DALTONIANA

NEWSLETTER
OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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IRGCVD News

Organisation of the IRGCVD 1991 Symposium and of the associated joint IRGCVD-AIC meeting is progressing well. Travel grants have been awarded to assist four young scientists residing in Europe to attend and contribute to the meetings. We have a provisional programme of 60 papers and posters which have been accepted so far. A list of authors and titles follows. There has been a good response to the poster option which justifies devoting two separate sessions to them.

IRGCVD Symposium

Adams, Schneck and Volrecht. *Acute changes in blood glucose and their effects on color vision function in diabetes.*

Bayer, Thiel and Zrenner. *Early detection of retinal disorders by colour vision tests.*

Billock. *Estimating the wavelength discrimination function from the Farnsworth-Munsell 100-hue test measurements.*

Billock, Vingrys, King-Smith, Grigsby and Benes. *Opponent colour detection threshold asymmetry: a strong indicator of optic nerve abnormalities.*

Birch. *The clinical use of the Holmes-Wright lantern.*

Birch. *Classification of anomalous trichromatism with the Nagel anomaloscope.*

Capilla and Aguilar. *A new solid state anomaloscope: design and calibration.*

Carpinell, Capilla, Illueca and Morales. *Color vision defects and albinism.*

Cheng and Vingrys. *Developing an optimised clinical test of colour vision.*

Cole (Invited Lecture). *Does defective colour vision really matter?*

Cole, Hine and Scott. *Relative contributions of luminance and chromaticity to the Craik-Cornsweet effect.*

Crognale, Rabin, Switkes and Adams. *Selective loss of S-pathway sensitivity in central serous choroidopathy revealed by spatio-chromatic visual evoked cortical potentials (VECP).*

Dain. *Characteristics of random arrangements of D-15 type tests.*

Dain, Honson and Curtis. *Suitability of fluorescent tube light sources for the Ishihara test as determined by colorimetric methods.*

de Mattiello, Gonella, Capilla and Illueca. *Abnormalities in chromatic and luminance flicker fusion in glaucoma.*

de Mattiello, Gonella and del Valle Brizuela. *Phase selectivity in chromatic and luminance flicker fusion.*

Deeb, Lindsey, Hibiya, Sanocki, Winderickx, Teller and Motulsky. *Molecular studies on genotype-phenotype relationships in human X-linked red/green color defects.*

Eisner and Dow. *Longitudinal changes of visual function: eyes whose fellow eye has exudative age-related macular degeneration.*

Flanagan. *Orientation selectivity in equiluminant gratings.*

Fletcher. *Observations on and with lantern tests.*

Hill. *An ROC analysis of some colour vision tests.*

Huang, Wu and Wu. *The characteristics of monochromatic VEP in normal subjects.*

Huang, Wu and Wu. *The assessment of panel D-15 test and FM 100-hue test for congenital color vision defects.*

Ishihara, Shimizu, Hamano, Obara and Ohta. *Pfluegertrident-plate for clinical evaluation of the sense of colour.*

Jacobs and Neitz. *Individuals showing extreme variation in the L:M cone ratio.*

Jacobs and Neitz. *Spectral sensitivity of protanopes and protanomalous trichromats.*

Kandatsu and Kitahara. *The visual characteristics of a deutan type of pigmentfarbenanomaly.*

Kudo, Smith and Pokorny. *Sensitivity of five screening tests for tritan discrimination as evaluated in normals at reduced levels of illumination.*

Majima. *Mistakes and difficulties in colour discrimination in daily life of colour vision defectives.*

Mäntyjärvi. *Screening of red-green defectives with Hahn colour vision test.*

Moreland. *Matching range and age in a blue-green equation.*

Moreland. *Design criteria for a clinical anomaloscope.*

Morland and Ruddock. *Opponent-colour responses generated by spatially tuned mechanisms in human vision.*

Ohhama, Ohta, Saiki, Notohashi and Takahashi. *Effect of tinted posterior chamber IOL to colour vision.*

Pelizzone, Sommerhalder, Haefliger and Hermès. *Automated Rayleigh and Moreland matches: optimization of stimulation parameters.*

Ronchi, Castellini, Ciamberlini and Pampaloni. *Proposals to test and compensate (some) color vision deficiencies of VDT operators.*

Scheibner and Lochner. *An opponent-colour theory based on gauging unsaturated colours.*

Schneck, Huie, Adams and Adams. *A simulator for color and spatial vision of the elderly eye.*

Serra, Zucca, Dessy and Fossarello. *On the assessment of visual impairment by the use of Anandron: colour discrimination versus dark adaptation.*

Smith, Pokorny and Yeh. *Chromaticities of the Farnsworth-Munsell 100-hue test in cone excitation space.*

Weitz (Invited Lecture). *Molecular genetics.*

Tanabe. *Evaluation of the tritan album.*

Vaegan, Banks, Gathy and Hamer. *The relationship between spatial contrast sensitivity loss, colour vision loss and aging: implications for a mechanism.*

Viénot and Fontvieille. *Evaluation of an apparatus for measuring wavelength discrimination: the differenciateur de Tonalite.*

Vingrys, Atchison and Bowman. *Using panel tests in screening for congenital colour vision defects.*

Vingrys and Cole. *The ability of colour defective observers to recognise an optimised set of red, green and white signal lights.*

Sperling (Invited Lecture). *Spatial and other influences on red-green opponency.*

Yeh, Pokorny and Smith. *S-cone discrimination sensitivity and the performance on arrangement tests.*

Zwick, Reynolds, Lund, Schuschereba, Stuck and Belkin. *A prolonged loss in long wavelength sensitivity after near IR (1064 nm) laser exposure.*

Zwick, Calabrese, Cook, Molchany and Bloom. *Visual mechanisms associated with rhesus visual motor performance.*

Joint AIC-IRGCVD Meeting

Anderton and Millar. *Evidence that colour opponent-type horizontal cells receive direct input from luminosity-type horizontal cells in the turtle retina.*

Barbur, Birch and Harlow. *Dynamic test of colour vision: a comparison of psychophysical and pupillometric data.*

Billock. *Effect of probability summation on the spectral sensitivity of the acuity function.*

Billock. *Properties of the Fechner-Benham subjective colour mechanisms.*

Drum and Sternheim. *Relative loss of chromatic vs achromatic response to monochromatic increments on intense achromatic backgrounds.*

Hine, Cole and McIlhagga. *Linear colour mechanisms obtained from detection thresholds in cone contrast space.*

McIlhagga and Cole. *Interactions between opponent process channels.*

Morland and Ruddock. *Variations in colour matching data: limits on variability in the absorption spectra of cone photoreceptors.*

Pokorny, Moreland and Smith. *Aberrant flicker sensitivity revealed by heterochromatic modulation photometry.*

Ronchi and Castellini. *Mechanisms underlying the response time(s) in herterochromatic brightness matching.*

Literature Survey

Foveal cone thresholds. R L PANDEY VIMAL, J POKORNY, V C SMITH and S T SHEVELL. Vision Res, 1989,29, 61-78.

The method of constant stimuli was used to estimate the psychometric functions for detection of one or two flashes when two light pulses were presented. The test stimulus consisted of two simultaneous 0.5 msec, 1' pulses separated by 17'. Observers reported seeing 0, 1 or 2 flashes. A computer-controlled direct-view apparatus allowed sampling of slightly different foveal locations on each trial. The data were analyzed assuming a binomial probability for sampling of L and M cones and Poisson distributed quantal fluctuation. Under these assumptions, the measurements imply that detection requires a minimum of 5-7 quanta absorbed per cone, and that the effective number of cones illuminated by the 1', 0.5 msec pulse is two. The estimated L/M cone ratio was 1.6 for one observer and 4.0 for the other; each observer's ratio was in general agreement with the value estimated independently by heterochromatic flicker photometry - **The Authors.**

Sources of individual differences in anomaloscope equations for tritan defects. Q ZAIDI, J POKORNY and V C SMITH. Clin. Vision. Sci., 1989, 4, 89-94.

The optimal blue-green equation for detecting tritan color defects was ascertained by systematically examining the effects of inert ocular pigments. Observers matched a test wavelength (410-470nm) plus 500 nm to a mixture pair of 480 plus 580 nm for two field sizes: 2 and 8°. This technique was used to separate the sources of variation contributed by lens and macular pigment in the Moreland equation. The results of the experiment supported a formal analysis that showed that the wavelength of narrowest distribution must minimize a weighted sum of the sample variances in concentrations of lens and macular pigment - **The Authors**

Heterochromatic modulation photometry J POKORNY, V C SMITH and M LUTZE. J Opt Soc Am, 1989, 1618-1623.

Heterochromatic modulation photometry is a method for obtaining equiluminance for a pair of heterochromatic lights presented in temporal alternation. A series of fixed standard-luminance/test-luminance ratios are presented, and at each ratio the modulation depth of the pair is reduced in tandem until the observer reports that flicker disappears. The data can be described by a luminance contrast template that appears V shaped when plotted on log-log coordinates. In the fitting of individual data, a free vertical scaling factor reflects the observer's sensitivity to luminance modulation and a free horizontal scaling factor reflects the observer's similarity in spectral sensitivity to the CIE standard observer. Data for red/green flicker photometric matches demonstrate the technique. Heterochromatic modulation photometry offers several advantages over flicker photometry: (1) a single fixed perceptual transition occurs on each trial series, namely, the transition from flicker to steady, and (2) luminance matches can be obtained at fixed frequencies at a number of luminance levels. The same procedure can be applied to the measurement of the minimally distinct border and to the identification of tritan pairs (stimulus pairs that differ only in their stimulation of short-wavelength-sensitive cones) - **The Authors.**

Endgültige Abklärung der Untersuchungsbefunde Goethes an Farbenblinden. (Goethe's examinations on colour blind persons and the final solution of his diagnosis). W Jaeger. Klin Mbl Augenheilk, 1989, 195, 382-387.

During his researches on colour-vision Goethe examined two colour blind students. Most of the reports and colour tests made by Goethe himself are preserved. Due to the colour confusions in the whole purple zone Goethe decided that the subjects were blue-blind. During the 19th century, however, the supposition arose that it must have been a red-green-blindness. It was Trendelenburg, who supposed it to be deuteranopia. On the other hand reconstructions of Goethe's examinations led to the conclusion that it was in all probability protanopia. A final solution of this dispute is now possible after a great-grandson of Goethe's subject Gildemeister was discovered and examined with a Nagel anomaloscope. He is a typical protanope. According to the pedigree demonstrating the typical x-linked hereditary transmission, we can now be sure that Goethe's subjects were protanopes - **The Author.**

Eine evolutionäre Interpretation des menschlichen Farbensehens. Dem Andenken an Dr Guy Verriest gewidmet. (An Evolutionary interpretation of human colour vision. Dedicated to the memory of Dr Guy Verriest). J D Mollon and G Jordan. Die Farbe, 1988/1989, 35/36, 139-170.

Many of the features of human colour vision can be understood if our chromatic discrimination is seen to depend on two distinct sub-systems, one overlaid on the other. The phylogenetically more ancient sub-system divides the spectrum into warm and cold colours and depends on a comparison of the signals of the short-wave cones, on the one hand, and some combination of the signals of the long- and short-wave cones, on the other. The second, phylogenetically more recent, sub-system depends on a comparison of the signals of the long- and middle-wave cones; it is parasitic upon the parvocellular system of the primate pathway.

Here we review the extent to which the two sub-systems remain independent at the early levels of the visual system, and in the psychophysical domain; and the extent to which colour analysis is independent of the analysis of spatial detail. It is argued that the properties of human colour deficiencies reflect the way our colour vision evolved and may offer a model for other neural disorders. In New World monkeys, as in our own species, heterozygous advantage may maintain a polymorphism of the long-/middle-wave cones - **The Authors.**

Retinal damage in Macaque after white light exposures lasting ten minutes to twelve hours. J J M KREMERS and D VAN NORREN. Invest Ophthalmol & Vis Sci, 1989, 30, 6, 1032-1040.

We induced photochemical damage in small parts of the retinas of anesthetized macaques after light exposures of varying intensity, lasting between 10 min and 12 hr. Damage was assessed both with funduscopy and densitometry at several periods after exposure. Damage was most extensive 2 days post-exposure, with similar thresholds for both methods. Reciprocity between exposure time and irradiance was found for all exposures at a threshold irradiant dose of 230 J/cm^2. This is in good agreement with part of the literature data on monkeys, yet contradicts another report (Sykes et al) in which a much lower threshold dose was found. The latter data probably concern a different class of damage. It remains unclear what optical factors distinguish the two diseases, observations more than 70 days post-exposure show a divergence between funduscopic and densitometric thresholds. Although the appearance of funduscopic lesions had changed, the threshold dose remained 230 J/cm^2. Densitometry showed full recovery of the amount of visual pigment for doses below 600 J/cm^2 - **The Authors.**

Retinal densitometry in acute posterior multifocal placoid pigment epitheliopathy. J E E KEUNEN, G J VAN MEEL, D VAN NORREN, V C SMITH AND J POKORNY. Invest Ophthalmol Vis Sci, 1989, 30, 7, 1515-1521.

Cone photopigment kinetics were investigated by retinal densitometry in six patients with acute posterior multifocal placoid pigment epitheliopathy (APMPPE). Our goal was to document the course of cone impairment during a period of at least 12 months following the onset of the disease process. During the active stage, we found that the amount of pigment measurable by densitometry (the density difference) was reduced and that the time constant of pigment regeneration was unmeasurable. Following resolution of the fundus lesions, the densitometric parameters gradually improved in eight of ten eyes. In patients who maintained foveal fixation (five eyes), the density difference and the time constant of pigment regeneration improved simultaneously, though with individual differences in time course. Photopigment kinetics returned to normal in all these patients but the density difference remained lower than normal in four of the five eyes. In patients with parafoveal fixation (five eyes), photopigment kinetics were slow, possibly reflecting mixed cone and rod contributions. With time, the density difference improved to a level comparable to that measured in normal observers at a similar retinal location, but the photopigment regeneration time constant remained abnormal or unmeasurable. Recovery was variable, with one eye changing from parafoveal to foveal fixation, and no improvement noted in two eyes with extreme parafoveal fixation. Our findings demonstrate a large interpatient variation associated with APMPPE - **The Authors.**

Changes in rod sensitivity through adulthood. E PULOS. Invest Ophthalmol Vis Sci, 1989, 30, 8, 1738-1742.

Absolute thresholds of 23 subjects 19-61 years of age were determined for three wavelengths at six retinal eccentricities in the horizontal meridian (2.5-30). The raw data were corrected for prereceptoral light losses that may be age-dependent. Lens density was estimated for each subject by comparing scotopic spectral sensitivity with the absorption spectrum of rhodopsin. Macular pigment density was estimated by comparing macular sensitivity with peripheral sensitivity. Average dark-adapted pupil size at each age was taken from published values. After correction for these prereceptoral light losses, changes in rod sensitivity with age were not significant at any retinal locus tested - **The Authors.**

Evidence for a neural basis of age-related visual field loss in normal observers. C A JOHNSON, A J ADAMS AND R A LEWIS. Invest Ophthalmol Vis Sci, 1989, 30, 9, 2056-2064.

Many studies have reported a decrease in visual field sensitivity as a function of increasing age in normal individuals. This age-related sensitivity loss has mainly been attributed to reductions in pupil size and transmission losses of the ocular media (particularly the lens), although neural losses in the retina, optic nerve and visual cortex have also been suggested. We evaluated the role of preretinal factors on normal visual field changes associated with aging. The central visual field of both eyes of 62 normal subjects (ages 20 to 72) were evaluated with Program 30-2 of a modified Humphrey Field Analyzer. Three test procedures were employed: (1) a standard visual field evaluation; (2) a yellow target on a yellow background condition (530 nm cutoff filter) to minimize the influence of lens transmission loses with age; and (3) a large target/high background luminance "yellow on yellow" test condition (530 nm cutoff filter, 635 asb background, size V target) to minimize both pupil size and lens effects on central visual field sensitivity. In addition, relative lens absorption estimates were obtained for each subject. All three test conditions revealed a loss in visual field sensitivity with increasing age (approximately 0.8 dB per decade) but no meaningful differences were found among the three test procedures. Relative lens density increased with age but was not related to visual field sensitivity for any of the three test conditions. These data suggest that normal age-related visual field sensitivity changes are primarily due to neural losses rather than preretinal factors - **The Authors.**

Diabetic dyschromatopsia study with spectral tests. A E COMBES. Thesis, University of Marseilles, 1990.

61 diabetic patients with and without background retinopathy were examined with 3 tests: Desaturated Panel D15, STILES and WALD-MARRÉ methods. 90.2% of patients showed deficiency in at least one of these tests. In patients without retinopathy, the desaturated D15 test detected only 57.3% of defects. The STILES method was the most sensitive and detected 85.4% - 1 and 3 impairments compared to the WALD-MARRÉ technique which only detected 78% of defects - **J. Vola.**

Abnormalities in Hue Discrimination Revealed With Very Brief Stimuli in Diabetes Mellitus and in Optic Neuritis. M O Scase, D H Foster, W P Honan, J R Heron, M C Gulliford and J H B Scarpello. Clinical Vision Sciences, 1990, 6, 49-57.

The effects of reduced stimulus duration on colour vision were assessed in two pathologies differentially affecting the optic nerve and retina. Hue discrimination thresholds were measured for long- and short-duration (500- and 2-ms) stimuli presented on a computer-controlled colour monitor in 10 patients

with previous optic neuritis, in 17 diabetic patients, 8 with and 9 without retinopathy, and in 10 normal controls. All patient groups had normal Farnsworth-Munsell 100- Hue scores. Thresholds were obtained by a hybrid-adaptive procedure requiring hue discrimination about a reference white. As flash duration was reduced, normal subjects showed greater threshold elevations along the red-green axis than along the tritanopic axis. For patients with previous optic neuritis, performance was similar to, but uniformly worse than, that of controls. In contrast, for diabetic patients without retinopathy, reduced flash duration had the effect of increasing thresholds more along the tritanopic axis than along the red-green axis. For diabetic patients with retinopathy, this selective temporal effect disappeared. The results suggest that in diabetes significant abnormalities in retinal function may occur early in the disease, and that measures of hue-discrimination with short-duration flashes may predict later, more marked, losses in colour vision - **The Authors.**

Photosensitive and photostable pigments in the retinae of Old World monkeys. J K BOWMAKER, S A D M HUNT and J D MOLLON. J exp Biol, 1991, 156, 1-19.

Microspectrophomotmetric measurements of retinal receptors are reported for eight species of Old World Monkey. Although the animals vary greatly in size, colourings and habitat, they all appear to be trichromats and the peak sensitivities of their cones invariably lie near 430, 535, and 565 nm. This consistent pattern contrasts with the results reported earlier for New World monkeys and with the results reported here for Tupaia glis. The trichromacy of frugivorus catarrhine monkeys may have co-evolved with a particular class of coloured fruit.

Short-wave cones were rare in all species. The ratio of the numbers of middle-wave and long-wave cones varied between individual animals, but had an overall value close to unity.

In the case of all the species examined here, we have recorded a photostable pigment in the inner segments of rods and cones. The latter pigment has a peak sensitivity close to 420 nm and an absorbance spectrum that is narrower than that of a photosensitive visual pigment - **The Authors.**

Changes in colour appearance following post-receptoral adaptation. M A WEBSTER and J D MOLLON. Nature, 1991, 349 No 6306, 235-238.

Current models of colour vision assume that colour is represented by activity in three independent post-receptoral channels: two encoding chromatic information and one encoding luminance. An important feature of these models is that variations in certain directions in colour space modulate the response of only one of the channels. We have tested whether such models can predict how colour appearance is altered by adaptation-induced changes in post-receptoral sensitivity. In contrast to the changes predicted by three independent channels, colour appearance is always distorted away from the direction in colour space to which the observer has adapted. This suggests that at the level at which the adaptation effects occur, there is no colour direction that invariably isolates only a single post-receptoral channel - **The Authors.**

S (blue) cone pathway vulnerability in retinitis pigmentosa, diabetes and glaucoma. V C GREENSTEIN, D C HOOD, R RITCH, D STEINBERGER and R E CARR. Invest Ophthalmol Vis Sci, 1989, 30, 1732-1737.

A variety of retinal diseases lead to a decrease in the sensitivity of the S (blue) cone pathyways. To determine the possible sites and mechanisms of this loss we compared the sensitivities of an S (blue/pi-1) and an M (green/pi-4) cone pathway in patients with retinal diseases that differ as to their primary locus of sensitivity loss. The sensitivities of an S and an M cone pathway were assessed in patients with retinitis pigmentosa, insulin-dependent diabetes mellitus and open-angle glaucoma using Stiles two-color increment threshold technique. A greater loss in sensitivity of an S than an M cone pathwya was found for all three disease groups; however, the diabetic patients showed a more selective loss. The results suggest that multiple sites are involved and that the combined effects of metabolic abnormalities and hypoxia contribute to the selective loss - **The Authors.**

Asymmetry of focal ERG in human macular region. Y MIYAKE, N SHIROYAMA, M HORIGUCHI and I OTA. Invet Ophthalmol Vis Sci, 1989, 30, 1743-1749.

Electroretinograms (ERGs) were elicited by hemicircular (half-disc) stimuli to the upper, lower, temporal and nasal maculas of 26 normal subjects, and the amplitudes and implicit times of the ERGs from opposing macular regions were compared. The amplitudes of a-wave, b-wave and oscillatory potentials (OPs) were significantly larger in the upper macular region than in the lower macular region (P). The amplitudes of a- and b-waves did not differ significantly between temporal and nasal macular regions, but OPs showed enormous asymmetry, with significantly larger amplitudes in the temporal retina than in the nasal retina (P). The implicit times of a-waves, b-waves and OPs did not differ significantly between upper and lower retina, or between temporal and nasal retina. These findings aided analysis of the ERG of a patients with a retinal defect - **The Authors.**

Information and Instructions for Authors

Proceedings of the 1991 IRGCVD Symposium, June 20-23, Sydney, Australia

New Editorial Policies

Starting with the upcoming Sydney Symposium, the editorial policies for the biennial IRGCVD Symposium Proceedings will undergo several significant changes. Most of these changes are related to a new peer review procedure, which is intended to establish high standards for quality and enhance the reputation of the Proceedings with the general scientific community. In addition, an absolute deadline for the submission of manuscripts is being implemented in an attempt to reduce the delay in publishing the Proceedings to approximately one year after the end of the Symposium (the proceedings from the last three meetings in Avignon, Annapolis and Cagliari involved delays of nearly two years.

The new review policies will establish the Proceedings as a fully peer-reviewed primary publication. Therefore, short versions of papers to be published elsewhere will be considered duplicate publication, not acceptable for the Proceedings.

In the past there have been no published guidelines to authors for the preparation of Proceedings manuscripts. As a result, manuscripts have been submitted in different formats, creating a great amount of extra work for the Editors. For the Sydney Symposium, however, all authors will be expected to adhere closely to the instructions for manuscript preparation below. The formats specified in these instructions are identical to those used for the two previous Proceedings, Colour Vision Deficiencies IX and X. Authors who have questions about the manuscript format may consult one of these volumes or they may contact the Editor at the address below. *Important Note: All authors are required to prepare their manuscripts according to the instructions below. Manuscripts that deviate significantly from the standard format will be returned to the authors for correction.*

Initial Submission Deadline

Authors are strongly urged to submit their manuscripts at the meeting if at all possible.

The absolute deadline for the Editor to **receive** manuscripts will be 30 days from the last day of the meeting. **The deadline for the Sydney Proceedings is Tuesday, July 23, 1991.** Manuscripts faxed to the Editor by the deadline date will also be acceptable, but only if they are exact copies of original manuscripts sent by Federal Express or other overnight mail on or before the date of the fax. **Manuscripts received after the deadline will be returned to the authors.**

Review Policy

Each manuscript will be reviewed for scientific quality by at least two anonymous IRGCVD members in addition to the Editor. The reviewers will be instructed to make their comments constructive whenever possible. However, if a reviewer feels that a paper cannot be made publishable with a reasonable amount of revision, he or she will be free to recommend rejection. A paper may be rejected only if the Editor and both reviewers all recommend rejection. Even if a manuscript is rejected, however, the authors may submit a revised manuscript if they believe that they can respond adequately to the criticisms of the reviewers.

Manuscripts that are either rejected or accepted pending satisfactory revison will be returned to the authors for their response. All revised manuscripts must be returned to the Editor within 30 days of receipt, accompanied by cover letters detailing the authors' response to the reviewers' and Editors's comments and specifying all changes to the manuscripts. Revised manuscripts will be accepted for inclusion in the Proceedings only if the revision and cover letters satisfactorily respond to the reviewers' comments.

Manuscript Preparation

Submission

Submit one original manuscript and three exact copies to The Proceedings Editor: Dr Bruce Drum, Wilmer Institute, B-20, Johns Hopkins Hospital, 601 North Broadway, Baltimore, MD 21205, USA.

All text including abstract, references, tables and figure captions, must be double-spaced with at least 1" (2.5cm) margins, and typed or printed with a laser printer or letter-quality dot matrix printer on 8.5" x 11" (A4) paper.

All manuscripts must be accompanied by a signed statement from the authors that the paper has not been published previously, that it is not currently being considered for publication elsewhere, and, if published in the Proceedings, that it will not be published or reprinted elsewhere in the same or similar form without the

written consent of the publisher.

Page Limits

The Publisher will allow 450 free Proceedings pages, including Tables and Figures, to be divided equitably among the individual contributions. In the past, five or six free printed pages each containing approximately 400 words typically have been allocated to each paper, depending on the total number of papers submitted. For papers that exceed the free page limit, authors will be charged Dfl. 100 for each printed page over the limit. Present indications are that the free page allocation for contributed papers will be seven.

Title Page

The first page of the manuscript must contain: (1) the title, right-justified, all in capital letters; (2) the authors' names, right-justified, all in capital letters except for the conjunction "and" in lower case betweeen the names of the last two authors; (3) city, state or province if applicable, and country, in upper and lower case letters, parenthesized and underlined or italicized.

Abstract Page

The second page of the manuscript must contain an abstract of up to 200 words, introducing the topic of the paper and briefly summarizing methods, results and conclusions.

Headings and Subheadings

All headings should be left-justified, typed in upper and lower case, without punctuation . In most cases, the principal headings should include the standard Abstract, Introduction, Methods, Results, Discussion, Conclusion, Acknowledgements and References sections, or their equivalents. No more than one level of subheading should be used, and then only when necessary for clarity. Principal headings should be typed in boldface and subheadings should be italicized or underlined.

Acknowledgments

Authors should acknowledge explicitly any financial or other commercial interest in any product that is evaluated in the paper. Also, any project sponsored by a private, corporate or governmental organization should be acknowledged.

References

All references should be cited in the text by authors' last name and year, as in the following examples. Single author; (Harrington, 1971): two authors; (Aulhorn and Harris, 1972): three or more authors; (Drance et al, 1981). Complete references should be listed alphabetically by author on one or more separate pages at the end of the manuscript, according to the following formats:

Journal Article

Lakowski, R., Bryett, J. and Drance, S.M. A study of colour vision on ocular hypertensives. Can. J. Ophthalmol. 7:86-95 (1972)

Book Chapter

Lutze, M., Smith, V.C. and Pokorny, J. Critical flicker frequency in X-chromosome linked dichromats. In: Drum, B. and Verriest, G. (eds.), Colour Vision Deficiencies IX, Doc. Ophthalmol. Proc. Ser. 52: 69-77, Kluwer Academic Publishers, Dordrecht (1989).

Book

Pokorny, J., Smith, V.C., Verriest, G. and Pinckers, A.J.L.G. Congenital and Acquired Color Defects. Grune and Stratton, New York (1979).

Authors Address

The name and full mailing address of the first author, or the author to whom correspondence should be addressed, should be typed left-justified following the list of references. It is not necessary to include the author's name if all authors have the same address.

Tables

All tables must be cited and identified by number in the text as Table 1, Table 2, etc. Each table should be constructed on a separate page following the text. Information should be organized in columns, but without vertical lines. The underlined or italicized table name (e.g., Table 2) must be typed left-justified above the table, followed by a brief descriptive title.

Figures

Line-drawing figures should be drawn with India Ink or printed using a laser printer or a high-resolution dot matrix printer with a new black ribbon. Original drawings, printouts or high-contrast photographs are all acceptable. Photocopies, however, are **not** acceptable. Figures intended for half-tone reproduction must be photographed on glossy white paper. Colour figures are possible, but the cost of reproduction will be charged to the author.

Each figure must be identified on the back with the figure number, the first author's name and an indication of proper orientation.

All graphs must have labelled axes, and all lines and lettering must be large enough to stand photographic reduction of the overall figure to a width of no more than 4.6 in. (11.7cm). All figures must be numbered consecutively in order of their first citation in the text and abbreviated "Fig." except at the beginning of a sentence. The approximate location of each figure should be clearly indicated by a note either in the margin or in a gap in the text.

Figure captions must be typed double-spaced on a separate page following the body of the text. Each caption should begin with the left-justified, abbreviated, italicized or underlined figure name (e.g., *Fig.* 2.). Captions should be brief but sufficiently explanatory to allow the main points of the figures to be understood without reference to the text.

SYMPOSIUM OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

June 20 - 23, 1991 Sydney, Australia

GENERAL INFORMATION

VENUE Electrical Engineering lecture theatre, University of New South Wales.

Special Themes - a) Occupational consequences of colour vision deficiencies,
b) Molecular genetics of colour vision deficiencies, and
c) Spatial aspects of colour vision

SCIENTIFIC PROGRAMME

Two of the sessions will be devoted to posters and one will be an IRGCVD Business Meeting

June 21	8:00 am - 5:00 pm
June 22	9:00 am - 5:00 pm
June 23	9:00 am - 5:00 pm
June 24	Joint IRGCVD-AIC Meeting

SOCIAL PROGRAMME

June 20	2:00 pm - 6:00 pm	Tour of Sydney
	6:00 pm - 10:00 pm	Welcome Reception
June 21	7:00 pm - 11:00 pm	Harbour Cruise
June 22	7:00 pm - 11:00 pm	Australian Dinner

ADDITIONAL ACTIVITIES FOR ACCOMPANYING PERSONS:

June 21	9:00 am - 4:00 pm	Taronga Park Zoo
June 22		Free shopping day
June 23	9:00 am - 5:00 pm	Blue Mountains

METHODS OF PAYMENT FOR REGISTRATION FEES AND ACCOMMODATION

Either bank cheque or bank transfer may be made in Australian Dollars.

i) A bank cheque should be made in favour of **IRGCVD XIth Symposium** and sent together with the completed Registration and Accommodation form.

ii) A bank transfer should be made through your own bank to the **IRGCVD account** at the **State Bank, University of New South Wales Branch, A/C 862047-00.**
Enclose a copy of the bank transfer with your Registration and Accommodation form.

CANCELLATIONS AND REFUNDS OF REGISTRATION FEES

Written notification should be received by the SECRETARIAT no later than May 15, 1991.

Refunds will be made as follows: Before May 15, 1991 Less by 20% for administration costs.
After May 15, 1991 No refunds.

ACCOMMODATION

Arrangements have been made with the most conveniently located motels and University residential colleges. Please see the "ACCOMMODATION AND REGISTRATION FORM".

For all communications, please mail , fax or e-mail to:

IRGCVD SYMPOSIUM SECRETARIAT
School of Optometry
University of New South Wales
Kensington
New South Wales 2033
Australia

Phone: Int + 61 2 697 4629 fax: Int + 61 2 313 6243 Telex: AA26054
e-mail: sdain%usage.csd.unsw.oz.au@murtoa.cs.mu.oz

SYMPOSIUM OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

June 20 - 23, 1991

AND JOINT IRGCVD-AIC MEETING

June 24, 1991

ACCOMMODATION INFORMATION AND FLIGHT HINTS

				Distance to venue
1.	Barker Lodge Single Twin Share	Tel: Int + 61 3 662 8444 $110 $120	32 Barker St, Kingsford Basis: room only	5 mins walk
2.	Eastside Motel Single Twin Share	Tel: Int + 61 3 663 0631 $85 $95	147 Anzac Pde, Kensington Basis: room only	10 mins walk
3.	Gemini Motor Inn Single Twin Triple	Tel: Int + 61 3 399 9011 $89* $89* $89*	65 Belmore Rd, Randwick Basis: room only Hotel will provide a shuttle bus service if there is a sufficient number of clients.	20 mins walk
4.	New College Single	Tel: Int + 61 3 697 5437 $42	On Campus Basis: Bed and Breakfast	5 mins walk
	Students receive an additional discount			
5.	International House Single Student	Tel: Int + 61 3 697 5436 $40 $27*	On Campus Basis: Bed and Breakfast	5 mins walk
6.*	Shalom College Single Student Kosher Cuisine	Tel: Int + 61 3 697 3435 $35 $25	On Campus Basis: Bed and Breakfast	5 mins walk

PLEASE NOTE: This accommodation has been selected for its vicinity to the University of New South Wales. If you are also attending the AIC meeting (25-28 June) and would prefer not to change accommodation, you will find that the AIC meeting site is reasonably accessible from this locality by public transport and taxis are plentiful and relatively cheap.

FLIGHT HINTS

June is the cheapest time to fly to Australia. The cheapest fares require a minimum stay of 14 days. For instance, the cheapest return flight from Britain by QANTAS is less than £900 at present. QANTAS also offers flights within Australia for a very modest fee to its own passengers and offers a cheap within Australia pass to passengers arriving on other airlines. For instance, it is possible to fly into Cairns and visit the Great Barrier Reef, fly to Sydney for the IRGCVD and AIC symposia and then fly to Melbourne for the CIE meeting all within the one ticket cost, but this is available only on airlines which make internal flights. This is mainly QANTAS although the Sydney/Melbourne flight is available with a number of other airlines including British Airways, KLM, Malaysian and Garuda Indonesia. To make your tour even more enjoyable, at least one stopover can be made before you reach or after you leave Australia even on the cheapest ticket. Travelling from Europe these can be in places like Bangkok or Singapore and from North America in Hawaii or Tahiti. In Britain, United States and Canada the company to contact about these flights and other pre- and post-conference tour options is Jet-About Travel (owned by QANTAS). In other countries contact your QANTAS office. If you need specific information and your local airline or travel agent is unhelpful, contact the local organizer.

* Revised or New Information

SYMPOSIUM OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

June 20 - 23 1991

JOINT IRGCVD AND AIC MEETING

June 24 1991

REGISTRATION AND ACCOMMODATION BOOKING FORM

REGISTRATION

NAME Prof/Dr/Mr/Mrs/Miss/Ms .....

ADDRESS .....

.....

.....

.....

REGISTRATION FEES

			(before 15 May 1991)	
Participant*		$AUS420	($AUS340)	$ .....
Non-member Supplement		$AUS 36	————	$ .....
Student (before May 15, 1991)		———	($AUS180)	$ .....
Proceedings Volume		$AUS 96	———	$ .....
(Non-member, Student)				
Accompanying person(s)		Name(s)		
.....	@	$AUS360	($AUS275)	$.....
JOINT IRGCVD-AIC meeting 24th June		$AUS 50	———	$ .....

The fees cover the social programme and lunches and the morning and afternoon refreshments.

* Full members who are in good standing for the years 1990 and 1991 will receive a copy of the proceedings automatically.

ACCOMMODATION

Arrival Date ..... Departure Date ..... Total number of nights .....

MOTEL

SINGLE/DOUBLE/TRIPLE ..... Indicate requirement

PREFERENCE 1 .....

(See page 11) 2 .....

3 .....

One night's deposit ..... $ .....

COLLEGE

PREFERENCE 1 .....

(See Page 11) 2 .....

3 .....

One night's deposit ..... $ .....

TOTAL ..... $ .....

See page 10 for payment instructions

For all communications, please mail or fax to:

IRGCVD SYMPOSIUM SECRETARIAT School of Optometry, University of New South Wales, Kensington, New South Wales 2033, Australia

Phone Int + 61 2 697 4629 Fax Int + 61 2 313 6243 Telex AA26054
e-mail sdain%usage.csd.unsw.oz.au@murtoa.cs.mu.oz