

DALTONIANA

NEWSLETTER

OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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LITERATURE SURVEY

Hue discrimination as a function of stimulus luminance,
by M.H. SIEGEL and A.B. SIEGEL, Perception and Psychophysics,
12/3, 295-299, 1972.

The authors intentionally use "hue" instead of "wavelength" discrimination. Hue discrimination was studied on three well trained observers with normal color vision. The 3° stimulus appeared in a white surround, which was set at the desired luminance. The standard half of the stimulus was adjusted in brightness to the surround. 25 standard stimuli of wavelength values ranging from 410 through 630 nm were presented each at 3 different brightness levels corresponding to 0.1, 1.0 and 10 fL. The observer had to respond "yes" or "no" to a question about the hue difference of the two half fields. The measure used to estimate sensitivity was the standard deviation. The studies show that 1) sensitivity decreased greatly as stimulus brightness is decreased to 0.1 fL 2) the regions of greatest (480-500 nm, 570-585nm and 420-430 nm) and least (extreme red and 530-550 nm) sensitivity are most evident at the highest stimulus brightness 3) the yellow region of the spectrum is the sole wavelength region in which discrimination seems not to be affected by brightness changes 4) the short wavelength portion of the spectrum is most affected by reduced brightness which seems to be a verification of the tritanopic effect at dim illumination. - Ingeborg Schmidt.

Threshold and suprathreshold perceptual color differences,
by R.F. WITZEL, R.W. BURNHAM and J.W. ONLEY (Res. Lab. Eastman
Kodak Co., Rochester, New York 14650) J. Opt. Soc. Amer. 63/5,
615-625, 1973.

From matching experiments it was deduced that it is possible for observers trained in color scaling to abstract the individual color attributes of hue, saturation and lightness.

A unit suprathreshold perceptual color ellipsoid can be described about a given color in color space. The precision of color-difference matching seems to be a function of the size of the perceptual color interval of the reference color. A tendency for the major axes of color difference-matching ellipses to orient toward the nearest colorimeter primary was noticed. - Ingeborg Schmidt.

Two genetic types of normal colour vision?, by J.W. METZ and R.F. BALLET, Nature (New Biology) 242, no. 119, 170, 1973.

An experiment to determine the wavelength of unique green for twenty-six normal subjects is described. The results do not indicate a bimodal distribution and no correlation with the R/G ratio was found. - Jennifer Birch.

Anomalous pigments in the eyes of the red-green colour blind, by W.A.H. RUSHTON, D.S. POWELL and K.D. WHITE, Nature, 243, 5403, 167-168, 1973.

Measurements using reflection densitometry indicate the presence of a single anomalous retinal pigment in the eyes of anomalous trichromates of different types. Data for one protanomalous and one deuteranomalous subject are given. - J. Birch.

Lateral inhibition in human colour mechanisms, by D.H. KELLY, J. Physiol. 668, 5-72, 1973.

The spatial properties of human colour mechanisms were explored by measuring contrast thresholds for sine wave gratings under conditions of intense chromatic adaptation. Adapting colours which tend to isolate the red, green and blue sensitive spatial responses were used and give results markedly different from each other and from neutral grating sensitivity. The green mechanism is more sensitive than the others. Spatial inhibition occurs both between and within the red and green mechanisms. Chromatic adaptation can eliminate the former but not the later. - Jennifer Birch.

The optical density of erythrolabe determined by retinal densitometry using a self screening method, by P.E. KING SMITH, J. Physiol. 230, 535-549, 1973. - The optical density of erythrolabe determined by a new method, by P.E. KING SMITH, J. Physiol. 230, 551-560, 1973.

The density of erythrolabe in foveal cones is derived by reflection densitometry for two deuteranopes, two deuteranomalous trichromates and one normal subject, corrections being applied to eliminate the Stiles-Crawford effect. In the second paper a new method of determining the optical density of erythrolabe is described which is based upon an analysis of stray light. The same subjects are used and the results obtained are in good agreement. - Jennifer Birch.

Neurophysiology of colour vision, by N.W. DAW (Dept. of Ophthalmology, Washington University School of Medicine, St.-Louis, Missouri, U.S.A.), Physiological Reviews 53/3, 571-611, 1973.

A comparative review of the properties of the receptors and colour coded cells contained within the nervous systems of various animals. The style is easy to read and there is a large bibliography. - Jennifer Birch.

Influences of chromatic adaptation on anomaloscopic findings, by Y. SAKUMA (Dept. Ophthal., Tokyo Women's Medical College), Folia ophthal. jap. 22, 1016-1021, 1971.

This study was performed on 10 normal, 1 protanopic, 13 protanomalous, 5 deuteranopic and 20 deuteranomalous subjects by means of the Rayleigh equation and by means of green-yellow and red-yellow brightness matches on white and chromatic adaptations (monochromatic lights of 480 nm, 546 nm, 577 nm, 579nm and 643 nm).

Chromatic adaptation of the normal eye extends the range of the Rayleigh equation mainly towards the red end but including the white adaptation equation. This proved a lowered wavelength discrimination. However a protanomalous Rayleigh equation was not observed in this experiment. This may suggest that dilution of the red sensitive pigment is not the only cause of protanomaly.

Although, some significant results were observed from the comparison between the effects of white and chromatic adaptations on the green-yellow and red-yellow brightness matches and also on the Rayleigh equation of protanomalous and deuteranomalous subjects. No definite conclusion was obtained. - Yasuo Ohta.

Incomplete congenital achromates and their rudimentary color vision, by I. IINUMA, E. OHMI and H. MAEDA (Dept. Ophthal., Wakayama Med. College), Jap. J. Clin. Ophth. 25, 1325-1333, 1971.

Two cases (22 year old female and 33 year old male) of incomplete achromatopsia with amblyopia, nystagmus and photophobia are reported. Their visual acuity and fields are reduced in usual room light, but become better in a low illuminated room.

They can discriminate red, orange, yellow and occasionally green out of standard color papers. Being tested by several kinds of pseudo-isochromatic plates (Ishihara, Okuma, TMC and HRR charts), their color vision is strongly reduced in room light, but becomes considerably better in dim illumination.

The Rayleigh equations are similar to that of the complete achromat. But, the more the light intensity of the instrument is reduced by neutral density filters, the more the

slope of the equation line becomes inclined off of that of the complete achromat.

In the spectrum of a monochromator, only yellow is recognizable in a range of 0.8-100 asb in intensity and of 560-600 nm in wavelength; the broadest width was found at 1.56 asb in the female case.

From these results, the authors conclude that the color vision of the defectives should be considered as a kind of severe disability glare. - Yasuo Ohta.

Studies on color vision using the color flicker vision tester, by K. HUKAMI, M. IKEDA and M. URAKUBO (Saiseikai Kyoto Hosp., Kyoto, Japan), Jap. J. Clin. Ophth. 25, 1709-1713, 1971.

With the use of a Color Flicker Vision Tester, which allows flicker photometry between red and green stimuli with and without a red adapting field, 73 subjects were tested among which 22 were normals, 12 protans, 34 deutan and 5 proto-carriers. The test discriminated the color defectives, including the proto-carriers, very clearly from the normals. It exists a correlation, for what concerns the deutan, between the present results and those obtained with the anomaloscope as to the degree of color defectiveness. The proto-carriers show Schmidt's sign and exhibit a low selective chromatic adapting effect. - Yasuo Ohta.

Visual functions in pericentral and central pigmentary retinopathy, by J. FRANCOIS, A. DE ROUCK, E. CAMBIE and J.J. DE LAEY (Ophth. Clinic Ghent, Belgium), Ophthalmologica 165/1, 38-61, 1972.

Nine cases of pericentral or central pigmentary retinopathy are reported. Colour vision was tested with the Ishihara, Tritan plate, AO H-R-R, Panel D-15 (illustrated) and Anomaloscope Nagel Model I. The results of colour vision examination were normal (2), acquired protan-deutan defect (1) acquired blue-yellow disturbance (3), acquired achromatopsia (3). None of the 9 cases showed a typical cone dysfunction the bioelectric picture was not very well defined. The authors conclude that the relationship between the different visual functions is inconclusive. - A. Pinckers.

Rétinopathie chloroquinique (Chloroquine retinopathy), by J. FRANCOIS, A. DE ROUCK, E. CAMBIE and J.J. DE LAEY (Ophth. Clinic Ghent, Belgium), Ophthalmologica 165/2, 81-99, 1972.

Seventeen patients with chloroquine retinopathy are examined. Colour vision disturbance is dependent on the changes in the macular area and present if the visual acuity is less than 7/10; in general blue-yellow disturbance was found, but two cases showed a red-green defect. If the visual acuity was 1/20 or less (cases) there was an achromatopsia (Comment : in three cases of early chloroquine retinopathy I found a

blue-yellow dyschromatopsia; later on the axis shifted to a red-green dyschromatopsia followed by an evident involvement of the optic nerve). - A. Pinckers.

Ocular side effects of indomethacin, by G. PALIMERIS, J. KOLIOPoulos and P. VELISSAROPOULOS (Univ. Eye Clinic Athens, Greece), Ophthalmologica 164/5, 339-353, 1972.

In 5 cases receiving indomethacin for at least 12 months ocular side effects are described. Most of the effects were reversed 1 year after discontinuation of the therapy. Colour vision was tested with Ishihara, AO H-R-R, 100 Hue and Panel D-15; illuminant : Macbeth Executive Daylight lamp C 1850 lux. An acquired blue-yellow dyschromatopsia, only detected by the F.M. 100 Hue, was found in 2 cases after 19 and 17 months of treatment respectively; colour vision returned to normal 6 months after discontinuation of therapy. - A. Pinckers.

Visual disturbances in optic neuritis, by N.K. KHACHATUROV; Vestn. Oftal. 1973/1, 57-60.

Visual disturbances of 132 patients with inflammations of the optic nerve (excluding vascular, traumatic, toxic forms and forms due to uveitis) were studied. Specific features were : disturbances of adaptation to increased illumination, reduced visual acuity at far (checked on short and prolonged exposure), reduced visual acuity at near, frequently more affected than that at far, fluctuations of vision on steady fixation and disturbances of color vision, the latter tested by the Rabkin plates. Color vision deficiency is frequently noticeable before disturbances of visual acuity set in. There is a certain sequence of restoration of color vision : after an achromatic stage first perception to blue returns, then to red, latest to green. Restoration of color fields shows a corresponding sequence. Sometimes visual acuity is normalized already on large sections of the visual field, whereas red-green color vision is lacking. A sign of functional instability of color vision is enhanced "color fatigue". At some stages of the disease it is difficult to distinguish acquired from congenital forms of color deficiency. - Ingeborg Schmidt.

How neural adaptation changes chromaticity coordinates, by C.R. INGLING and R.A. DRUM, J. Opt. Soc. Amer. 63/1, 367-373, 1973.

If color matches are made by causing the lights on the two sides of a field to have equal quantum absorptions in the photopigments and spectral sensitivities, and if the latter are invariant with adaptation, color matching functions must be additive. However, color matching data by Crawford (Vision Res. 5, 71, 1965) and by Richards (J. Opt. Soc. Amer. 57, 1047, 1967) imply failures of additivity of color matching functions. The authors try to find out how observers can make

matches that violate the assumptions. A model of the neural interaction is presented which suggests that the observers were not setting equal quantum absorptions on the two sides of the field. - Ingeborg Schmidt.

The X-Chrom contact lens and color deficiency, by H.I. ZELTZER, Opt. Journ. and Rev. Optom., 110/5, 15-21, 1973.

The X-chrom lens (see also DALTONIANA No. 4, 4-5) is a hard contact lens of polymethyl-methacrylate transmitting light particularly in the 590nm region. The author found it effective to improve color vision of color deficient persons. It "does not reduce visual acuity so as to interfere with binocularity and a person wearing the lens becomes highly motivated and soon overcomes Pulfrich's phenomenon." Since the first development major increases in light transmission have been made. The lens can be fabricated in almost all prescriptions and can be worn throughout the daylight hours. It is fitted monocularly on the non-dominant eye. Trial visits, homework, regular post-examinations are assigned to the patient. He is informed that the lens will be of little advantage under reduced light, except when viewing illuminated traffic signals, car stop lights, color television etc. Four pages of questions and answers explain the X-chrom lens to the color deficient patients. They contain some errors; one of the least is that "Prior to the advent of the X-chrom lens, there never was any method to help the color deficient." - Ingeborg Schmidt.

Tobacco amblyopia, by A.M. POTTS, Survey Ophthal. 17/5, 313-321, 1973.

A review of history, etiology and nutritional studies in reference to tobacco amblyopia. By the criteria set for toxic etiology the tobacco amblyopia is not a disease caused by a toxic substance but a disease of nutritional deficiency. - Ingeborg Schmidt.

The noxious effects of general medications on the visual organ (Les effets nocifs des médications générales sur l'appareil visuel), by G. HERMANS, J.R. LE JEUNE, R. VAN OYE, M. WATILLON, A. ROBE-VANWYCK, L. DRALANDS and P. GARIN, Bull. Soc. belge Ophtal. 160, 3-516, I-XLIV, 1972.

In this important book the reader will find many references concerning the effects on colour vision of tridione, chloroquine, digitalis, halogenated oxyquinoline derivatives, streptomycin, ethambutol, Filis mas, piperazine and disulfiram. - Guy Verriest.

Retinal intoxication by digitalis (Intoxication rétinienne par la digitale), by J. BABEL and N. STANGOS, Bull. Soc. belge Ophtal. 160, 558-566, 1972.

A blue-yellow deficiency was followed in a human subject by means of Panel D-15 and 100 hue. From the other hand, an experimental study shows the accumulation of digoxin in the rat retina. - Guy Verriest.

Color deficiency, an obstacle in mass education (Farbenfehlsichtigkeit, Hindernis bei Mengenlehre), by H. SCHNEIDER, Dtsch. Arzteklatt 17, 1051, 1972.

Colour has a great importance in the new teaching methods. 8.7% of the boys and nearly 0.5% of the girls have thus learning difficulties owing to congenital deficiencies of colour vision. The author suggests that the material should be adapted in order that it could be applied to all subjects. J. Kellecom.

Color sense criteria for the aptitude determination of aviation personnel (Kriterien des Farbsinns bezüglich der Richtlinien für die Feststellung der körperliche Tauglichkeit des Luftfahrpersonals), by H. LAUE, Wehrmedizinische Monatschrift, 2, 54, 1971.

For what concerns the anomaloscope the allowed match range is 10 graduations for road traffic, 5 graduations for railway traffic and ± 5 graduations for air traffic. The quotients 0.7 - 1,4 are considered as normal. - J. Kellecom.

The examination of colour sense in flying personnel (L'examen du sens chromatique du personnel navigant), by G. PERDRIEL and J. CHEVALERAUD, Rev. Méd. aéronaut. pat. 32, 1969.

The tests used by the authors should allow to detect all cases of deficiency and to recognize the type of the defect in 95% of the cases. - J. Kelecom.

Practical considerations on the data obtained during the examination of the color sense in the selection center of aeronautical personnel (Considerazioni pratiche su dati rilevati dall' esame del senso cromatico in sede di selezione del personale aeronautico), by TERRANA, Riv. Med. aeronaut. spaz., suppl. of nr. 4, december 1966.

The comparison of the performance at the chromopteric lantern of Beyne with that at the Ishihara and Farnsworth tests show that protanopia is the most severe deficiency from the practical point of view; deuteranopia is less severe but white can be confused with green; also in the anomalous trichromatisms the protan defects are more severe than the deutan ones. - Filippo Bozzoni.

The Colour, by M.N. ROILOS, Iatriki, 22, 409-415, 1972.

A short treatise is given on Maxwell's electromagnetic theory, the quantum nature of light energy, the spectrum of the electromagnetic radiations, the resolving power of prisms and gratings, the main quantities of photometry and their units, the spectral sensitivity of the eye, the relations between light stimulus and colour sensation, the characteristics of pure and compound colours, the various ways by which colours are produced and the colour of opaque and transparent bodies. - John Koliopoulos.

Colour Vision, by J. HADJIMINAS (Dept. of Physiology, University of Athens, Gudi, Athens, Greece), Iatriki 22, 416-422, 1972.

The sensation of vision is produced when the image formed on the retina, codified by the rod or cone system, is transmitted to the brain. The signal generated by the former system does not contain elements for wavelength discrimination while the one produced by the cone system is suitable for the genesis of the sensation of "colour". The receptor generator potential is produced by light energy, through chemical transformation of the visual pigments, of which only one is contained within the rod system; on the other hand, the cone system included three different receptor types, each containing a special pigment, sensitive to only a part of the visual spectrum. Therefore, a certain mixture of wavelengths or even monochromatic light produces generator potentials of varying intensity on two, or even on the three kinds of cones, in such a way that the final signal, formulated by the circuitry of the retina and transmitted to the brain, contains the necessary information for wavelength discrimination, in the form of "colour" sensation. While the above mentioned Young-Helmholtz theory of colour vision seems to be securely founded, especially after the experimental proof of the existence of the three kinds of cones, the electrophysiological evidence regarding the behaviour of the ganglion cells, as well as of other retinal and geniculate body cellular elements favour the Hering colour vision theory. So, according to present day experimental data, the theory is accepted that the original codification on the receptor level is being accomplished according to the Young-Helmholtz theory, but the final signal transmitted to the brain is somehow complying rather to the Hering's colour vision theory. - John Koliopoulos.

Colour vision disturbance, by J. KOLIPOULOS (University Eye Clinic, Ophthalmological Centre, Cholargos-Athens, Greece), Iatriki 22, 422-432, 1972.

In this review the essentials of colour vision and the colour vision defects are discussed. The classic trichromatic vision, normal and anomalous, is described as well as the "opponent theory" from the clinical point of view. The differences between congenital and acquired deficiency of colour discrimination are presented as well as the four types of acquired defects of colour vision. The methods and the tests for detection of colour vision defects are briefly reviewed. The incidence of colour vision deficiencies in a screening of 29,985 young Greeks is discussed and compared with the available bibliographic data. - John Koliopoulos.

Colors in the investigation of the personality, by N. VELENTZAS, Iatriki 22, 433-437, 1972.

In this paper, the theoretical and practical value of color research in psychology and psychiatry is emphasized. The use of colors in the assessment of the personality in characteristic personality tests is analysed and the usefulness of colors in the assessment of the personality and the help they offer in psychiatric practice is discussed and evaluated. - John Koliopoulos.

Ergonomics exposure of colour, by P. IORDANIDIS (Dept. of Iatrodikastiki, University of Athens, Academias str., Athens 135, Greece), Iatriki 22, 438-445, 1972.

The influence of colour upon working man in relation to his productivity, safety etc. is reviewed. The importance of using the appropriate colour in the working environment, for comfort and reduction of fatigue simplifying the work process, preventing accidents and organising work is presented. The focal colour field of workers, the colour codification of the various stages of productivity procedure and the finishing presentation of goods are examined. Some examples of applications are given as applied industry, offices and hospitals. The predisposal of the consumer towards colour in buying goods is referred; too, the most probable explanation for human reactions to colours are discussed. - John Koliopoulos.

PUBLICATIONS OF THE MEDICAL PERSONNEL OF THE
ITALIAN MINISTRY OF TRANSPORTATION

LAMBUSTA A. : Il senso cromatico in rapporto all'acutezza visiva e valutazione del danno lavorativo inerente alla sua perdita (Atti IX Congr. Naz. Med. Leg. e Ass., Siena, 1947).

LAMBUSTA A. : Ricerche sulla percezione dei colori in soggetti di origine siciliana (Atti X Congr. Naz. Med. Leg. e Ass., Parma, 1949).

LAMBUSTA A. : Il test di Rorschach applicato ad un gruppo di soggetti con alterazioni della percezione dei colori (In "Atti III Congr. Reg. Med. Leg.", Siracusa, 1953).

MARZANO T. : Colore, attenzione, sicurezza (In "Atti II Congr. Naz. Colore", Padova, 519, 1958).

MARZANO T. : Senso cromatico e sicurezza del traffico stradale (In "La riforma medica", 44 : 1250, 1958).

MARZANO T. : Stabilità affettiva e preferenze cromatiche (In "Atti IV Congresso Naz. Colore", Padova, 1960).

(By courtesy of Filippo Bozzoni).

PREPRINT OF THE SUMMARY OF A PAPER WAITING
PUBLICATION

Unilateral amblyopia and color vision. I. Some basic specifications, by C. CASTELLINI and G. SALVI (Istituto Nazionale di Ottica, Arcetri, Firenze; Cattedra di Ottica Fisiopatologica dell'Università di Firenze), to be published in Atti Fond. G. Ronchi 28, 1973.

The present paper aims at producing some data concerning the variability of data obtained by testing a number of normal individuals by means of both the Nagel Anomaloscope and the 100-hue test. The data obtained from their right eye are compared to those obtained from their left eye. The variability of the so-called anomaly ratio seldom exceeds 0.10. The differences between the right- and the left-eye total error scores are displayed in some graphs where the data recorded from a few subjects suffering from unilateral amblyopia are also displayed. - Lucia Kositani-Ronchi.

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

42. Papers by Prof. Georg H.M. WAALER (Rikshospitalet, Oslo 1, Norway).

- R WAALER G.H.M. - Über die Erbliehkeitsverhältnisse der verschiedenen Arten von angeborener Rotgrünblindheit, Z. indukt. Abstamm. - und Vererbungslehre 45/4, 279-333, 1927.
- R WAALER G.H.M. - Über die Erbliehkeitsverhältnisse..., Acta ophthal. (Kbh.) 5, 1927.
- R WAALER G.H.M. - Heredity of two types of normal colour vision, Nature, 215, No. 5099, p. 406 only, July 22, 1967.
- R WAALER G.H.M. & LINKSZ A. - Naming of groups with normal colour vision, Nature, vol. 218, No. 5142, pp. 687-688, May 18, 1968.
- R WAALER G.H.M. - Heredity of two normal types of colour vision, Nature, vol. 218, No. 5142, pp. 688-689, May 18, 1968.
- (R) WAALER G.H.M. - The heredity of normal and defective colour vision, Avh. Det Norske Vidsk.-ak. i Oslo I. Mat. - Naturv. Kl., Ny serie No 9 1967.

- (R) WAALER G.H.M. - New facts in the genetics of colour vision besides ideas of the colour perception. Avh. Det Norske Vidensk.-Ak. i Oslo I. Mat.-Naturv. Kl., Ny serie No. 11 1968.
- (R) WAALER G.H.M. - Studies in colour vision, Avh. Det Norske Vidensk.-Ak. i Oslo I. Mat.-naturv. Kl. Ny serie No. 12 1969.

WAALER G.H.M. - Genetics and physiology of colour vision ("My story on colour vision genetics and physiology"), Acta ophthal. (Kbh.), suppl. 122, 1973.

The three (R)-marks mean that the papers may be bought through UNIVERSITETSPORLAGET, Box 307, Blindern, Oslo 3 Norway (Prices 5.-, 5.- and 12.- Norw. crowns + porto).

43. Papers by Prof. P.L. WALRAVEN and other staff members of the Institute for Perception TNO, Soesterberg (Neth.).

BOUMAN M.A. & WALRAVEN P.L. - A study of normal and defective colour vision, Optician, 289-293, 1957.

WALRAVEN P.L. & LEEBEEK H.J. - Recognition of color code by normals and color defectives at several illumination levels. An evaluation study of the H.R.R. plates, Amer. J. Optom. 37, 82-92, 1960.

WALRAVEN P.L. - The use of H.R.R.-plates for selection among colour defectives, Ophthalmologica 141, 36-37, 1961.

BOUMAN M.A. & WALRAVEN P.L. - Quantum theory of color discrimination of dichromats, Vision Res. 2, 177-187, 1962.

WALRAVEN P.L. & LEEBEEK H.J. - Chromatic Stiles-Crawford effect of anomalous trichromats, J. opt. Soc. Amer. 52, 836-837, 1962.

WALRAVEN P.L. & BOUMAN M.A. - Fluctuation theory of colour discrimination of normal trichromats, Vision Res. 6, 567-586, 1966.

WALRAVEN P.L., VAN HOUT A.M.J. & LEEBEEK H.J. - Fundamental response curves of a normal and a deuteranomalous observer derived from chromatic adaptation data, J. opt. Soc. Amer., 56, 125-126, 1966.

VOS J.J., VERKAIK W. & BOOGAARD J. - Kleurzien-tests. Evaluatie van enige kleur-zien-tests ten behoeve van standaardisatie van testmethoden en -procedures. Studies ten behoeve van de projectiegroep Standaardisatie onderzoekmethoden van de gezichtsfunctie CARGO-TNO, T. soc. Geneesk. 49, Suppl. 2 bij nr 4. 12 pp. 1971.

VOS J.J., VERKAIK W. & BOOGAARD J. - The significance of the TMC and HRR colour-vision tests as to red-green defectiveness, Amer. J. Optom. (in press).

44. Papers by Dr. J. ZANEN (74, Rue Belliard, B-1040-Bruxelles, Belgium).

ZANEN J. - Introduction à l'étude des dyschromatopsies rétinienne centrales acquises, Bull. Soc. belge Ophtal. 103, 1953.

ZANEN J. & SUCS - Les seuils achromatiques et chromatiques en vision centrale dans l'amblyopie, Bull. Soc. belge Ophtal. 112/2, 193, 1956.

ZANEN J., WIBAIL R. & MEUNIER A. - Les seuils achromatiques fovéaux dans les dyschromatopsies congénitales, Bull. Mém. Soc. franç. Ophtal. 70, 81, 1957.

ZANEN J., SUCS, & PIRART J. - Les seuils achromatiques et chromatiques dans le diabète, Bull. Soc. belge Ophtal. 115/2, 210, 1957.

ZANEN J. & MEUNIER A. - Les seuils achromatiques fovéaux dans la sclérose en plaques, Bull. Mém. Soc. franç. Ophtal. 71, 95, 1958.

ZANEN J. & MEUNIER A. - Disparité de la perception chromatique chez des femelles univitellines, Bull. Soc. belge Ophtal. 118, 356, 1958.

ZANEN J. & MEUNIER A. - Nouvelle observation de disparité de la perception chromatique chez des femelles univitellines, Bull. Soc. belge Ophtal. 119, 444, 1958.

ZANEN J. - L'intervalle photochromatique en pathologie oculaire Bull. Mém. Soc. franç. Ophtal. 72, 498, 1959.

ZANEN J. & VAZQUEZ R. - Contribution à l'étude des valeurs énergétiques absolues des seuils achromatiques fovéaux, Bull. Mém. Soc. franç. Ophtal. 74, 238, 1961.

ZANEN J. & VAZQUEZ R. - Contribution à l'étude des valeurs énergétiques absolues des seuils achromatiques fovéaux, Vision Res. 2, 477, 1962.

ZANEN J. & MEUNIER A. - Les déficits sensoriels oculaires dans le botulisme, Bull. Mém. Soc. franç. Ophtal. 75, 316, 1962.

ZANEN J. - Les altérations du sens chromatique en neuro-ophtalmologie, Acta neurol. psych. belq. 64/4, 423, 1964.

ZANEN J. & MEUNIER A. - La perception colorée et les seuils absolus et chromatiques dans la rétinopathie séreuse centrale, Bull. Soc. belge Ophtal. 140, 359, 1965.

KOULISCHER L., ZANEN J. & MEUNIER A. - La théorie de Lyon peut-elle expliquer la disparité exceptionnellement observée de la perception colorée chez des femelles univitellines? C.R. Ier Cong. Int. Neuro-Génétique et Neuro-Ophtalmologique, p. 242, 1968.

ZANEN J. & MEUNIER A. - La méthode des seuils dans les dégénérescences maculaires non séniles, Bull. Mém. Soc. franç. Ophtal. 82, 466, 1969.

ZANEN J. - Discussion du rapport sur les amblyopies, Bull. Soc. belge Ophtal. 151/2, 309, 1969.

ZANEN J. - La méthode des seuils en pathologie oculaire, C.R. XXI Concil Ophtal. Mexico, 2, 1750, 1970.

ZANEN J. - The foveal spectral thresholds in acquired dyschromatopsia, Mod. Probl. Ophtal. 11, 170, 1972.