practical situations. These papers and the questions and remarks in the discussions which followed devoted special interest to the problem, "to what extent is color vision required in the activities of

flying personnel, ground personnel and personnel in other aviation operation career fields." According to the report of the D. Kürschner , the majority of the attendees were of the opinion that :

1. Certain types of inherent color vision deficiencies (for example, mild anomalous trichromats) can no longer be considered as absolutely incompatible with flying activities and flying safety. This seemed to be justified by "in-flight" observations, pragmatic color vision testing, on-the-job analyses and the fact that not one aviation accident has ever been documented as having been caused by a color vision deficiency on the pilots involved.

2. In a considerable number of military aviation specialties (air traffic controller, mechanics, crew members, etc.) special emphasis is not placed on normal color vision as a physical requirement. This is due to the fact that color signals, or color markings are either not the sole source of information or they are not employed at all, for example a radar scope, black and white instrument display, etc.). However, due to the redundancy of information displayed, or the type of display, normal color vision may be mandatory for such career fields.

3. If comments 1 and 2 above are accepted as operationally valid then subjects showing a color vision deficiency diagnosed by conventional pass/fail screening test methods may subsequently be accepted as a student pilot or crew member if able to pass a color lantern test. The color lantern tests being less severe enable the mild anomalous trichromat to pass, while failing the severe anomalous trichromat and the severs dichromat. This technique permits a color defective individual, trained pilot, crew member, or even an applicant to be considered as "color safe". Test like the Farnsworth Lantern and the USAF Color Threshold Test have been operationally validated and proven to have this discrimination ability.

4. For the time being one of the best methods for screening subjects to determine normal color vision is to employ pseudo-isochromatic tables, such as the original by ISHIHARA. This test, the Tokyo Medical College series and similar tests are excellent pass/fail test to establish normal vs non-normal. On the other hand, they are not good predictors of severity of anomaly or type of anomaly.

5. A standardization of color vision testing methods between the NATO nations does not appear feasible at this time because of the general lack of unanimity about the relative merit of test methods, the problem of differences in personal experience and training among professional staff, and also the problem of differences in organization. The variability associated with the management of physical evaluation of applicants and flying personnel is one of the key issues. For example, the control provided by having all medical exams performed centrally at one facility is necessary for the quality control of certain color vision testing techniques. Moreover it depends on the number of testees and on the battery of color

vision test available and feasible. Some are prohibitively expensive and require considerable scientific skill and ability to administer. Decentralization of physical examinations prevents the optimum and necessary control of color vision evaluation. This problem alone defeats standardization.

6. Dichromats (those color defectives totally red-green blind) and extremely abnormal trichromats (i.e., borderline cases who have nearly as severe color vision defects as the red-green blind dichromats) should be excluded from aviation activities that require any degree of color perception. Until more information is available there is a high risk that this level of color defect vision could lead to judgement errors and consequently to erroneous actions compromising mission accomplishment and flight safety. This type of color defective is unable to pass the color lantern tests (Farnsworth Lantern).

7. Even though color coding as a means of information display is technically easy to give and easy for the color normal to perceive, aircraft designers and manufacturers should be required to devote sufficient attention to color vision so that information displays are not color dependent. If this is done color coding will not become the only source of information for those who must control an aircraft or perform maintenance duties on it. So, it may be expected that almost 50% of color deficient subjects, especially mild deuteranomalous ones, could be successful in aviation careers for which they are otherwise qualified, e.g., by extraordinary psychomotor skills, high motivation, and lack of motion sickness sensitivity, etc. - J. Kelecom.

LISTS OF THE PUBLICATIONS ON COLOUR VISION DEFICIENCIES OF MEMBERS OF THE RESEARCH GROUP

30. - Papers by Dr. A. PINCKERS (Oogheelkundige Kliniek, St. Radboudziekenhuis, Nijmegen, Nederland).

R PINCKERS A. - Le syndrome de Wagner. Electro-oculographie et sens chromatique, Ann. Oculist. 203, 569-578, 1970.

R PINCKERS A. - Portée du 100 Hue-test de Farnsworth-Munsell dans les examens de follow-up, Ann. Oculist. 203, 811-820, 1970.

R PINCKERS A. - La maladie de Stargardt (ERG, EOG et sens chromatique), Ann. Oculist. 204, 1331-1346, 1971.

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R PINCKERS A. - Verworven stoornissen van de kleurzin, een klinisch onderzoek, Thesis, Nijmegen, 1971.

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R PINCKERS A. - Is cordarone schadelijk voor het oog? Ned. T. Geneesk. 116, 66-67, 1972.

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31. Papers by Dr. R.H. POLLACK (Psychology Department, University of Georgia, Athens, Georgia 30601, U.S.A.).

R EBERT P.C. & POLLACK R.H. - Magnitude of the Mueller-Lyer illusion as a function of hue, saturation, and fundus pigmentation, Psychon. Sci. 26(4), 225-226, 1972.

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R SKOFF E. & POLLACK R.H. - Visual acuity in children as a function of hue, Percept. Psychophys., 6(4), 244-246, 1969.

32. Papers by Dr. M. Catherine RITTLER (Edward S. Harkness Eye Institute, 635 West 165th St., New York, N.Y. 10032, U.S.A.).

HARDY L.H., RAND G. & RITTLER M.C. - Color vision and recent developments in color vision testing, Columbia Univ., College of Physicians and Surgeons, Proc. Conference on Indust. Ophthal., May 1945, pp. 192-207; also Arch. Ophthal. 35, 603-614, 1946.

HARDY L.H., RAND G. & RITTLER M.C. - Tests for the detection and analysis of color blindness, I. The Ishihara test : An evaluation, J. Optical Soc. Amer., 35, 268-275, 1945; also : Arch. Ophthal. 34, 295-302, 1945.

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OFFICIAL COLOUR VISION REQUIREMENTS

CANADA (1972)

Category	Colour Vision Requirements	Tests
Private car driving	- no limitations	
Automotive transport Buses, taxis, chauffeurs, trucks, ambulance, firetruck	- normal colour vision only	a) Keystone Telebinocular Test b) Live Colour Wheel Test
Firemen	- mild red-green confusion accepted	- Color Plate Test
Policemen (Federal)	- 18 correct outof 24 accepted	- A-O HRR Test
Railway : Flagman, conductor, fireman, locomotive engineer, trainmain, yardman, signal apprentices	- 13 correct out of 16 accepted - 3 mistakes allowed	a) Ishihara (16 plates) b) Coloured Lantern test
Aviation : (I) Civil Aviation - Ministry of Transport Airline transport pilot licence (ab) Senior commercial pilot licence (ab) Commercial pilot licence (ab) Flight Navigator (ab) Flight engineer (ab) Private pilot licence (ab) Glider pilot licence (ab) Air Traffic controller (ab)	- 22 correct out of 24 - acceptable for performance of duty	a) Ishihara (24 plates) and/or b) Colour Perception Lantern test
Private pilot licence (day only) (c) Glider pilot licence (day only (c)	- ability to see red lights flashed from tower	c) Practical Colour Perception test valid for day flying only with 2-way radio communication from tower
(II) Commercial Airlines : Commercial Airline transport pilot licence	-13 correct out of 16	- Ishihara (16 plates)
National Defence Department : Air traffic controller, Pilot, transport driver, maritime surface pilot, lab technician, electrician	-1 mistake allowed on plates 1 - 12	- R.C.A.F. American Optical (24 plates)
Customs Officer :	- no limitations	
Marine Services : Ministry of Transport Navigator Master Mate	- no red-green confusion allowed	- Colour Perception Lantern test

Romuald Lakowski

INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

During its last session the Concilium Ophthalmologicum Universale affiliated the International Research Group on Colour Vision Deficiencies. - A. Dubois-Poulsen, secretary of the Concilium Ophthalmologicum Universale.

Renewal statements of the membership fees has been recently sent to all members belonging to non socialist countries. Indeed membership year follows calendar year and fees are due on the first of January of each year. Applications received at other moments will still be billed for the full yearly amount. Renewal statement will be sent out in January and February of each year. Reminder statement will be sent out in May of the membership year. - Romuald Lakowski.

The draft programme of the 28th-30th June Edinburgh Symposium recently sent to all members has been based on an older state of the scientifical sessions. Of course, the definitive sessions programme will be in agreement with all arrangements made afterwards with the general secretary. - Guy Verriest.