

DALTONIANA

NEWSLETTER

OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

President: Prof. W. D. WRIGHT (U.K.)

Secretary for the Western Hemisphere:

Dr. R. LAKOWSKI

Department of Psychology, University of British
Columbia, VANCOUVER 8 (Canada)

General Secretary and Editor of the Newsletters:

Dr. G. VERRIEST

Dienst Oogheekunde, Akademisch Ziekenhuis
De Pintelaan 135 - B-9000 GENT (Belgium)

(verantw. uitg.)

Secretary for the Socialist Countries:

Dr. M. MARRÉ

Universitäts-Augenklinik, Fetscherstrasse 74
8019 DRESDEN (D.D.R.)

Tweemaandelijks Tijdschrift

Nr. 49 - 1st September 1983

ADMINISTRATIVE REPORT FROM THE 7TH IRGCVD

INT. SYMPOSIUM IN GENEVA

The Directorial Committee of the IRGCVD met twice during the Geneva Symposium. The present committee members were : Mrs. Birch, Mr. Grützner, Mrs. Marré, Mr. Ohta, Mrs. Smith, Mr. Sperling, Mr. Verriest, Mr. Went and Mr. Wright. Were absent but excused themselves : Mr. Hedin, Mr. Lakowski and Mr. Lanthony. Mr. Lakowski sent a financial report and wrote that he wished to retire as treasurer of the Society, while Mr. Wright announced that he considered his presidential mandate as over. As usually, the committee decided about the acceptance in the proceedings volume of the papers of new and of absent members.

Moreover the Committee decided :

(1) that all IRGCVD members have to choose a new directorial committee by written ballot through Daltoniana after the Symposium; it recommended Mr. Jaeger and Mr. Mollon as new candidates;

(2) that the next (1985) international symposium will be held in the South of France (in the region of Marseilles) with Mr. Vola as (main) local organizer; that the successful new system of 5 minutes discussion after each paper should be maintained; that the authors will have to remit abstracts already at the first submission of their titles;

(3) that the general assembly should set a preferential order among the following themes for the 1985 int. symposium : Colour vision and ergonomics, New facts in genetics of colour vision, Visual effects of intense lights, Radiometric, photometric, spectrophotometric and colorimetric instruments used in colour vision research, Effects of intoxications on colour vision, and Ageing of the eye;

(4) that the general assembly should vote the site of the 1987 international Symposium;

(5) that a second regional symposium should be held in 1986 in Dresden;

(6) that the general assembly should elect a new president (Mr. Dubois-Poulsen being recommended by the committee) and a new treasurer (Mrs. Birch and Mr. Massof being candidates).

The general assembly was held on June 24 :

(1) it added as further candidates for the new directorial committee Mr. Cavonius, Mrs. Ronchi, Mr. Roth and Mr. Zrenner;

(2) the (approximate) order of preference for the 1985 themes was Intoxications (most votes), Ageing, Ergonomics, Intense light, Instruments, Genetics and (as theme added by the assembly) Colour vision in animals;

(3) Baltimore was chosen as site of the 1987 symposium, with Dr. Massof as local organizer;

(4) Mr. Dubois-Poulsen was elected as president and Mrs. Birch as treasurer.

However, Mr. Dubois-Poulsen resigned during the Saturday morning session when it was too late to organise a fresh election. In these critical conditions, committee members convinced Prof. Wright to accept to carry on as a "Caretaker president" till the next 1985 symposium - at least if this could be stated as the wish of the membership.

The invited speakers for the 1985 symposium will be : Prof. W. Jaeger for "Effects of intoxications on colour vision", J. Marshall and R. Weale for "Ageing of the eye", and H. Sperling for "Visual effects of intense lights". All of them accepted.

The next issue of Daltoniana will include Mrs. Birch's report of the meeting of the Committee on Standardization.

Guy Verriest.

THE LAST PAGE OF THIS ISSUE IS A BALLOT SHEET TO
BE RETURNED.

FINANCIAL STATEMENT

	<u>Jan. 1/80 - Dec. 31/80</u>	<u>Jan. 1/81- June 31/82</u>	<u>July 1/82- May 1/83</u>
Revenue			
Membership fees (includes gain of foreign exchange)	\$ 1780.04	\$ 2264.83	\$ 2440.23
Interest Income	179.20	668.76	314.35
Other Income(1)	<u>582.41</u>	<u>2553.71</u>	<u>192.37</u>
	\$ 2541.65	\$ 5487.30	\$ 2946.95
Expenses			
Publication expense	\$ 841.99	\$ 1000.00	\$ 800.00
Administration expense	182.00	71.00	116.00
Other expense(2)	86.46	399.34	20.46
Conference expense(3)	<u>-</u>	<u>1628.03</u>	<u>1230.00</u>
	\$ 1110.45	\$ 3098.37	\$ 2166.46
Net gain for period	\$ 1431.20	\$ 2388.93	\$ 780.49
Retained earnings at the beginning of the period	\$ 1627.00	\$ 3058.20	\$ 5447.13
Retained earnings at the end of the period	\$ 3058.20	\$ 5447.13	\$ 6227.62

Notes

- (1) Includes money returned from conference, monies credited to account from other banks (monies recovered from cheques that were sent on collection) and, for Jan. 1/81 - June 31/82 only, surplus funds from 6th Symposium.
- (2) Includes money paid to A.I.C., registrar of companies, bad cheques, postage and handling.
- (3) Includes speaker's honorarium and money taken/sent to conference.

R. Lakowski.

LITERATURE SURVEY

Hue names in colour mixtures, by R.W.G. HUNT (Kodak Ltd., Headstone Drive, Harrow HA1 4TY, England), Die Farbe, 28, 156-160, 1980.

Cites several lines of evidence that suggest that the primaries in additive color mixture are perceptually closer to red, green, and violet than to red, green, and blue; and that the primaries in subtractive mixture are best described as blue (or cyan), magenta, and yellow. - C.R. Cavonius.

The perception of blackness, by W.D. WRIGHT (68 Newberries Ave, Radlett WD7 7EP, England), Die Farbe 28, 161-166, 1980.

Prof. Wright discusses the importance of blackness in color rendition. When luminance gradients are removed from e.g. a color slide the chromaticity is scarcely changed, but the appearance of the colors may be changed dramatically; the original color appearance cannot be restored by simply reducing the overall luminance. Wright suggests that blackness is a positive perception that is not directly related to an absence of luminance, and that it merits closer study. - C.R. Cavonius.

Chromatic adaptation and π mechanisms, by J. WALRAVEN (Institute for Perception TNO, Soesterberg, The Netherlands) and S. WERNER (University of Colorado, Boulder, Colorado, USA), Col. Res. and Applic. 7, 50-52, 1982.

Adaptive hue shifts of the achromatic point were measured in conditions in which a test field was presented as a flashed increment on steady chromatic backgrounds. The variables investigated were background chromaticity, luminance, and stimulus contrast. The results could be accounted for quantitatively by a mechanistic model with the following properties: discounting of the (steady) background, or ac-coupled signal processing; cone spectral sensitivities as estimated by Vos and Walraven; and receptor-specific gain controls that have the same action spectra and gain characteristics as Stiles' π_5 , π_4 , and (modified π_1 mechanisms. - The Authors.

Electroretinographic and psychophysical measures of cone spectral mechanisms using the two-color threshold technique, by M. KORTH (Psychol. Dept., Northeastern Univ., Boston, MA 02115, USA) and S. SOKOL (Dept. of Ophthalmol. New England Medical Center, and Tufts Univ. School of Med., 171 Harrison Avenue, Boston, MA 02111, USA), Vision Res. 20, 205-212, 1980.

The two-color threshold paradigm of Stiles and a spatially alternating bar pattern stimulus were used to derive electrophysiological and psychophysical spectral sensitivity curves from the human retina. The test wave-

wavelength was kept constant at 600 nm and the background wavelength was varied from 450 to 650 nm. Three experiments were carried out with two color normal subjects. In the first experiment the original stimulus configuration of Stiles, a 1°, 500 msec test flash on a 10° background was used to determine increment threshold curves. In the second experiment, ERG were recorded with a bar pattern test field with a stripe width of 30° alternating at a rate of 8 Hz superimposed on a steady background. The diameter of both test and adaptation field was 15°. In the third experiment psychophysical thresholds were determined with the same stimulus conditions used to record the ERG. Stiles' \bar{M}_λ mechanism provides a good fit to the spectral sensitivity curves derived from the increment threshold ($\Delta I/I$) functions. - The Authors.

On the merits of model making in understanding color-vision phenomena, by J.J. VOS (Institute for Perception TNO, Soesterberg, The Netherlands), Col. Res. and Applic. 7, 69-77, 1982.

Since 1962, I have intermittently been engaged in problems of color-vision modeling, intrigued by some apparent inconsistencies in the original Walraven color-vision model. This has carried me into problems of receptor action spectra and densities, of gain control and chromatic adaptation, and of the concept of luminance as a linear or nonlinear combination of receptor inputs. By taking a simple physical model as a start and adding physiological elements whenever the quantitative predictions failed, we hope to have gained some insight into the color-vision mechanisms. This review is intended to enable a discussion of the limitations and merits of this rather theoretical approach. - The Authors

Studies on the printing color and the screening efficiency of the Ishihara test for color blindness. I. Evaluation of the screening efficiency of the Ishihara test published in 1959 and 1978, by O. OKAJIMA (Dept. Ophthalmol., School of Med. Univ. of Tokyo, Japan), Acta Soc. Ophthalmol. Jpn. 85, 1784-1790, 1981.

The printing colors used in the Ishihara test published in the 50's markedly differ from those in the recent editions. The screening efficiencies were compared by examining 3077 students by means of both editions and of the anomaloscope. Color vision defectives who misread not more than 3 plates were 27.5% of all defective at the former edition and 8.1% at the latter. The cause of the better screening efficiency of the former edition is a higher incidence of misreadings of plates 6 to 9 and of plates 17 to 20. - Yasuo Ohta.

Clinical usefulness of new Okuma plates for color deficiency, by T. MIYAMOTO, K. SHIMIZU, Y. OHTA and T. YAMAGUCHI (Dept. Ophthalmol., Tokyo Medical College, Tokyo, Japan), Jap. J. Clin. Ophthalmol. 35, 1787-1792, 1981.

We tested the clinical usefulness of the New Okuma Plates in 30 protan and 87 deutan congenital color defectives. The New Okuma Plates consist of 8 charts for detection and 6 charts for determination of type and severity. All 117 subjects were also tested by anomaloscope (Nagel type I), Ishihara plates, Okuma plates, TMC plates and Panel D-15 test. The detection rate of the New Okuma Plates was 100%, as all the 117 subjects were classified as color deficient. 35% of the subjects could not be classified as to the type of color deficiency. There was a general trend that the New Okuma Plates gave a milder grading of strong protan and deutan, when compared with the anomaloscope and Panel D-15 tests. These findings indicate that the New Okuma Plates are a sensitive and accurate means of detection of color deficiencies. It is recommended that tests should be used simultaneously to assure a greater reliability in the grading and classification. - Yasuo Ohta.

Exploitation et interprétation du test de Farnsworth 100 hue par micro-ordinateur (Use and interprétation of the Farnsworth 100 hue test by micro-computer), by R. HEITZ, A. BERGAMINI and R-M. HEITZ-WACKERMANN (Serv. d'Ophthalmol., Centre Hospitalier de Haguenau, France). Presented on 17th oct. 1982 at the Soc. Ophthalmol. de l'Est de la France in Strasbourg.

The use of a micro-computer (Apple II) to exploit and interpret the Farnsworth 100 hue test has important advantages. The uptake of data is speeded-up and combined with control of its validity. The determination of differences and its expression in graphic form is automatic. The determination of total and partial scores relative to areas of special interest permits quantitative evaluation and coding of results. The micro-computer greatly simplifies the use and interpretation of the test and provides an important diagnostic aid. - The Authors.

Visual acuity of blue cone system and its clinical application, by Y. NAKAI, T. OHARA and M. YOKOYAMA (Dept. Ophthalmol., Mie University School of Medicine, Tsu-city, Japan), Jap. J. Clin. Ophthalmol. 35, 1295-1299, 1981.

Visual acuity of the blue cone system was measured with Landolt rings projected through a blue filter (max. 450 nm) on a wide yellow field of 2000 asb. The blue cone vision obtained with suprathreshold stimuli was found to be a very stable clinical indicator without case to case variation or age to age alteration. Averaged value of the blue cone vision from 35 normal eyes was 0.16 ± 0.03

This was selectively reduced in some cases with idiopathic central choroidopathy, retinal detachment, open angle glaucoma and retinitis pigmentosa and was occasionally retarded in the course of recovery. - The Authors.

The Early Receptor Potential in human eyes.

II. ERP in dichromats, by M. OKAMOTO, O. OKAJIMA and T. TANINO (Dept. Ophthalmol., School of Med., Univ. of Tokyo, Japan), Acta Soc. Ophthalmol. Jpn. 85, 296-299, 1981.

The human early receptor potential (ERP) was studied in 13 protanopes and in 29 deuteranopes. In both groups the amplitude of the R₂ wave of the ERP was significantly smaller than in the normal subjects. The present study may indicate that dichromats have fewer cones than normal subjects. - Yasuo Ohta.

Abnormal spectral sensitivity of electroretinographic off-response in protanopia and protanomaly, by H. NAKAZATO, K. KAWASAKI, D. YONEMURA and I. KAWAGUCHI (Dept. of Ophthalmol., School of Med., Kanazawa Univ., Japan), Acta Soc. Ophthalmol. Jpn. 85, 1513-1520, 1981.

The ERG was evoked by repetitive rectangular monochromatic stimuli having equal quanta. Stimulus of 125 msec duration was repeated at 4 Hz. Averaged waveforms of 40 responses were analysed. The amplifier time constant was 2 sec. The pupil was fully dilated. The spectral sensitivity curve of the rapid off-response in normal subjects peaked at 550 nm, and approximated in shape to the human photopic visibility curve. The spectral sensitivity of the rapid off-response was lowered at long wavelengths, and the maximum sensitivity was at 520 nm in most of protanopic and protanomalous patients. The mean of the sensitivity of the rapid off-response was significantly lowered at 560 nm and longer wavelengths ($p < 0.005$), and elevated at 460 and 480 nm ($p < 0.05$) in protanopic and protanomalous patients, as compared with the normal control. These results indicate abnormality of the photopic function at the receptor level in some cases of protanopia and protanomaly. The rapid off-response would be useful for objective evaluation of protanopia and protanomly. - Yasuo Ohta.

Classification of complete and incomplete autosomal recessive achromatopsia, by J. POKORNY, V.C. SMITH (Eye Res. Lab., Univ. of Chicago, USA), A.J.L.G. PINCKERS (Dept. of Ophthalmol., Cath. Univ. of Nijmegen, The Netherlands) and M. COZIJNSEN (Bartimeus School for the Visually Handicapped), v. Graefe's Arch. Clin. Exp. Ophthalmol. 219, 121-130, 1982.

We studied color vision in 32 patients with autosomal recessive achromatopsia. Color matching revealed complete achromatopsia (rod monochromacy) in ten patients (Group I) and incomplete achromatopsia in the remaining twenty-two patients. Amongst the incomplete achromats, were three

groups distinguishable by their color matching. Patients in Group II were dichromats; their color matches were mediated by rods and MWS (middle-wavelength sensitive) cones. Patients in Groups III and IV were trichromats. Color matches of patients in Group III were mediated by rods, LWS (long-wavelength sensitive) cones and MWS cones. Group III patients showed no evidence of SWS (short-wavelength sensitive) cones. Color matches of patients in Group IV were mediated by rods, LWS cones and SWS cones; color matching did not reveal MWS cones. - The Authors.

Essential night blindness with cone monochromasy, by A.J.L.G. PINCKERS (Dept. of Ophthalmol. Cath. Univ. of Nijmegen, The Netherlands), J. FOKKORNY, V.C. SMITH (Eye Res. Lab., Univ. of Chicago, 939 East 57th Street, Chicago, Ill. 60637, USA) and D. VAN NORREN (Institute for Perception TNO, Soesterberg, The Netherlands), v. Graefe's Arch. Clin. Exp. Ophthalmol. 218, 322-326, 1982.

A young patient with reduced vision complained of night blindness and color blindness. Clinical examination data and retinal densitometry were consistent with essential night blindness. Spectral sensitivity and color vision testing revealed cone monochromasy. - The Authors.

A case of cone-rod dysfunction syndrome, by A. SATO E. UESUGI (Dept. of Ophthalmol., Tokyo Medical and Dental University School of Medicine) and Z. NIKAMURA (Ofuna Hyosai Hospital, Japan), Folia Ophthalmol. Jpn. 32, 1461-1466, 1981.

A 26-year-old male with cone-rod dysfunction syndrome was presented. He had (1) very slowly progressive disturbance of visual acuity and colour sense, (2) absence of the first portion and elevation of threshold in the second portion of the dark adaptation curve, (3) absence of the photopic component, reduction and delay of the scotopic component of the electroretinogram and abnormal photopic visually evoked potential, (4) normal ocular fundi by both ophthalmoscopy and fluorescein angiogram, and (5) mild horizontal nystagmus. Since the patient had not only very slowly progressive disturbance of cone function, but also mild disturbance of rod function, it appears that his disease could be called cone-rod dysfunction syndrome rather than cone dystrophy. - Yasuo Ohta.

Spectral sensitivity and color discrimination changes in glaucoma and glaucoma-suspect patients, by A.J. ADAMS, R. RODIC, R. HUSTED and R. STAMBER (School of Optometry, Univ. of California, Berkeley, the Ophthalmol. Clinic, Silas Hayes Army Community Hospital, Fort Ord. and Dept. of Ophthalmol. Pacific Medical Center, San Francisco, Calif., USA), Invest. Ophthalmol. Vis. Sci. 23, 516-524, 1982.

Color vision changes may occur early in the course of glaucoma and may precede visual field loss. Glaucoma sus-

pects, having raised intraocular pressure and no diagnostic optic nerve head or visual field changes, may also have color vision loss. Unfortunately, the instruments used in the studies that have demonstrated these color vision changes were not feasible for routine clinical use; likewise, the studies did not carefully control for the effects of small pupil size and age or did not point to the underlying mechanisms responsible. We studied 19 glaucoma patients, 19 glaucoma suspects, and age-matched controls for each group by means of the Farnsworth D-15 panel test, a desaturated version of the D-15 test, and by measures of spectral increment threshold. Minor modifications of the Farnsworth D-15 panel test produce highly significant differentiation of glaucoma and glaucoma-suspect patients from age-matched normal groups. Further, spectral increment thresholds, with a two-degree spectral target flashed at either 1 or 25 Hz on a bright white background, show that both achromatic and chromatic sensitivity are significantly reduced when compared with their age-matched normals. Pupil size does not seem to be a significant factor. These results suggest that the function of two different ganglion cell populations is affected in glaucoma and that glaucoma may produce functional loss in the central foveal area earlier in the disease process than previously believed. - The Authors.

Zur Prognose und Therapie des Primären Glaukoms
(About prognosis and treatment of primary glaucoma),
 Proceedings of the second DDR/ČSSR Symposium held in Žinkovy from 13th to 16th Nov. 1979, edited and published by G. PIETRUSCHKA, Wilhelm Pieck Univ., Rostock, GDR.

Contains 4 papers of interest for the readers of Daltoniana :

- Erfassung von Frühausfällen des Offenwinkelglaukoms durch kinetische Perimetrie des Blaufarbsehmechanismus (Detection of early defects in wide angle glaucoma by kinetic perimetry of the blue mechanism), by E. Marré, M. Marré, P. Mierdel and E. Schreiber (pp. 125-130);

- Versuch einer individuellen Funktionsprognose des Glaucoma simplex mittels der 3 Farbsehmechanismen nach intraokulärer Druckprovokation (An attempt to functional prognosis in wide angle glaucoma by measurement of the three colour vision mechanisms after provoked augmentation of intra-ocular pressure), by H.J. Zenker, E. Marré and P. Mierdel (pp. 131-137);

- Nachweis von Funktionsstörungen der visuellen Systems mittels VECP in Falle von Glaucoma simplex (Demonstration of visual defect by EVP in wide angle glaucoma), by P. Mierdel and E. Marré (pp. 139-143);

- Glaukom und Farbsinn (Glaucoma and colour vision) by J. Malec and E. Rihová (pp. 145-147). - Guy Verriest.

Color vision in clinical pharmacology, N. RIETBROCK and G. WOODCOCK (Eds.), The Proceedings of the 3rd International Symposium on Methods in Clinical Pharmacology, Frankfurt/Main, Methods in Clinical Pharmacology Number 4 Publ. Friedr. Vieweg & Sohn, Braunschweig/Wiesbaden, 118 p. (1983).

Contents :

Contemporary trends in the classification of the acquired colour vision defects (G. Verriest), An introduction to the neurophysiological basis of color vision and its clinical applications (E. Zrenner), Clinical, electrophthalmological and psychophysical findings in patients with drug induced colour vision deficiencies (C.J. Krüger and M. Baier), Color vision deficiencies : a common sign of intoxication in chronically digoxin-treated patients, (N. Rietbrock and R.G. Alken), The use of colour vision measurement in the diagnosis of digoxin toxicity (J.K. Aronson and A.R. Ford), Differences in color vision impairment caused by digoxin, digitoxin, or penguotoxin (K.-C. Haustein, G. Oltmanns, N. Rietbrock and R.G. Alken), Pharmacodynamic effects of the cardiac glycoside gitofor-mate (pentaformylgitoxin) (P.E. Austh, S.J. Lieberich, G.G. Belzy and G. Alken), The arterially perfused eye : colour vision mechanisms and neurotransmitters (R.P. Schuurmans and E. Zrenner), The retina as a neuropharmacological and neurochemical model : Studies on neurotransmitter receptor binding (W.E. Müller and H.O. Borbe). - G. Verriest.

Color vision, by J.D. MOLLON (Dept. of Exp. Psychol., Univ. of Cambridge, Downing Street, Cambridge CB2 3EB U.K.), Ann. Rev. Psychol. 33, 41-85, 1982.

Contents :

INTRODUCTION: Trichromacy and the trichromatic theory, Psychophysical estimates of the cone sensitivities, The two-color procedure and the π mechanisms, Postreceptoral processes, Color deficiency RECENT REVIEWS AND BIBLIOGRAPHIC SOURCES, TESTS, PERSONALIA : Books, Journals, Reviews and specialist bibliographies, New tests and other materials, Necrology. THE FUNDAMENTAL SENSITIVITIES : (Psychophysical estimates, Microspectrophotometry, Concordance of Estimates of the human fundamentals, Individual differences). THE ANOMALIES OF THE SHORTWAVE SYSTEM : Group A : Sensitivity of short-wavelength system. Group B : Adaptational anomalies, Two explanatory principles. COLOR-OPPONENT CHANNELS : Primate electrophysiology, Psychophysical techniques for isolating color-opponent channels, Chromatically opponent processes manifested in threshold measurements, Possible-identity of opponent mechanisms revealed by changes in sensitivity, by phenomenological cancellation and by chromaticity discrimination). DO STILES'S π MECHANISMS CORRESPOND TO CONE FUNDAMENTALS? : (Experimental tests, A theory of π_1 and π_3 , Self-screening, Conclusions)

SILENT SUBSTITUTION FOR POSTRECEPTORAL CHANNELS? THE REIFICATION OF LUMINANCE. TO WHAT EXTENT IS COLOR ANALYZED INDEPENDENTLY OF OTHER ATTRIBUTES OF THE RETINAL IMAGE? :

Cortical electrophysiology, Color-contingent aftereffects, Pathology, The problem of perceptual synthesis.

This review is dedicated to Dr. W. Stiles on the occasion of his eightieth birthday. It concentrates on human psychophysics and primate electro-physiology. While remembering those who use chapters in the Annual Review of Psychology as bibliographic instruments, I have tried also to write for the student reader who knows something of visual psychology but has not yet been initiated in the delicious mysteries of color. To this end I have corralled most of the general references into the second section and have attempted in the first to introduce the basic concepts needed later. The most recent survey of color vision in the Annual Review of Psychology was that by Jacobs (1976), which remains a most profitable source. - The Author.

Color vision, by Leo M. HURVICH. Sunderland, Massachusetts, Sinauer Associates, Inc., 1981. Softcover, 326 pages, subject index, 175 black and white figures, 25 color plates. \$ 25.

The author says that "Color Vision" was written to present a clear and simple picture of the topic of color perception to nonspecialists and laypeople. The treatment is based on his personal view that the data and experience of color can be explained within the framework of the so-called opponent process theory of color vision. Leo Hurvich and Dorothea Jameson have long been associated with opponent process theory - the notion that human color percepts reflect neural processing by a set of mutual antagonistic processes, which categorize light stimuli in terms of redness or greenness, blueness or yellowness, and whiteness or blackness. The treatise is comprehensive; the 21 chapters span a wide variety of topics, including basic color discrimination data, color deficiencies, color contrast, and color reproduction. The 25 color plates provide easily understood examples of some complex concepts of color vision and vivid examples of various perceptual phenomena.

This is a successful book, one which should open the world of color vision to a new audience. We, like Leo Hurvich, are often asked to suggest readings in color vision for nonspecialists and we are happy to know there is finally a book that we can recommend. - V.C. Smith and J. Pokorny.

Daltonism and painting (Daltonisme et peinture), by P. LANTHONY (Paris), J. Fr. Ophthalmol. 5, 373-385, 1982.

The influence of daltonism on painting was studied by Goethe. After a brief historical review, the methods employed are described. These included copying of paintings, critical analysis of paintings by color-blind subjects, and speculations on the history of art. The manner of painting of persons with daltonism depends upon the pictorial consequences of the dyschromatopsia, and the compensatory procedures employed : monochrome or polychrome. Acquired dyschromatopsia also affects painting. Daltonism influences esthetic taste and has to be taken into account during orientation of art students. - The Author. (Also publ. in Bull. Soc. Ophthalmol. Fr. 82, 509; 1982).

L'ergofoftalmologia dei VDT : dal visual strain alla lesione da luce blu, by L. BARCA and F. PASSANI (Università degli Studi di Firenze, Prima Cattedra di Clinica Oculistica), Atti Fond. G. Ronchi 37, 107-115, 1982.

The factors responsible for the sensation of weariness, for visual fatigue and discomfort claimed by some VDU operators after prolonged watching at the screen are examined. Next, by considering the spectral emission of phosphors currently used, we evaluate, in relative terms, their potential risk in relation to a "toxic" effect, recently discovered, the so-called blue light lesion. - The Authors.

An equi-energy-color pattern generator and its application to VECP studies in a protan, by E. ADACHI, Y. CHIBA, K. ISHIHAWA (Dept. of Ophthalmol. School of Medicine, Chiba University, Japan) and S. ISHIKAWA (Creact Co., Ltd.), Folia Ophthalmol. Jpn. 32, 1517-1521, 1981.

A color generator with outputs leading into the red, green, blue inputs of a color display monitor has been newly developed. In combination with the multiple TV pattern generator developed in 1977, multiple color patterns with variable functions can be versatily displayed. The device permits the generation of the following color patterns : (1) Checkerboard of rating patterns, consisting of the pairing of any given color with its complementary color in equal energy; (2) The chroma and luminance of any given color can be varied by keeping the energy equal for a pair of checks or stripes; (3) It is also possible to give a pair of checks or stripes with different chromas; (4) A gray colored checkerboard or grating pattern is available. The energies of all colors are kept equal; (5) With the aid of masking circuits, the adaptation field can be varied like the test field, but independently of the test field. Using this generator, color vision experiments were performed on a normal subject and a protan, with the use of VECPs. - Yasuo Chita.

Use of a microcomputer in measuring the color of lights, by P. STANDAHL (Inst. für Lichttechnik der Techn. Univ., Einsteinufer 19, D-1000 Berlin 10, BRD), Die Farbe 27, 23-34, 1978/79.

A system is described that measures the spectral distribution of lights by means of a microprocessor-controlled monochromator and photomultiplier. The system calculates coordinates in several color systems. A flow diagram of the program is given. An interesting feature of the program sharpens spectral lines that have been spread by the monochromator. - C.R. Cavonius.

Calculation of color-rendering indices with a desk computer, by F. HAEGER and A. STOCKMAR (Inst. für Lichttechnik der Techn. Univ., Einsteinufer 19, D-1000 Berlin 10, BRD), Die Farbe 28, 167-182, 1980.

A program is described with which color-rendering indices and correlated color temperature can be calculated on a HP-41 C calculator. - C.R. Cavonius.

PAPERS READ AT THE ERGOPHTHALMOLOGICAL SYMPOSIUM
(San Francisco, 1982)

VOCATIONAL COLOR VISION REQUIREMENTS, by
Colenbrander and A.J.A. Adams.

U.S. legislation prohibits discrimination against the handicapped. This has prompted the California State Personnel Board to request justification for color vision requirements in 51 State personnel classes. The prevalence of color-sensitive tasks was surveyed through a questionnaire. In the surveyed job classes color-sensitive tasks were found to occur in all ranges of the spectrum. An optimal vocational test, therefore, should test across the entire spectrum, not just in the red-green area, as is common in diagnostic tests. Under normal illumination individuals with mild deficiencies can perform tasks such as the sorting of color-coded wires and resistors as well as normals do. These individuals need not be excluded from employment. The Farnsworth D-15 test covers the entire spectrum and allows minor defects to pass. For most jobs involving color-sensitive task (e.g., Laboratory workers) the Farnsworth D-15 test is the recommended entry level criterion. Normal color vision is recommended only for jobs involving critical color matching (e.g., in color printing and textile work). The problems surrounding the increasing use of tinted lenses are discussed.

RETINAL DAMAGE AND OCCUPATIONAL EXPOSURE TO STRONG LIGHT, PRELIMINARY RESULTS FROM AN EPIDEMIOLOGICAL CASE-REFERENT STUDY, by B. Knave, B. Tengroth, M. Voss, I. Lomaeus and S. Tornqvist.

Mechanisms giving rise to senile and presenile macular degeneration are poorly understood, although the fact of age-relation suggests that impairments in the blood circulation may be a major cause.

Mainly on the basis of animal experiments, it appears that strong light may induce retinal damage in the fovea centralis. This may initiate or contribute to macular degeneration. This hypothesis is supported by the above animal studies in which retinal changes were provoked at luminous levels far lower than previously thought possible. These levels are well within the exposure to strong light experienced by several categories of employees at their normal place of work. Recent studies on animals and humans suggest that the blue light in particular, might enhance macular degeneration following the destruction of the blue cones (Marshall, 1982).

Preliminary results are presented from an epidemiological case referent study, in which patients are registered at ophthalmic clinics in Sweden as presenile/senile macular degeneration, the referents being age and sex-matched patients at the same clinic under another diagnosis. Both cases and referents are examined from an occupational standpoint with emphasis on exposure to strong illumination.

PAPERS READ AT THE INT. CONFERENCE

"COLOUR VISION" (Cambridge, U.K., 1982)

(by courtesy of John Mollon)

Normal and deficient colour discrimination analysed by colour television, by P.E. KING-SMITH, G.M. CHICRAN, K.L. SELLERS and S.L. ALVAREZ (College of Optometry, Ohio State University).

Many tests of colour discrimination suffer from the disadvantage that an observer may use brightness clues to discriminate between coloured stimuli. Thus a protanope may perform well on the 100 Hue test because the reddish caps appear dimmer than the others. The following technique for measuring colour discrimination avoids artifacts from brightness clues, even if the subject's sensitivity to different coloured stimuli is unknown before the experiment.

The principle is to measure the detection threshold for an "equiluminous" test spot, i.e. a coloured spot which has the same luminance as the surrounding screen. The 1-deg. 0.2-sec foveal test spot is generated on a colour television (Sony Trinitron) within a 100 cd/m²

white surround. The coloured test spots are generated by brightening or dimming the red phosphor only, the green phosphor only, or by combining such red and green stimuli in fixed ratios. Thresholds are recorded on a plot of contrast (Weber fraction) of the green phosphor as a function of contrast of the red phosphor; phosphor dimming is represented by negative contrasts. Such a plot can generally be fitted by an ellipse, centred at the origin (cf. Noorlander et al., J. opt. Soc. Amer. 71, 473).

For all congenital and some acquired colour defects, the ellipse is very elongated and the major axis has a negative slope; these observations are consistent with the idea that the major axis represents equiluminous test stimuli, which have high thresholds because of the poor colour discrimination. Thus colour and luminance thresholds may be derived from major and minor axes respectively. For 14 deuteranomalous subjects, the ratio of colour to luminance thresholds varied from 3.3 to 27. The ratio was 8.7 in a case of optic atrophy, probably corresponding to a selective loss of "tonic" axons.

For normal observers, the ellipses were less elongated and sometimes nearly circular. In this case, the colour threshold was determined by the intersection of the ellipse with an equiluminous line whose slope was calculated from measurements of the phosphor luminances. The luminance threshold was similarly determined from a line at right angles to this line. The ratio of colour to luminance thresholds varied from 0.93 to 3.0 in 28 normal subjects. Thus the best deuteranomalous subject had slightly poorer colour discrimination than the worst normal on this test.

Ethambutol affects selectively nonlinear color opponency in vertebrate retina, by B. J. VAN DIJK and H. SIEKREIJSE (Laboratory of Medical Physics, University of Amsterdam).

There are no quantitative, electrophysiological models successfully describing color processing in the vertebrate retina. In the most distal retinal cells (i.e. receptors and horizontal cells) passive interactions seem to occur when the cells are driven by small signals. The commonly used notation of receptive field organisation, e.g. R+ G-, suggests that this also holds for more proximal cells. However, in these cells the interactions are of nonlinear nature : for example, simple summation of a set of three independent ganglion cell spectra is not always an adequate description of ganglion cell action.

In man acquired color deficiencies due e.g. to Ethambutol (Zrenner and Krüger, Doc. Ophthalm. 27, 13-26, 1981) do not seem to affect the sensitivity of underlying fundamentals but rather their interactive processes occurring at later stages. In an attempt to understand the physiological basis of these clinical findings, we have

used an animal model with well established trichromacy (carp retina).

To study nonlinear interactions in color processing a precise knowledge of the action spectra of isolated color mechanisms is essential. Using the silent substitution technique we derived from carp ganglion cell responses the action spectra of the isolated spectral mechanisms. These "pure" spectra agree well with both the action spectra Kaneko (in prep) recorded in isolated carp cone pedicles and the action spectra we measured in the carp horizontal cells. These electrophysiologically determined fundamentals enable us to study non-linear interactions in the carp ganglion cell responses. We have confirmed that the application of Ethambutol affects these interactions and causes a decrease in the strength of a nonlinear color opponent mechanism without changing the sensitivity of the contributing spectral mechanisms. Only an algebraic opponent mechanism remains active.

Effects of photic environment on the development of color vision mechanisms in the ground squirrel, by G.H. JACCBS and M.E. McCOUP (Department of Psychology, University of California, Santa Barbara).

The California ground squirrel (Spermophilus beecheyi) has dichromatic color vision based on the operation of cone photopigments having λ_{max} located at c. 440 and 525 nm. In this rodent about 30% of all optic nerve fibers received inputs from both photopigment classes while the remaining fibers are driven solely by the 525 nm pigment. We have used single unit recordings to examine the development of responsivity of optic nerve fibers in this animal. Animals were reared from birth in one of three different photic environments : white light, darkness, or red light. Eye opening in this species occurs at about 30 days of age. Recordings were made from a total of 38 young squirrels ranging in age from about 50 to more than 200 days. Many optic nerve fibers having inputs from the 525 nm cone were recorded from the youngest animals in all three groups, but the proportion of units receiving inputs from both cone mechanisms was low, approximately one-third of what it is in the adult. For animals reared in white light the proportion of fibers receiving inputs from both cone types increases rapidly from this initially low level, reaching adult status at about 75 days of age. For animals reared in complete darkness or in red light there was also a gradual increase in the proportion of units receiving inputs from both cones and, for both groups, the adult standard was eventually achieved. However, the length of time required to reach the adult organization was significantly longer in dark-reared than in white-reared animals, and very much longer still in animals reared in red light. The results indicate that (a) the neural organization necessary for normal colour vision

in this species develops gradually during early postnatal life, and (b) the time required to reach the normal state can be significantly extended if the spectral environment in which the animal is reared provides a highly biased stimulation of the two cone mechanisms.

(To be continued)

OBITUARY

Dr. Oskar NEUBAUER

(1922-1983)

The IRGCVD loses in Oskar Neubauer one of his most sympathetic, friendly and inspiring members.

"Ossi" was born on August 18th 1922 in Vienna. During World War II he was prisoner and contracted a renal disease of which he never healed. After war he started to study medicine in Vienna. He graduated in 1953 and specialized in ophthalmology from 1955 to 1960 in the Hanusch-Krankenhaus der Wiener Gebietskrankenkasse. He continued to work in the same ophthalmological department, where he became chief physician in 1965 and retired in 1982. He received the title of Medizinalrat in 1975 and that of Obermedizinalrat in 1980.

Nearly all his papers are devoted to colour vision deficiencies. He discovered the acquired defect due to liver disease in 1967 and the acquired defect due to the use of contraceptives in 1971. He compared methods of examination of acquired defects in 1971 and in 1975. Since 1976 he became interested in the problems of colour deficiencies in road traffic and it is in this field that he published in 1979 with Harrer, Marré, Verriest and Uvijls an important study which has been supported by the Austrian government and owing to which a protanope can now be allowed to drive his private car in Austria.

Ossi played also a very important role in the early days of the IRGCVD. He was one of the few founders of the group in Stockholm in 1969 and the first public Symposium in Ghent in 1971 was prepared in 1970 by a closed meeting in Vienna of which Dr. Neubauer was the organizer. One of his last journeys was to Geneva in 1982 for preparing the 1983 Symposium.

He died meanwhile on February 4th 1983 in Vienna. One of his last joyces was to see his son Nikolaus also became Doctor in Medicine.

Theodora Neubauer, Udo Nemetz, Marion Marré and Guy Verriest.