DALTONIANA

NEWSLETTER
OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES
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ADMINISTRATIVE REPORT

The IRGCVD directorial committee and general assembly decided during the 9th international Symposium in Annapolis that

(1) Professor R. Lakowski becomes member of honour of the Research Group;

(2) the quadriennal elections will be done just after the Annapolis Symposium by written ballot through Daltoniana (please find on the last page the ballot form with the names of the candidates proposed by the directorial committee and by the general assembly);

(3) following a suggestion of Prof. Mollon and an agreement of the publisher, the IRGCVD members not attending the actual symposia will be able to order the proceedings at the special bulk price per copy (please read on the last page the Prepublication Purchase announcement);

(4) the special themes of the 10th international IRGCVD Symposium held in Cagliari (Italy) in the second half of June 1989 will be (a) Influence of field size on colour vision (with Professor Ohta as invited speaker), and (b) Genetics;

(5) the 11th international IRGCVD Symposium will be held in 1991 in Ghent (as the 1st Symposium 20 years ago); several proposals have been made for the 12th Symposium in 1993, of which the site will be chosen in 1989;

(6) an IRGCVD Symposium will be held in Japan in 1990 in conjunction with the International Congress of Ophthalmology in Singapore. - Guy Verriest.

TREASURERS REPORT

At the 8th int. symposium of the IRGCVD held in Avignon in June 1985 the Research Group decided to appoint a separate Treasurer, Dr. Bruce Drum, for the American Continent. Following the symposium £100 were transferred from the U.K. to enable Dr. Drum to open an account for the IRG in Baltimore. Since 1985 subscriptions from members in Europe, Scandinavia, Japan, Israel and Australia (currently 120 members) have continued to be received in London and members in the U.S.A., Canada and South America (currently 94 members) have been received in the U.S.A. The ex-

penses for Daltoniana have been met from the U.K. account. Because of the unfavourable position of sterling in comparison to the Belgian Franc this expenditure has continued to rise. IRGCVD funds have been placed on deposit both in the U.K. and in the U.S.A. and the accrued interest has contributed to the good financial standing of the Group. The balance held in the U.S.A. on May 31st 1987 was 2713.74 Dollars. This amount does not include either the expenses or income from the Annapolis meeting.

Postal requests for outstanding subscriptions for 1987 will be sent to members in August. - J. Birch.

U.K. Account

THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

Statement of Income and Expenditure from June 1985 and Balance as of June 1st 1987.

Income and Expenditure from June 1985 to July 1986

Current Account:

Income		Expenditure	
Balance	£1,102.56	Guest VIII Sym	369.91
Subs 1985	640.00	Trans. U.S.A. acc.	100.61
		Post & Mail	29.74
		Daltoniana	333.17
		Sub A.I.C.	39.00
		Post Reprints	20.00
	£1,742.56		£892.43

Balance £850.13

Deposit Account:

Balance	£3,203.47
Subs 1986	277.97
Interest	194.75
Interest	148.92
	£3,825.11

Total Balance at July 1985 £4,675.24

Income and Expenditure from July 1986 to June 1st 1987

Current Account:

Income		Expenditure	
Balance	£ 850.13	Post & Mail	£ 22.22
Subs 1986	£ 765.00	Daltoniana	404.22
		Stationery	6.60
		Daltoniana Or Harré (IXth Sym)	423.24 137.05
	£1,615.13		£993.33

Balance £621.80

Deposit Account:

Balance	£3,825.11
Interest	143.23
Interest	131.37
	£4,099.71

Total Balance at June 1st 1987 £4,721.51

LITERATURE SURVEY

Density profile of blue-sensitive cones along the horizontal meridian of macaque retina, by F.M. de MONASTERIO, E.P. McCRONE, J.K. NEWLANDER and S.J. SCHEIN (Section on Visual Processing, Clinical Branch, National Eye Institute, National Institutes of Health, Bethesda, Maryland, U.S.A.). Invest. Ophthalmol. Vis. Sci. 26, 289-302, 1985.

Intravitreal injection of some fluorescent and nonfluorescent tissue-reactive dyes results in selective intracellular staining of a specific population of cones of macaque retina that have been identified tentatively as blue-sensitive cones. This paper describes quantitative density profiles of these cones

as a function of retinal eccentricity. These profiles were measured from 0 deg to about 60 deg eccentricity along the nasal and temporal segments of the horizontal meridian of macaque retina. Stained cones were found to be absent from the very center of the fovea. These cones reach peak densities at 0.75-1.50 deg eccentricity, and decrease with greater eccentricity, more rapidly on the temporal than on the nasal segment of the horizontal meridian. Peak densities were found to be slightly closer to the foveal center of the retinas of adult male than of adult female macaques. Packing patterns of stained and unstained cones are discussed as is the mathematic expression of stained cone distribution. The spatial properties of the retinal distribution of stained cones agree very closely with those obtained in psychophysical human studies and other anatomic simian studies of blue-sensitive cones. - The Authors.

Foveal cone pigment density difference in the aging human eye, by P.E. KILBRIDE, L.P. HUTMAN, M. FISCHMAN and J.S. READ (Dept. of Ophthalmol., Eye and Ear Inf., Univ. of Illinois, Coll. of Med. at Chicago, 1855 West Taylor Street, Chicago, Il. 60612, U.S.A.). Vision Res. 26, pp. 321-325, 1986.

Using fundus reflectometry, we have measured a decrease in the density difference of the foveal cone visual pigments with age in human subjects. This decrease is consistent with a loss of visual pigment in the retina with age. Fundus reflectance and normalized density difference spectra data are presented for these subjects. A decrease in cone pigment with age would be consistent with both anatomic studies, which indicate a loss and displacement of photoreceptors with age, and psychophysical studies, which demonstrate loss of photoreceptor function with age. - The Authors.

Early colourdeprivation in a monkey (Macaca fascicularis), by E. BRENNER, J. SCHELVIS and J.F. NUBOER (Netherlands Inst. for Brain Research, Meibergdreef, 33, 1105 AZ Amsterdam and Laboratory of Comparative Physiology, State University of Utrecht, The Netherlands). Vision Res. 25, 1337-1339, 1985.

Various forms of selective visual deprivation are known to affect the development of the monkey visual system. In the present study a monkey was born and spent the first three months of its life under red illumination. Despite this colour deprivation, the young monkey learnt to distinguish between colours. Furthermore, the monkeys' increment threshold spectral sensitivity was not affected by the deprivation. - The Authors.

Effect of light adaptation on the perceptual red-green and yellow-blue opponent-color responses, by S. TAKAHASHI, Y. EJIMA (Dept. of Psychol., Kyoto Univ., Yoshidanihonmatsucho, Sakyo-ku, Kyoto 606, Japan) and M. AKITA (Psychol. Lab., Kyoto Institute of Technology, Matsugasaki, Sakyo-ku, Kyoto 606, Japan). J. Opt. Soc. Am. A, 2, 705-712, 1985.

Spectral sensitivities of the red-green and yellow-blue opponent-color responses were determined under broadband light adaptation for the light-adaptation levels of 5 to 5000 Td. With changing light-adaptation level, the spectral-sensitivity functions

of the opponent-color systems change in shape, especially in the short-wavelength region of the spectrum. The light-adaptation effect on the red-green responses can be ascribed to the changes at the cone receptor level, whereas the light-adaptation effect on the yellow-blue responses can be ascribed to the changes at two sites, i.e. at the cone receptor site and at the opponent site. - The Authors.

A comparative study of successive and simultaneous methods in colour discrimination, by J. ROMERO, E. HITA and L. JIMENEZ DEL BARCO (Dept. of Optica, Fac. de Ciencias, Univ. de Granada, Spain). Vision Res. 26, 471-476, 1986.

Simultaneous and successive methods of comparison of stimuli are studied by comparing experimental results of colour discrimination experiments. In this way, colour differential thresholds for two normal observers and four different stimuli were measured by the two methods. In most cases, the capacity to discriminate colour decreased when the successive method was used, although no differences were found in qualitative aspects of discrimination. These results differ somewhat from previous reports in this field, probably because of experimental differences in the method of obtaining the thresholds. - The Authors.

Visibility curves by direct comparison in a 10° field at 1000 Td, by D.A. PALMER (Inst. Ophthalmol., Judd Street, London WC1H 9QS, England). J. Opt. Soc. Am. A,2, 578-583, 1985.

Twenty-four observers matched monochromatic lights to a white reference light in a 10° field. The retinal illuminance was 1000 Td over most of the spectrum. Twelve persons' visibility curves were more or less additive and resembled the $\bar{y}_{10}$ color-matching function of the CIE. Eight others had a double-peaked function, which failed badly to obey Abney's law. The remaining four were more additive, although tehir curves were broader than $\bar{y}_{10}$. - The Author.

Color matching at high illuminances : the color-match-area effect and photopigment bleaching, by S.A. BURNS and A.E. ELSNER (Dept. Ophthalmol. Univ. of Pittsburgh, 230 Lothrop Street, Pittsburg, Pennsylvania 15213, U.K.). J. Opt. Soc. Am. A, 2, 698-704, 1985.

We evaluated whether a self-screening hypothesis can account for changes in red-green color matches with changes in retinal illuminance and changes in the size of the matching field. The dependence of the color match on field size measured at moderate illuminances was not present at high illuminances. For color matches made with normal pupil entry, there was no need to postulate any factors other than self-screening to account for the changes with either illuminance or field size. The self-screening model allowed us to estimate the optical density of the foveal cones and the retinal illuminance that caused half of the photopigment to be bleached at equilibrium. These estimates were in quantitative agreement with previous estimates made using other techniques. We also found that the change in a color match with increasing illuminance was inconsistent with first-order kinetics.- The Authors.

A new procedure of acquiring color mixture data at the blue end of the spectrum, by G.A. FRY (College of Optom., The Ohio State University, Columbus, Ohio, U.S.A.). Die Farbe 32/33, 139 1985/1986.

I have used the spectral lights of 417, 536 and 680 nm as primaries for the determination of the spectral values. The monochromatic stimuli between 417 and 536 nm are desaturated with the red primary and matched to mixtures of 417 and 536 nm. The colors from 400 to 430 nm match mixtures of 417 and 680 nm. The 417-680 nm line in the chromaticity diagram can be used to locate the blue fundamental. - The Author.

Relationship between individual factors and the mistakes on pseudoisochromatic tests for color vision deficiencies, by J. PERALES, E. HITA and J. ROMERO (Dep. de Optica, Fac. de Ciencias, Univ. de Granada, Spain). Atti Fond. G. Ronchi 40, 163-176, 1985.

The intensive application of pseudoisochromatic tests for the identification of color vision deficiencies, in large samples of individuals, makes it advisable to study possible variations which may be introduced by individual factors that could influence test responses. In the first part of this experiment the relationship between age and errors committed was studied. The sample was 404 individuals between 7-15 years of age, all diagnosed as having normal color vision by Ishihara test. The tests used were Ishihara, Ulloa, and the Tokyo Medical College test. The same relationship was also studied for a sample of 225 observers diagnosed as having defective color vision by Ishihara test. The results show significant variations of the number of errors in relationship with age for normal observers. A different effect is noted depending on the test used and the type of error (typical or non-typical). On the other hand, no significant variations were noted for observers with defective color vision. In the second part of this study, errors committed were evaluated by the sex of the individual, for the same normal color vision sample. Slight differences were detected in the behavior of males compared to females when typical and non-typical errors were studied, but not when total number of errors were studied. Also variations were detected by the type of test used. - The Authors.

Monochromatic ERG responses in deutans, by Y. UJI, F. TAKEUCHI and M. YOKOYAMA (Dept. Ophthalmol., Mie Univ. School of Med., Japan). Acta Soc. Ophthalmol. Jpn., 88, 76-84, 1984.

Few definite and reliable studies on spectral ERG responses in deutans have been reported in contrast to protans. For making research into spectral characteristics of the b_p-waves of the ERGs in deutans, our time-locked scanning method was improved : (1) the wavelengths of 10 msec monochromatic stimuli having equal energy were settled at intervals of 10 nm between 520 and 600 nm; (2) the half-band widths of interference filters were 4-6 nm; (3) the time interval between each stimulus was 300 msec and one quick scanning took only 3.9 sec; (4) the opaque contact lens electrode made of plastic was used to get Ganzfeld stimulation and adaptation. The difference of spectral response patterns between color defectives and normal could be recognized at a glan-

ce with this scanning method though it is difficult and complicated to determine the peak of the spectral sensitivity curve from the amplitude versus stimulus intensity curve for each wavelength.

Amplitudes of b_p-waves at each wavelength were calculated as percentages of the response height at 560 nm in 50 normal subjects and at 580 nm in 16 deutans. The wavelengths of the peak responses were slightly variable in normal and also in deutans. In deutans the shift of the peak responses to either 570 or 580 nm with slight but definite deviation of the spectral response curves to the longer wavelengths of the spectrum was found without exceptions. From these results, the possibility of fast and objective diagnosis of congenital color defects was shown. - Yasuo Ohta.

Color vision defects with normal Rayleigh match. (1) Characteriscs of color vision, by H. TOKUDA and T. YASUMA (Dept. Ophthalmol. Nagoya Univ. School of Med., Japan). Jpn. J. Clin. Ophthalmol. 37, 1493-1496, 1983.

Congenital color vision defects, which respond by errors on pseudoisochromatic plates but by normal Rayleigh match, are called "Pigmentfarbenamblyopie" (G.V. : more exactly "Pigmentfarbenanomalie"). We performed various kinds of pseudoisochromatic plate tests, lantern test, Panel D-15 test and anomaloscopic examination in 17 cases of Pigmentfarbenamblyopie from 10 pedigrees. The patients were also tested as to flicker-photometrical luminous efficiencies. This condition seemed to be inherited in an X-linked recessive mode similar to the usual color vision defects. Although they displayed almost normal Rayleigh match pattern, they made a lot of errors in pseudoisochromatic plate tests, according to which they were devided into protan- and deutan-types. They were also divided into these two groups by their luminous efficiencies. Each group was significantly different from normals in luminous efficiencies, but was indistinguishable from protan or deutan groups. These results seemed to suggest that "Pigmentfarbenamblyopie" is one of the variations in anomalous trichromats. - Yasuo Ohta.

Color vision defects within normal Rayleigh match (2) Pathophysiology, by H. TOKUDA, T. YASUMA and H. ICHIKAWA (Dept. Ophthalmol., Nagoya Univ. School of Med., Japan). Acta Soc. Ophthalmol. Jpn, 88, 516-522, 1984.

Each type (protan-type or deutero-type) of congenital color vision defects, considered as "Pigmentfarbenamblyopie", was examined by the following methods : selective chromatic adaptation method, increment threshold method and heterochromatic matching method. The wavelength discrimination function was also measured.

In the selective chromatic adaptation method, one of the two cone mechanisms, located in the middle or long wavelength region, could not be isolated. This suggests that an easily saturated anomalous cone mechanism would exist in the retina of "Pigmentfarbenamblyopie". On the other hand, the increment thresholds of 200 msec stimulus had almost the same sensitivity as those of 20 msec stimulus, and any additional peak, which was assumed to reflect the neural response, could not be detected. The luminous

efficiency curve measured by the heterochromatic matching method showed the sensitivity loss, depended on the defective type, and the wavelength discrimination function was decreased in borh types. These results suggest that the "Pigmentfarbenamblyopie" has anomalies in the neural pathway as well as in the cone pigment. - Yasuo Ohta.

Fixation, pursuit and optokinetic nystagmus in a complete achromat, by L.T. SHARPE, H. COLLEWIJN and K. NORDBY (Neurologische Universitätsklinik, 7800 Freiburg i. Br. F.R.G., Dept. of Physiology 1, Erasmus Univ., 3000 DR Rotterdam, The Netherlands and Psychological Institute, Univ. of Oslo, Blindern, Oslo 3, Norway). Clin. Vision Sci. 1, 39-49, 1986.

The fixation, pursuit and optokinetic nystagmus (OKN) of a complete achromat were studied, after first investigating his central perimetric field and his preferrred area of fixation. The results indicate that : his central foveola contains a scotoma; his preferred area of fixation is displaced; his fixation is unsteady; his pursuit is generally very imprecise, especially in the horizontal direction; and his spontaneous nystagmus is of the dual jerk type, with a strong horizontal component. They suggest that these eye movement abnormalities cannot be explained by a foveal scotoma. Also, contrary to previous reports, it was found that the OKN responses of this complete achromat display no temporal to nasal directional preference, and no build-up in slow phase velocity with time. - The Authors.

Wavelength discrimination deteriorates with illumination in blue cone monochromats, by R.S.L. YOUNG and J. PRICE (Dept. Ophthalmol. & Vis. Sci., Texas Tech. Health Sciences Center, Lubbock, Texas, U.S.A.). Invest. Ophthalmol. Vis. Sci. 26, 1543-1549, 1985.

Two types of incomplete congenital achromats were studied : one type (blue cone monochromats) has a conspicuous short wavelength cone mechanism, and the other type (deutan incomplete achromats) has a conspicuous long wavelength cone mechanism. The photoreceptor mechanisms were inferred from color matches and from test action spectra measured on rod-saturating backgrounds of different wavelengths. Interestingly, the illumination-dependency of color discrimination (for 5° bipartite fields that were centrally fixated) differed between the two patient types, even though rhodopsin photoreceptors were common to both. As illumination level increased, the ability to discriminate wavelength differences deteriorated for the blue cone monochromats, whereas, for the deutan achromats, wavelength discrimination remained relatively constant even near 100.000 scotopic Trolands. The performance decrement of the blue cone monochromats was probably not associated with rod saturation, as the field action spectrum to cause a just-noticeable-difference decrement in discrimination was poorly fitted by a rhodopsin action spectrum. In addition, the blue cone monochromats had rhodopsin photoreceptors that did not saturate in bright illuminations. The authors hypothesize that the deterioration of wavelength discrimination at high illuminations is not an abnormality of blue cone monochromacy. Rather, it may be a property of the normal color mechanisms through which signals from the short wavelength cones pass. - The Authors.

Dyschromatopsia following cataract surgery, by D.R. JORDAN and J.D. VALBERG (Dept. of Ophthalmol., Ottawa Civic Hosp. of Ottawa, Canada). Can. J. Ophthalmol. 21, 140-143, 1986.

The authors report on 19 individuals who experienced colour obscurations (dyschromatopsia) following cataract surgery. Although a transient blue discoloration (cyanopsia) might be expected following cataract surgery, an erythropsia (red vision) is more common. Symptoms generally begin after outdoor activity in bright sunlight, vary in duration and are recurrent. It is important to look for a history of drug use, migraine or cerebrovascular accidents. - The Authors.

Modification by fluoangiography of colour vision in diabetic patients, by M. FONTANA and G. VERRIEST (Dept. of Ophthalmol. of the Ghent Univ., Akad. Ziekenh., De Pintelaan 185, B-9000 Gent, Belgium). Bull. Soc. belge Ophthal., 215, 37-48, 1985.

Fluoangiography causes in diabetics a temporary increase of the number of errors when reading Birch and SPP II pseudo-isochromatic plates, especially in case of macular edema and for tritan plates. Other experiments show that this change is more due to an increased filter effect by the fluorescein accumulation than to the increase of glare by the flashes for photography. Measurements of the foveal spectral increment threshold sensitivity curves does not show impairment of the blue mechanism by fluoangiography; on the contrary the green and red mechanisms become less sensitive. - The Authors.

Colour perimetry in retrobulbar neuritis : considerations and personal observations on our cases (L'esame del campo visivo cromatico nella neurite ottica retrobulbare : considerazioni ed osservazioni personali sulla notra casistica), by G. VACCARI, F. PASSANI, A. FRANCHINI, M.L. BARBERA and V.U. GORI (Istituto di Clinica Oculistica, Università degli Studi di Firenze, Italy). Atti Fond. G. Ronchi 41, 225-231, 1986.

The Authors have verified the visual field related to the colours in 8 retrobulbar neuritis afflicted patients and have noticed a clear reduction of the peripheral isopters for red, in comparison with those for white and for green. They conclude pointing out that their results don't always agree with those of the literature. - The Authors.

Multiple sclerosis : abnormalities in luminance, chromatic and temporal function at multiple retinal sites, by R.S. SNELGAR, D.H. FOSTER, J.R. HERON, R.E. JONES and R.J. MASON (Depart. Comm. and Neurosci., Univ. of Keele, Staffordshire, ST5 5BG, England). Docum. Ophthalmol. 60, 79-92, 1986.

and Neurosci. Univ. of Keele, Staffordshire, ST5 5BG, England.

Visual function was assessed in a group of patients with multiple sclerosis (MS) and in a group of matched normal controls. In these patients the disease was relatively mild. For each subject, measures of a range of psychophysical visual functions were carried out at multiple sites in each eye. Previous reports have only included some of these functions. Here, luminance threshold, two-flash resolution, perceptual latency, luminance critical flicker frequency (CFF), and chromatic CFF were all measured. Variabilities of these functions and correlation between chromatic and luminance CFFs were also evaluated. For both the MS group

and the normal control group, the correlations between pairs of visual parameters were not overall significantly greater than chance level. The MS group did give a significantly reduced valuerelative to the normal group for luminance CFF and for the gradient of the plot of chromatic CFF against luminance CFF. This group was then subdivided according to history of visual involvement. The subgroup with previous visual symptoms had significant impairment for luminance threshold, variability of luminance threshold, luminance CFF, variability of two-flash resolution, and for the gradient of the plot of chromatic CFF against luminance CFF. The subgroup without previous visual symptoms showed no significant impairment for any individual parameter, although the gradient of the plot of chromatic CFF against luminance CFF was lower than normal. - The Authors.

The colour vision deficiencies as a possible variable on school achievement, by J. PERALES, L. JIMENEZ DEL BARCO and E. HITA (Depart. de Optica, Facult. de Ciencias, Univ. de Granada, Spain). Atti Fond. G. Ronchi 41, 419-428, 1986.

The studies related to the influences of colour vision deficiencies on learning seem to be scarce and have sometimes given contradictory results. The purpose of this study is to determine what differences, if any, in school achievement of 189 male pupils aged from eight to sixteen years with defective colour vision, can be found compared with colour-normal pupils. The co-relationship between school achievement and colour vision deficiency measured as errors made in reading the Ishihara test, was investigated by subjects studied. Small effects on this achiement, in relation to the referred variables, have been noted. - The Authors.

"Colour Blindness" : further clinical notes on disillusion, countertransference and transference, with some relevant history, by N. BRADLEY (1194 Cragmont Avenue, Berkeley, CA 94708, USA). Int. Rev. Psycho-Anal., 13, 51-75, 1986.

This is a discursive but thought-provoking contribution to the question of whether daltonians suffer long-term anxieties as a result of their discovery that they perceive the world in a different way to others. The author, himself an anomalous trichromat, goes so far as to suggest that the colour-defective child, failing to perceive the numbers in the Ishihara plates, may compensate by excelling in mathematics. Proper attention is given to the issue of whether the daltonian analyst should acknowledge his own defect to the defective analysand - in order to encourage a transference cure. - J.D. Mollon.

Are standards of colour vision in the transport industries justified? by A.J. VINGRYS and B.L. COLE (Victorian Coll. of Optom. and Dept. of Optom., Univ. of Melbourne, Australia). Report to the Australian Dept. of Aviation, 1985.

Colour vision standards are imposed in road, maritime and aviation transport but are often subject to vigorous opposition by those excluded by the standard. With greater emphasis in recent years on equality of opportunity, it is important that standards of personal fitness, such as colour vision standards, which exclude some people from participation in a range of occupations and activities, be subject to critical scrutiny. Such appraisal

should be able to demonstrate that the community benefit arising from the application of the standard is sufficient to justify the personal and other costs of retaining the standard. This paper reviews the evidence relating to colour vision standards in the transport industries and concludeds that a strong case can be made for the retention of colour vision standards in public transport. Colour coding is widely used to convey information and to provide visual organisation in transport and is still often a primary source of information despite the introduction of electronic communication and control systems that reduce dependence on the human operators. There is good evidence that colour is a very effective primary visual coding dimension and also has value in reducing errors and enhancing the speed of decision making even when it is used redundantly. Several laboratory and field investigations of the ability of colour vision defective observers to correctly identify coloured signal lights are summarised to show that such observers often make errors and are usually significantly slower in their responses. However it is noted that some colour vision defective observers are better at the recognition of distant signal lights than some observers with normal colour vision. It would therefore be improper to exclude all colour vision defective observers without further test of their ability and in some circumstances where very distant and dim signals must be seen, such as in maritime navigation, there may be justification for excluding the worst of the normal observers. Protan observers, those whose visual system lacks a normal red absorbing cone receptor, make more errors than observers with other kind of defective colour vision and in addition have a very substantially reduced visual range for red signal lights. They are also found by two studies to be more likely to be involved in road accidents than are drivers with normal colour vision presumably because of their reduced visual range for red signal lights. The reports and studies that attempt to relate defective colour vision to accidents are reviewed and are found to differ in their conclusions and are often defective in their methodology and reporting. However, there are four well constructed studies, two that relate to road transport and two to aviation, that show that those with defective colour vision are more likely to be involved in accidents than are colour normal observers. - The Authors.

Defective colour vision can impede information acquisition from colour coded video displays, by B.L. COLE and W.A. MacDONALD (Victorian College of Optometry, University of Melbourne, 374 Cardigan Street, Carlton, Vict. 30, Australia), Report No. 3 of the Victorian College of Optometry to the Dept. of Avaiation, July 1986.

In an earlier paper (Macdonald and Cole, 1986) it was shown that redundant colour coding decreased response times and reduced errors in carrying out various tasks that required information acquisition from the video display of an electronic flight instrument system. In the experiment reported in this paper it is shown that observers with defective colour have slower response times and higher error rates than normal observers for some of the tasks and that their performance is similar to that for a monochrome display. However, they are not disadvantaged when blue is used

to colour code the target feature. Protanopes are shown to be especially disadvantaged in responding to a red "fail" message. - The Authors.

Colour and its history, by J. GAGE (Dept. of History of Art, Univ. of Cambridge, 1 Scroope Terrace, Cambridge, CB2 1PX, United Kingdom), Interdisciplinary Science Reviews, 9, 252-258, 1984.

This is a brief overview of the history of colour written by an art historian who is familiar with the technological and scientific literature. He provides a very useful bibliography, but points to the (surprising) shortage of treatments of colour by historians of art.

Gage quotes a striking passage from Ptolemy's "Optics", in which is described the mixture of colours that occurs when different colours are presented to the eye in rapid succession (by a spinning disc) or when adjacent colours are viewed from a distance.

The introduction of oil painting, Gage suggests, and the practice of mixing pigments, may have been responsible for the notion of a set of basic colours, a notion that becomes widespread during the seventeenth century. He also discusses briefly some early attempts by artists to develop scales of chroma and value; Newton's analogy between the spectrum and the musical octave; and the notorious question of whether changes in the work of celebrated painters can be related to aging of the eye. - J.D. Mollon.

1987 Deane B. Judd-AIC Award to Robert Hunt

The Deane B. Judd-AIC Award is given biennially by the Association Internationale de la Couleur (AIC) to recognize and honour persons who have performed work of outstanding merit in colour science. Previous recipients have been Miss Dorothy Nickerson, Prof. William David Wright, Dr. Günter Wyszecki, Prof. Manfred Richter, Dr. David Lewis MacAdam and Prof. Dorothea Jameson/ Leo Hurvich.

The 1987 Deane B. Judd-AIC Award will be conferred upon Robert W.G. Hunt in recognition of his extensive contributions to the science and technology of colour. In particular his work on colour negative films, the telecine transfer of film to television, the reproduction of reversal film using graphic art materials, his investigations towards the assessment of colour appearance and the ability of an observer to scale the hue, colourfulness and lightness of a surface colour using a variety of adaptation conditions, are among the contributions noted here for recognition by the AIC. His professional career at Kodak Research Laboratories spans a period of more than 35 years during which time he has published his book "The Reproduction of Colour", which is seen as a standard text-book by anyone involved in the art and science of reproducing colour using photography, television or printing. Even after 1982 in retirement he has not been inactive. His book is updated, another one written as well and he was President of the AIC from 1982 to 1985 having previously served on the AIC Executive Committee. His contributions to colour repro-

duction and the assessment of colour appearance, and his contributions to colour standardization in the relevant CIE Committees have earned him admiration and gratitude of colleagues and associates throughout the international colour community.

The award consist of a gold medal with a portrait of Deane Judd on one side, and on the other side the inscription "To honour Robert Hunt 1987 for important work in colour science". - Press release.

Prepublication Purchase of 9th IRGCVD Symposium Proceedings

As with the previous three symposia, the Proceedings of the 9th IRGCVD Symposium will be published by W. Junk as a volume of the Documenta Ophthalmologica Proceedings Series. For a limited time, IRGCVD members who did not attend the 9th Symposium in Annapolis may still purchase copies of the Proceedings for **$65**, the same greatly reduced price as for those who attended. This is only about half of the expected retail price of the Proceedings after publication. Please note that we can guarantee this offer only if we receive your order before October **15, 1987.** Please send your name, mailing address and check for $65 (U.S. dollars), payable to IRGCVD, to:

Bruce Drum
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Annapolis Symposium Programs and Tote Bags for Sale

Printed Programs of the Annapolis Symposium and "Crab Bags" provided to Symposium registrants are still available. The programs contain the meeting schedule and abstracts of all talks and posters. The bags are 33 x 38 cm beige canvas tote bags with the red "crab logo" printed on one side as illustrated below. The programs can be purchased for $6 apiece and the tote bags for $15 apiece by sending checks to Bruce Drum, Wilmer Institute B-27, Johns Hopkins Hospital, 601 N. Broadway, Baltimore, MD. 21205, U.S.A. All checks should be in U.S. dollars, payable to IRGCVD. Please note that these items are in limited supply and will be sold on a first come, first served basis. All proceeds from the sale of bags and programs will be used to help pay Symposium expenses.