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DALTONIANA

- number 90 - April, 1998

The bulletin of the International Colour Vision Society

Edited by Stephen Dain

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Daltoniana on the web

Welcome to the second edition of the web based **Daltoniana**. This edition will be downloaded from the website and mailed to members from locations in North America, Europe and Australasia.

Contents

Officers and Committee

President	André Roth
General Secretary	Ken Knoblauch
Treasurer	Ted Sharpe
Membership Secretary	Anne Kurtenbach

General Secretary's report

We are three-quarters of the way to mid-term between our bi-annual meetings and it seems our proceedings, to appear in Vision Research, are well on the way towards a publication date a year in advance of what has been habitual. All appreciation for this speed-up should go to the three editors, C. R. Cavonius, J. D. Mollon and E. Zrenner. The review process being spread out over three editors and several months may have seemed less well organized to individuals with multiple contributions, since the reviews of different papers likely arrived with separations of a few months. A small price to pay, I would think, for the overall efficiency of the final result. More jarring to some may have been the level of criticism dished out by referees of a journal at the level of Vision Research. If our society is to maintain high standards in basic and clinical sciences, then the exposure to outside standards is important, even if it sometimes hurts. Welcome to the real world! I am sure that this will be a hot point of discussion at the next meeting, and I would be grateful to have your comments and thoughts on the matter beforehand. What is important is that higher standards should not be an excuse for exclusion from the society. It would be a shame if such were so perceived. It has been my experience (though it was usually difficult to see at the time) that even the meanest and most ad hoc criticisms that I have received led me to produce a better article, on revision. (Easy to say, after the fact!) In any case, it is my hope that the society will continue to be one in which constructive criticism flourishes to the benefit of increasing our understanding about all facets of color vision and from all quarters of our membership.

We are continuing the distribution of Daltoniana by mail from 5 distribution points while keeping a version available on the web site. There were some minor glitches in the first attempt at this but we think that they have been ironed out. Let us know!

The web site, as well, is evolving. You can now link to a number of important color vision sites from our site. Tell us your suggestions for improvements.

It will soon be time to think about the next meeting. Advance information about the current state of organization can be found in this issue and on the web site. Look forward to seeing you there.

Call for Nominations for the Verriest Medalist

The Verriest Medal is bestowed by the International Colour Vision Society* (ICVS) to honour long-term contributions to the knowledge of colour vision. The Medal was established in 1991 in memory of Dr. Guy Verriest, and is presented at the ICVS biannual Symposia. Previous recipients have been Harry Sperling (1991), Marrion Marré (1993), Vivianne Smith and Joel Pokorny (1995) and Jack Moreland (1997).

Candidates need not have been active in the affairs of the ICVS but they must be either current or former ICVS members. The past and present membership of the ICVS boasts a number of individuals deserving of such recognition but choosing a candidate requires participation of the vision community.

Nominations for the 1999 Verriest Medal are now being solicited.

Submitted materials should include a letter of nomination and, if possible, the candidates's curriculum vitae. Please take the time to consider and to nominate a worthy candidate for this honour.

* formerly the International Research Group on Colour Vision Deficiencies (IRGCVD)

Jack Moreland, 1999 Verriest Medal Chair
CNS Department, Keele University,
Staffordshire ST5 5BG, U.K.
Fax: + 44 (0)1782 583055
email: coa09@keele.ac.uk

Ghent Symposium Proceedings
edited by Dick Cavonius, John Mollon and Eberhart Zrenner

Message from the Editors

The Proceedings of the 1997 Ghent meeting are now close to publication and will appear as issue 18 of volume 38 of 'Vision Research'. The scheduled publication date is August 1998. The Editors have accepted approximately 52 manuscripts, and are grateful to the many members of ICVS who have contributed as authors or referees. All accepted manuscripts have passed through the standard reviewing process of 'Vision Research'.

Proofs should be returned directly to Elsevier Science Ltd., Stover Court, Bamfylde Street, Exeter, Devon, EX1 2AH, United Kingdom. Proofs have been set in the new format that Elsevier are introducing for 'Vision Research' from issue 10 of the current volume. The most notable change is the use of non-alphabetical, numbered references. Elsevier had not given us any notice of this change and in the long term it is likely to be reversed by the Editorial Board; but with respect to the ICVS special issue, we judge it best to acquiesce in the new format, since re-setting would delay publication and probably introduce further errors. In correcting proofs, ICVS authors should be alert to errors introduced by sub-editing that the new format has occasioned: for example, dates of papers may retain a now redundant suffix (1997a, 1986b etc). Structural errors may also be produced by the newly introduced numbering of subsections.

J. D. Mollon, E. Zrenner, C. R. Cavonius

Vision Research, volume 38, issue 18

Normal colour vision

1. STOCKMAN, A. and SHARPE, L.T., Human cone spectral sensitivities: a progress report

2. LOGVINENKO, A.D., On derivation of spectral sensitivities of the human cones from trichromatic colour matching functions.

3. SJOBERG, S.A., NEITZ, M., BALDING, S.D., and NEITZ, J., L-cone pigment genes expressed in normal colour vision

4. NEITZ, M., KRAFT, T., and NEITZ, J., Expression of L-cone pigment gene subtypes in females

5. WOLF, S., SHARPE, L.T., KNAU, H., and WISSINGER, B., Numbers and ratios of X-chromosomal-linked opsin genes

6. SHARPE, L.T., STOCKMAN, A., KNAU, H., and JÄGLE, H., Macular pigment densities derived from central and peripheral spectral sensitivity differences

7. MORELAND, J.D., ROBSON, A.G., SOTO-LEON, N., and KULIKOWSKI, J.J., Macular pigment and the colour specificity of visually evoked potentials

8. USUI, T., KREMERS, J., SHARPE, L.T., and ZRENNER, E., Response phase of the flicker ERG is influenced by cone excitation strength

9. JORDAN, G. and MOLLON, J.D., Shift in Rayleigh matches after adaptation to monochromatic light of various intensities.

10. BUCK, S.L., KNIGHT, R., FOWLER, G.A., and HUNT, B., Rod influence on hue-scaling functions

11. SMITH, V.C., JIN, Q., and POKORNY, J., Color appearance: neutral surrounds and spatial contrast

12. WATANABE, A., POKORNY, J., and SMITH, V.C., Red-green chromatic discrimination with variegated and homogeneous stimuli

Developmental studies

13. TELLER, D.Y., Spatial and temporal aspects of infant color vision

14. CROGNALE, M.A., KELLY, J.P., WEISS, A.H., and TELLER, D.Y., Development of the spatio-chromatic visual evoked potential (VEP): a longitudinal study

15. BIEBER, M.L., WERNER, J.S., KNOBLAUCH, K., NEITZ, J., and NEITZ, M., M- and L-cones in early infancy III: Comparison of genotypic and phenotypic markers of color vision in infants and adults

Comparative studies

16. HUNT, D.M., DULAI, K.S., COWING, A., JULLIOT, C., MOLLON, J.D., BOWMAKER, J.K., LI, W.-H., and HEWETT-EMMETT, D., Molecular evolution of trichromacy in primates

17. JACOBS, G.H., A perspective on color vision in Platyrrhine Monkeys

18. KAINZ, P.M., NEITZ, J., and NEITZ, M., Recent evolution of uniform trichromacy in a New World monkey

19. REGAN, B.C., JULLIOT, C., SIMMEN, B., VIÉNOT, F., CHARLES-DOMINIQUE, P., and

MOLLON, J.D., Frugivory and colour vision in Alouatta seniculus, a trichromatic platyrrhine monkey

20. SILVEIRA, L.C.L., LEE, B.B., YAMADA, E.S., KREMERS, J., and HUNT, D.M., Post receptoral mechanisms of colour vision in New World primates

21. KREMERS, J. and LEE, B.B., Comparative retinal physiology in Anthropoids

22. YAMADA, E.S., SILVEIRA, L.C.L., MARSHAK, D.W., and CASAGRANDE, V.A., Morphology of P and M retinal ganglion cells of the bush baby Galago garnetti

23. GAMLIN, P., ZHANG, H., HARLOW, A., and BARBUR, J.L., Pupil responses to stimulus colour, structure and light flux increments in the rhesus monkey

Congenital colour vision deficiencies

24. BALDING, S.D., SJOBERG, S.A., NEITZ, J., and NEITZ, M., Pigment gene expression in protan colour vision defects

25. KAINZ, P.M., NEITZ, M., and NEITZ, J., Genetic detection of female carriers of protan defects

26. SHEVELL, S.K., HE, J.C., KAINZ, P.M., NEITZ, J., and NEITZ, M., Relating color discrimination to photopigment genes in deutan observers

27. CROGNALE, M.A., TELLER, D.Y., MOTULSKY, A.G., and DEEB, S.S., Severity of color vision defects: electroretinographic (ERG), molecular and behavioral studies

28. VERHULST, S. and MAES, F.W., Scotopic vision in colour-blinds

29. USUI, T., KREMERS, J., SHARPE, L.T., and ZRENNER, E., Flicker cone ERG in dichromats and trichromats

30. PARAMEI, G.V., BIMLER, D.L., and CAVONIUS, C.R., Effects of luminance on color perception of protanopes

31. SCHEIBNER, H. and CLEVELAND, S., Dichromacy characterised by chrominance planes

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32. MÄNTYJÄRVI, M. and TUPPURAINEN, K., Colour vision in gyrate atrophy

33. SIMUNOVIC, M., VOTRUBA, M., REGAN, B.C., and MOLLON, J.D., Colour discrimination ellipses in patients with dominant optic atrophy

34. BIRCH, J., KOLLE, R.U., KUNKEL, M., PAULUS, W., and UPADHYAY, P., Acquired colour deficiency in patients with Parkinson's Disease

35. REGAN, B.C., FREUDENTHALER, N., KOLLE, R.U., MOLLON, J.D., and PAULUS, W., Colour discrimination thresholds in Parkinson's Disease: results obtained with a rapid computer-controlled colour vision test

36. HUBSCHMAN, J.P., VOLA, J., CONRATH, J., BERROS, P., and HOUGRAND, F., The short-wavelength mechanisms of Stiles in age-related macular degeneration

37. SOMMERHALDER, J., BAGLIVO, E., PELLIZONE, M., ROTH, A., BARBEY, C., and HIRSCHEL, B., Colour vision in AIDS patients without HIV retinopathy

38. BARBUR, J., SAHRAIE, A., SIMMONS, A., WEISKRANTZ, L., and WILLIAMS, S.C.R., Residual processing of chromatic signals in the absence of a geniculostriate projection

39. D'ZMURA, M., KNOBLAUCH, K., HENAFF, M.-A., and MICHEL, F., Dependence of color on context in a case of cortical color vision deficiency

Colour tests and apparatus

40. OLIPHANT, D. and HOVIS, J., Comparison of the D-15 and City University (2nd edition) colour vision tests

41. ERB, C., ADLER, M., STÜBIGER, N., WOHLRAB, M., ZRENNER, E., THIEL, H. Color vision in normal subjects tested by the color arrangement test "Roth 28-hue desaturated".

42. DAIN, S.J., Skewness and transformations of Farnsworth-Munsell 100-Hue test scores

43. KNIGHT, R., BUCK, S.L., FOWLER, G.A., and NGUYEN, A., Rods affect S-cone discrimination on the Farnsworth-Munsell 100-hue test

44. COLE, B. and MADDOCKS, J.D., Can clinical colour vision tests be used to predict the results of the Farnsworth lantern test?

45. HOVIS, J. and OLIPHANT, D., Validity of the Holmes-Wright Lantern as a colour vision test for the rail industry

46. MORELAND, J.D., Interference filter calibration for vision research

47. ROBSON, A.G. and KULIKOWSKI, J.J., Objective specification of tritanopic confusion lines using visual evoked potentials

Next Symposium

The XVth meeting of the ICVS will be held in City of Göttingen, Germany from the 23rd. to the 27th. July 1999, beginning on the Friday lunchtime and finishing at noon on Tuesday. Göttingen is an old University town set in rolling countryside right in the middle of Germany. The University of Göttingen was famous as a center of physics for over a hundred years, and Gauss, Weber and many other eminent physicists worked there. But for the Society, the most interesting period was the latter half of the 18th. century, when several professors of physics were interested in color vision, and Thomas Young spent a year in Göttingen from 1795-1796; a special topic of the meeting will be the history of color science.

The meeting will be held at the Max Planck Institute for Biophysical Chemistry, set on a hill overlooking

the town. There will be a shuttle service for transport to and from central hotels, and a social program for accompanying persons. Reduced rate registration and student housing will be available for a limited number of student applicants.

Preliminary Program:

Invited Speakers:

Paul Martin, Sydney: The anatomy of color: the origins of the signals for chromatic vision.

Gordon Plant, London: Colour vision disorders in neurological disease.

P. Lanthony, Color vision and Art

Conference Symposium:

Color Constancy: Organiser: Steve Shevell.

Special Topics:

History of Color Science: Organiser: Barry Lee

Color defects in the Clinic: Organiser: Eberhardt Zrenner

Color Vision Testing: Organiser: Ken Knoblauch

Organisers:

Barry Lee, Walter Paulus, Joel Pokorny, Lukas Rüttiger,Vivianne Smith

For further information please contact:

Dr. B.B. Lee, Max Planck Institute for Biophysical Chemistry, 37077 Göttingen, Germany.

Membership dues

The membership list includes your membership status for 1997. If you have "No" in the column headed 1997 Status would you please send 1997 membership renewal to the Membership Secretary of Treasurer without delay and before someone might think of removing you from the list.

ICVS WEBNEWS

The web site address is now http://orlab.optom.unsw.edu.au/ICVS/ . The old address now contains only a pointer to the new address

The useful links page. If you have or know of useful colour and colour vision links to personal sites, organisational sites please let Stephen Dain know. The page has been started but is still in need of additions and embellishment

A frequently asked questions page. If you have a favourite question you keep being asked and/or an answer of which you are particularly proud please send them (preferably both) to Stephen Dain. We need the questions, the answers are helpful too.

COLOUR NEWS

New color web site

Tektronixs and Adobe have combined to produce a website on color which contains some useful production tips and well as some revolting colour combinations, particularly clickable fields in orange and backgrounds in khaki, the webmaster must be a deuteranope !

http://www.colorize.com

Viagra and colour vision

The folowing appeared on the USA Today website 5/5/98

Eye doctors want more studies on Viagra

SAN FRANCISCO - The world's largest organization of eye doctors called for more studies into the newly approved impotence drug, Viagra, and said users with some types of eye problems should stay away from higher doses.

A moderate percentage of people taking Viagra have experienced temporary vision problems, and the American Academy of Ophthalmology, meeting here this week, urged that people take the effects seriously.

"FDA clinical trials show that taking the medication, especially at higher doses, can cause some retinal dysfunction and affect the way we see for a number of hours," association spokesman Dr. Michael F. Marmor said Monday.

Patients reported visual disturbances described as a bluish color tinge and light sensitivity.

"On the surface, seeing the world with a bluish tinge may just be annoying," Marmor said in a statement.

Marmor, a professor of ophthalmology at Stanford University, said a clinical study showed that electrical measures of retinal function dropped by 30% to 50% and lasted for at least five hours after taking a high dose of Viagra.

"We need to do some studies about the long-term effects of taking Viagra," he said.

He suggested that users with retina problems such as macular degeneration or retinitis pigmentosa to "stay at

the lowest dose level possible." According to the FDA, the recommended dose level for most patients is 50 mg.

The American Academy of Ophthalmology has more than 23,000 members.

Representatives of the drug's developer, Pfizer Inc., did not immediately return calls left on an answering machine today.

By The Associated Press

MEMBERSHIP

A message from the Treasurer and Membership Secretary

Dear Member,

We are now requesting membership dues for 1998.

The conditions of payment are listed below. Please fill out the accompanying form, noting the appropriate method of payment, and return it to Lindsay T. Sharpe. Subscriptions are payable in German Deutschmark (DM) only. The basic fee for 1998 has been raised to 120 DM plus service charges (where applicable). This is roughly equivalent to AU$90, FRF405, GBP40, JPY7740 and US$67.

Please note that in order to receive the 1997 Proceedings volume from Ghent, you must have paid membership fees for both 1996 and 1997 (DM 100 a year) or you must have paid the membership fee for 1997 (DM 100) plus the volume supplement (DM 75).

Payment may be made by any of the following methods:

i) Bank transfer or international cheque (drawn on a German bank)

membership renewals	120 DM
new members	120 DM
student/retired	30 DM
Proceedings volume supplement	75 DM

ii) Eurocheque

membership renewals	120 DM
new members	120 DM
student/retired	30 DM
Proceedings volume supplement	75 DM

iii) Credit card (American Express or Mastercard/Eurocard or Visa)

	128

membership renewals	128 DM*
new members	128 DM*
student/retired	33 DM*
Proceedings volume supplement	80 DM*

* (includes card service fee)

We would appreciate an early response.

Thank you.

Anne Kurtenbach Lindsay T. Sharpe
(Membership Secretary) (Treasurer)

The International Colour Vision Society
(formerly known as The International Research Group for Colour Vision Deficiencies)

Memberships and Membership Renewals 1998

The full subscription is DM 120 for new members and renewing members or DM 30 for students and retired members (excluding credit card charges). Full members who are paid up for 1996 and 1997 are entitled automatically to the 1997 (Ghent) Proceedings. A supplementary fee of DM 75 ensures this entitlement for new members joining in 1997. All members receive the ICVS newsletter Daltoniana. Subscriptions, payable in Deutschmarks (DM) only, may be made by the following methods.

PLEASE SELECT THE APPROPRIATE SECTION

NAME: _____ (please print)

☐ I have arranged to transfer DM 195, DM 120 or DM 30 (cross out where not applicable), drawn on a German bank,
payable to Lindsay T. Sharpe (ICVS), Volksbank Tübingen, Bank Code 641 901 10, Account Number 53796 004.

Signature_____

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Signature_____

☐ I authorize the ICVS to charge my credit card account DM 208, DM 128 or DM 33 (cross out where not applicable).

☐ AMERICAN EXPRESS

☐ EUROCARD/MASTERCARD

☐ VISA

Card Number_____ Expiry Date_____

Signature_____ Date_____

PLEASE RETURN THIS FORM TO:

Lindsay T. Sharpe
Forschungsstelle für Experimentelle Ophthalmologie
Röntgenweg 11
D-72076 Tübingen
Germany

Fax: + 49 7071 295777

The International Colour Vision Society proceeding Volumes for 1991, 1993 & 1995

To stimulate sales of the Proceeding volumes, we are offering them to all ICVS members, including new, student and retired members, at a reduced price. The price per volume, including postage, is DM 100 by bank transfer or EUROcheque and DM 106 by credit card. Only limited numbers of the Sydney (1991) and Tübingen (1993) Proceedings are available.

PLEASE FILL IN THE APPROPRIATE SECTIONS

☐ I have arranged to transfer DM _____ , drawn on a German bank, payable to Lindsay T. Sharpe (ICVS), Volksbank Tübingen, Bank Code 641 901 10, Account Number 53796 004.

Signature_____

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☐ AMERICAN EXPRESS

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Card Number_____ Expiry Date_____

Signature_____ Date_____

PLEASE RETURN THIS FORM TO:

Lindsay T. Sharpe
Forschungsstelle für Experimentelle Ophthalmologie
Röntgenweg 11
D-72076 Tübingen
Germany

Fax: + 49 7071 295777

Membership List and request for email addresses

The mailed version of Daltoniana September 1997 had a list of members attached. This was not been made accessible from the web to minimise the possibility of inappropriate use. It is available to committee members only as a password protected file.
Please send email addresses for inclusion in the Membership List to any of

General Secretary	Ken Knoblauch
Treasurer	Ted Sharpe
Membership Secretary	Anne Kurtenbach
Daltoniana Editor	Stephen Dain

You could also include a personal website, if you have one, and we could start a list of those.

Vale

Dorothea Jameson died unexpectedly on Easter Sunday, 12th April 1998 at the age of 77.
A full obituary will appear in the next Daltoniana.

Book announcement

NEW FROM ELSEVIER SCIENCE

**Color for Science, Art and Technology, edited by K. Nassau,
AZimuth Volume 1**

"Color for Science, Art and Technology" is the first in a new series of interdisciplinary books on topics that cut across the boundaries of today's established scientific disciplines.

Under the editorship of K. Nassau, this book is a comprehensive assembly of information on the basics of color. But it goes way beyond that. Color measurement experts, as well as general readers and artists will

find useful information on the perception, causes and uses of color.

The book covers not only the fundamentals but research on the frontiers of color. For example, there is news on a new approach to testing for the biological and therapeutic effects of color, and information on the encoding of color in a photo compact disk system with its surprising complexity.

You get new information on:
- the still unresolved complexities of color measurement (chapter 2)
- why many of the fine details of color vision remain unknown (chapter 3)
- the new movements in art that find original ways to use the pigments and dyes that continue to be discovered (chapter 5)
- the problems of trying to crystallize the philosophical approach to color (chapter 7)
- and much more.

Bibliographic details: 1998 510 pages Hardbound Price: NLG 230.00 / US$ 132.00 ISBN 0-444-89846-8

For a detailed description and full contents, go to our website at: www.elsevier.nl

or send an e-mail to: nlinfo-f@elsevier.nl

Details supplied by Elsevier. Review planned for next edition of Daltoniana.

Farnsworth Lantern Production

It appears probable that a production run of the FaLant will occur later this year. At this stage I have asked permission to put an announcement in Daltoniana but have had no reply. Interested parties could contact Stephen Dain in the meantime.

Abstracts of colour vision papers. Compiled by Joel Pokorny

Hirose H. Terasaki H. Awaya S.

[Aging of the blue mechanism studied by measuring the increment threshold on flashed background]. [Japanese]

Nippon Ganka Gakkai Zasshi - Acta Societatis Ophthalmologicae Japonicae. 101:237-242, 1997

Abstract: We studied aging of the blue cone mechanism by measuring increment thresholds for detection of a small blue flash of light(439 nm, 1 degree, 50 ms duration) on a second flashed light of identical color, (439 nm, 2 degrees, 500 ms duration) in 30 subjects. Simultaneously, a large yellow adapting field was presented. Subjects, consisting of 17 normal cases, 13 cases with refraction errors under 3 diopters, 11 myopes, and 2 hyperopes, with 1. 0 or better corrected visual acuity, were divided into 4 groups by age. The control group consisted of 11 cases under 30 years, group I, 7 cases in their forties, group II, 6 cases in their fifties, and group III, 6 cases over 60 years. Best fitting exponential curves were calculated for this phase of the blue mechanism and averaged threshold curves for each group were evaluated. The averaged threshold curve in group I showed an upper shift, that is, an increase in the threshold alone. Curves in groups II and

III demonstrated an upper right shift, with increased thresholds in both the blue flash and the yellow background. Together with decreased function of the blue cone mechanism, the shift of curves in the elderly groups is probably caused largely by yellowing of the crystalline lens.

Latanov AV. Leonova AIu. Evtikhin DV. Sokolov EN.

[The comparative neurobiology of human and animal color vision]. [Russian]

Zhurnal Vysshei Nervnoi Deiatelnosti Imeni I. P. Pavlova. 47:308-19, 1997

Abstract: Discrimination of colours was studied using instrumental learning paradigm in monkeys (Macaque rhesus) and fishes (Carpio Cyprinus L.). The confusion matrices composed of probabilities of instrumental responses were treated by factor analysis. The spherical structure of perceptual colour space revealed in both animals was close to one in humans. Four eigenvectors constituting four-dimensional Euclidean hyperspheres correspond to red-green, blue-yellow, bright and dark neuronal channels.

Schellart NA. Pollen M. van der Kley A.

Effect of dysoxia and moderate air-hyperbarism on red-green color sensitivity.

Undersea & Hyperbaric Medicine. 24:7-13, 1997.

Abstract: The effect of acute air-hyperbarism (maximal 520 kPa), normobaric low and high FIO2 levels (minimal 0. 1, maximal 1. 0)and hyperbaric oxygen (HBO2) on the red-green sensitivity ratio(rgSR) and on color discrimination for foveal vision were studied. Effects were quantified by measuring the red-green flicker (16Hz) fusion point for normals with the Oscar tester (Am J Optom Physiol Opt 1983; 60:892-901). Color discrimination was examined with the Lanthony's Desaturated 15 Hue test After 15-20 min of exposure rgSR is enhanced 4% (relatively increased red sensitivity)by normobaric acute hypoxia, and reduced 4% by normobaric hyperoxia(FIO2 = 1. 0), but HBO2 gives a smaller reduction, and air-hyperbarism(FIO2 = 0. 21) has no effect. Hypercapnia (increased FICO2), normobaric hypoxia (reduced FIO2), and HBO2 increase the duration of the Lanthony's test about 20-40%, but the number of errors were practically unchanged. The reduced effect during HBO2 upon rgSR is attributed to an opposing effect of hypercapnia. The absence of an effect during air-hyperbarism is probably due to a suppression by nitrogen of the effect of high PO2. In general, during moderate air-hyperbarism and HBO2 color vision seems to be normal, but evaluation of the colored scene is probably less stable and slightly slower.

Aroichane M. Pieramici DJ. Miller NR. Vitale S.

A comparative study of Hardy-Rand-Rittler and Ishihara colour plates for the diagnosis of non glaucomatous optic neuropathy.

Canadian Journal of Ophthalmology. 31:350-355, 1996

Abstract: OBJECTIVE: To determine the ability of the Hardy-Rand-Rittler(HRR) and Ishihara colour plates to detect acquired colour vision defects in patients with non glaucomatous optic neuropathy (NGON). DESIGN: Prospective study. SETTING: Neuro-Ophthalmology Unit of the Wilmer Eye Institute, Baltimore. PATIENTS: A total of 178 consecutive patients (349 eyes) referred to the Neuro-Ophthalmology Unit and the General Eye Service of the Wilmer Eye Institute and examined by two of the authors were enrolled from

July 1992 to June 1993. OUTCOME MEASURES: Results of testing with HRR and Ishihara plates. RESULTS: Among the 202 eyes that were found to have no ocular disease on neuro-ophthalmologic testing, the HRR plates gave a normal result in 168 (83. 2%), compared with 196 (97. 0%)with the Ishihara plates ($p < 0.0001$). The HRR plates detected an acquired colour vision deficit in 48 (87. 3%) of the 55 eyes with NGON, compared with 38 (69. 1%) for Ishihara plates ($p = 0.001$). The values for the eyes with NGON with a visual acuity of 20/25 or better were 76. 5% (13/17) and 35. 3% (6/17) respectively ($p= 0.008$) and with a visual acuity less than 20/25, 92. 1% (35/38)and 84. 2% (32/38) respectively. CONCLUSIONS: For patients with unilateral or bilateral NGON, HRR plates are more likely than Ishihara plates to detect a colour vision defect, particularly when the visual acuity is 20/25 or better. However, neither testis sensitive enough to be used as the sole criterion for the diagnosis of NGON. The results of comparison of colour perception of the two eyes may be more useful than absolute colour vision responses, particularly in patients with unilateral disease.

Kelly JP. Fourman SM. Jindra LF.

Foveal color and luminance sensitivity losses in glaucoma.

Ophthalmic Surgery and Lasers. 27:179-87, 1996

Abstract: BACKGROUND AND OBJECTIVE: Losses in color vision sensitivity are noted in patients with glaucoma and these losses can occur before the onset of visual field defects in ocular hypertensive patients. The authors incorporate a technique that measures foveal luminance and isoluminant-color thresholds. PATIENTS AND METHODS: This study included 31 patients with glaucoma, 10 patients suspected of having glaucoma, and 67 control subjects. The testing conditions measured thresholds under identical spatial and temporal conditions. Individual differences in luminosity between colors were controlled by presenting 16 different ratios of the three phosphors on a color monitor. RESULTS: Relative to the control subjects, the patients with glaucoma showed a nonselective defect in both color and luminance sensitivity for red-green stimuli ($P < .05$), butt selective color defect for yellow-blue stimuli ($P < .01$). There were no statistically significant differences between patients suspected of having glaucoma and control subjects ($P > 0.3$). CONCLUSION: If the isoluminant-color stimuli are detected by foveal P-ganglion cells, then these results suggest that glaucoma leads to a generalized decrease in P-ganglion cell sensitivity that is more pronounced for cells with an input from cones sensitive to short wavelengths.

Dean FM. Arden GB. Dornhorst A.

Partial reversal of protan and tritan colour defects with inhaled oxygen in insulin dependent diabetic subjects.

British Journal of Ophthalmology. 81:27-30, 1997

Abstract: AIMS: Abnormalities in colour perception occur early in the development of diabetic retinopathy. Whether these change scan be influenced by increasing circulating oxygen saturation was studied in comparison with non-diabetic controls. METHODS: Protan and tritan colour thresholds were measured using a computer graphics system in 37 insulin dependent diabetic subjects, with no or minimal background retinopathy, and 27 matched controls. Colour thresholds were performed after subjects inhaled either gaseous air or 100% oxygen for a minimum of 5 minutes. RESULTS: Diabetic subjects had higher colour vision thresholds when inhaling air when compared with controls (protan (mean 3. 93 (SEM 0. 39), v 2. 36 (0. 16), $p < 0.0002$) and tritan (8. 15 (0. 62) v 5. 42 (0. 31), $p < 0.002$)). The colour vision thresholds

observed in diabetic subjects inhaling air fell when they inhaled oxygen (protan (3. 93(0. 39) v 3. 57 (0. 33), p < 0. 025) and tritan (8. 15 (0. 62) v 7. 35(0. 59), p < 0. 005)). No fall in colour thresholds was seen in non-diabetic controls who inhaled oxygen. CONCLUSION: A small improvement in the colour vision thresholds was observed using computer graphics in diabetic subjects, with minimal or no retinopathy, who inhaled oxygen. This study supports a hypothesis that reduced retinal oxygenation contributes to the colour vision defects in diabetes.

Moutoussis K. Zeki S.

A direct demonstration of perceptual asynchrony in vision.

Proceedings of the Royal Society of London - Series B: Biological Sciences. 264:393-399, 1997

Abstract: We have addressed the question of whether, in addition to being processed separately, colour and motion are also perceived separately. We varied continuously the colour and direction of motion of an Abstract: pattern of squares on a computer screen, and asked subjects to pair the colour of the pattern to its direction of motion. The results showed that subjects misbind the colour and the direction of motion because colour and motion are perceived separately and at different times, colour being perceived first. Hence the brain binds visual attributes that are perceived together, rather than ones that occur together in real time.

Long GM. Tuck JP.

Closure and acuity in pseudoisochromatic color tests.

Perceptual & Motor Skills. 84:81-82, 1997

Abstract: While visual acuity was related to performance on several pseudoisochromatic color tests for 73 male college students, no evidence was found that perceptual closure also affected performance. No scores were correlated for the 69 undergraduate women.

Allan LG. Siegel S.

Contingent color after effects: reassessing old conclusions.

Perception & Psychophysics. 59:129-141, 1997

Abstract: Although there is considerable evidence supporting an associative interpretation of contingent color after effects, there are data that appear inconsistent with this interpretation. New findings from seven experiments are presented indicating that, contrary to earlier claims, contingent color after effects are observed after induction with (1) single orthogonal black bars on colored backgrounds, (2) geometric forms, and (3) two orthogonal grids of the same color. The results of these experiments are relevant to an associative interpretation of contingent color after effects, as well as to assessing alternative interpretations of the phenomenon.

Moller P. Hurlbert A.

Interactions between colour and motion in image segmentation.

Current Biology. 7:105-111, 1997

Abstract: BACKGROUND:. An important early stage in visual processing is image segmentation, in which similar regions are grouped together and segregated from dissimilar regions, so that distinct objects ultimately may be located and recognized. In the natural world, objects are simultaneously characterized by colour, motion, texture and other visual attributes. How does the human visual system combine these attributes to segment the image? Although colour and motion information are conveyed by distinct functional streams from retina to visual cortex, there is increasing evidence for early and substantial cross-talk between the streams. Here, we explore psychophysical evidence for interactions between colour and motion in image segmentation. RESULTS:. Observers performed forced-choice segmentation tasks on random-dot stimuli. The dots in the vertical target figure were distinguished from the background dots by a different distribution of speeds or colours. To explore interactions between motion and colour segmentation, we added motion noise to the colour signal (or vice versa) by assigning all dots speeds (or colours) drawn from one of several noise distributions. Motion noise severely affects segmentation by colour. Motion noise defined by a broad distribution of speeds degrades colour segmentation, but a two-speed motion distribution (half moving up, half moving down) facilitates colour segmentation. Control experiments prove that the facilitatory effect is not caused by integrating colour information over different frames, nor can it be explained by probability summation over the two planes of moving dots. Colour noise also affects motion segmentation, but under a more restricted range of conditions, and not in a facilitatory way. CONCLUSIONS:. Colour and motion information interact at early stages during image segmentation, before decisions based on either cue in isolation are made. The robust bipolar effects of motion information on segmentation by colour indicate that the establishment of motion-defined surfaces takes primacy, and that such surfaces constitute important primitives for further processing.

Nijhawan R.

Visual decomposition of colour through motion extrapolation.

Nature. 386:66-69, 1997

Abstract: The perception of yellow has played a central role in distinguishing two main theories of colour vision. Hering proposed that yellow results from the activation of a distinct retinal-neural mechanism, whereas according to the Young-Helmholtz-Maxwell view, yellow results from the combined activation of red and green cone mechanisms. When red and green images are presented separately to corresponding retinal locations in the two eyes, the resulting sensation is yellow. As the pathways from the two eyes do not converge until the cortex, this suggests that yellow can indeed arise from the central combining of separate red and green channels. I now show that the reverse process can also occur; the visual system can decompose a 'yellow' stimulus into its constituent red and green components. A 'yellow' stimulus was created by optically superimposing a flashed red line onto a moving green bar. If the bar is visible only briefly, the flashed line appears yellow. If the trajectory of the green bar is exposed for sufficient time, however, the line is incorrectly perceived to trail the bar, and appears red. Motion processing occurs in the cortex rather than the retina in primates, and so the ability of motion cues to affect the perception of colour is consistent with the Young-Helmholtz-Maxwell notion of a 'central synthesis' of yellow.

Nuzzi R. Bellan A. Boles-Carenini B.

Glaucoma, lighting and color vision. An investigation into their interrelationship.

Ophthalmologica. 211:25-31, 1997

Abstract: The results of a study on color vision capacity performed with a view to further analyzing glaucomatous dyschromatopsia are reported. The Farnsworth-Munsell 100-hue test was used in a population of 52 subjects (104 eyes) with daylight fluorescent lighting and low-tension halogen lighting. Photocolorimetric observations with each type of lighting were made. It was found that halogen lighting increased the glaucomatous subjects' mean score, the number of dyschromatopsia and the number of blue-yellow dyschromatopsia axes. The authors conclude that halogen lighting is preferable for the Farnsworth-Munsell 100-hue test in glaucoma and confirm the predominance of blue-yellow dyschromatopsia axes in glaucoma.

Ionica V. Gastaud P.

[Color vision test for detection and evaluation of dyschromatopsia]. [French]

Journal Francais d Ophtalmologie. 19:679-688, 1996

Abstract: METHODS: The color vision test for diagnosis and evaluation of the dyschromatopsias consists of a set of 92 colored test charts of the pseudochromatic type, a lamp and a test report giving agraphic image of the sensitivity to color deficiency. RESULTS: The test makes it possible to identify each neutral zone of all types of dyschromatopsia, places the neutral zone within the color spectrum and establishes its extent according to 6 axes (Protan, Deutan, Tritan, Tetartan, Scotopic and Monochromatic) and 10 levels. The visual sensitivity to color is measured on a 10 point scale, just as visual acuity is. Between a normal sensitivity to color, which is marked 1, and an anopia (i. e complete lack of visual sensitivity to color along one axis), marked 0, there are 9 intermediary levels marked 0. 9; 0. 8: 0. 7; 0. 6: 0. 5; 0. 4; 0. 3; 0. 2 and 0. 1. CONCLUSION: Testing is important for all kinds of eye diseases or common diseases which affect eyesight making possible not only early diagnosis of a disease but also treatment follow-up.

Mertens HW. Milburn NJ.

Performance of color-dependent air traffic control tasks as a function of color vision deficiency.

Aviation Space & Environmental Medicine. 67:919-927, 1996

Abstract: BACKGROUND: This experiment was conducted to validate the requirement for normal color vision in Air Traffic Control Specialist (ATCS) personnel who work at en route center, terminal, and Flight Service Station (FSS) facilities. METHODS: A data base was developed involving 121 individuals with normal color vision, 31 simple and 44 extreme anomalous trichromats, and 48 dichromats; both protans and deutans were included. The performance of subjects with normal color vision was compared with the performance of individuals with various classifications of color vision deficiencies on a battery of color-dependent ATCS tasks. Simulations of the ATC color tasks concerned color coding in flight progress strips(at en route centers), aircraft lights and Aviation Signal Light indicator (in tower operations), and color weather radar (at FSS's). RESULTS: Errors were rare among normal trichromats. Mean errors were significantly higher at every level (degree) of color vision deficiency. Approximately 6% of color deficient subjects were able to perform ATC color tasks without error. The 6% were all from the simple anomalous trichromat category; all extreme anomalous trichromats and dichromats were prone to error on ATC tasks. CONCLUSIONS: We conclude that these findings provide support for the requirement of normal color vision in the initial medical screening of ATCS personnel.

Stoilova D. Child A. Desai SP. Sarfarazi M.

Refinement of the locus for autosomal dominant juvenile optic atrophy to a 2 cM region on 3q28.

Ophthalmic Genetics. 18:1-6, 1997

Abstract: Juvenile optic atrophy (Kjer type; OPA1) is an autosomal dominant trait with an insidious onset in the first decade of life. The condition is characterized by a progressive loss of visual acuity that usually occurs with severe defects in color vision and visual fields. Genetic linkage analysis of a number of families has already assigned the OPA1 locus to the 3q28-qter region, within an estimated region of about 8 cM that is flanked by D3S1601 and D3S1265. Our study of a four-generation English family also supported tight linkage between the OPA1 locus and a group of DNA markers from the reported region. Of the 13 markers genotyped in this family, D3S2305 provided the maximum LOD score of 3. 91 at theta = 0. 00. Inspection of the haplotype transmission in this family identified critical recombinant individuals that refined the location of the OPA1 locus to an estimated region of about 2cM that is flanked by two DNA markers of D3S1601 andD3S2748. This refinement should facilitate the molecular cloning of the OPA1 gene and the determination of its defective product.

Jonasdottir A. Eiberg H. Kjer B. Kjer P. Rosenberg T.

Refinement of the dominant optic atrophy locus (OPA1) toa 1. 4-cM interval on chromosome 3q28-3q29, within a 3-Mb YAC contig.

Human Genetics. 99:115-120, 1997

Abstract: Dominant optic atrophy, type Kjer, is an autosomal dominant eye disease that is characterized by progressive optic atrophy with onset in early childhood, decrease of visual acuity, colour vision defects and centrocecal scotoma. By examination of 5 Danish families and the use of polymorphic markers, we have refined the localization of the OPA1 locus and assigned it to a 1. 4-cM interval on chromosome 3q28-3q29, between markers D3S3669 and D3S3562. This localizes the gene on a 3-Mb YAC contig covering the disease locus. We have also located a possible candidate gene HRY to this contig.

Brown J Jr. Fingert JH. Taylor CM. Lake M. Sheffield VC. Stone EM.

Clinical and genetic analysis of a family affected with dominant optic atrophy (OPA1).

Archives of Ophthalmology. 115:95-99, 1997

Abstract: OBJECTIVES: To refine the dominant optic atrophy locus, OPA1, on chromosome 3q and to characterize the phenotype of a6-generation family pedigree affected with this disease. METHODS: Fifty-six family members had a complete eye examination. Clinical records of an additional 3 patients were reviewed. Goldmann perimetry and a 21-chip subtest of the Farnsworth-Munsell 100-Hue test were performed on selected patients. Affected patients, unaffected siblings, and potentially informative spouses were genotyped with short tandem repeat polymorphisms located on chromosome 3. The genotypic data were subjected to linkage analysis. RESULTS: Thirty-four family members were found to be clinically affected. Most experienced vision loss (20/40 or poorer) in the first decade of life. Most(9 of the 16 eyes) progressed to 20/800 or poorer visual acuity by age 60 years, while 2 patients maintained visual acuities of 20/40 at that age. Affected patients had a 2- to 10-fold increase in the error score of a 21-chip subtest of the Farnsworth-Munsell100-Hue test compared with age-matched unaffected family members. The optic nerve examination revealed temporal pallor and excavation in all affected individuals. Linkage analysis revealed

significant lod scores with 9 markers. The highest lod score, 10. 1 (u = 0), was obtained with marker D3S2305. Analysis of recombinants narrowed the disease interval to approximately 3. 8 centimorgans, flanked by D3S3669 (centromeric) and D3S1305 (telomeric). CONCLUSIONS: Most patients affected with dominant optic atrophy in this family progressed to legal blindness by middle age. Color vision testing is a sensitive method for detection of affected patients. The dominant optic atrophy locus, OPA1, has been refined by the identification of new flanking markers: D3S3669 (centromeric) and D3S1305 (telomeric).

Johnston RL. Burdon MA. Spalton DJ. Bryant SP. Behnam JT. Seller MJ.

Dominant optic atrophy, Kjer type. Linkage analysis and clinical features in a large British pedigree.

Archives of Ophthalmology. 115:100-103, 1997

Abstract: OBJECTIVES: To perform DNA linkage studies in an extensive 5-generation British pedigree with dominant optic atrophy and to validate the efficacy of domiciliary screening for affected members. METHODS: Family members received a domiciliary examination based on corrected visual acuity, color vision, visual field defects, and optic disc appearance; DNA linkage analysis was performed using 7 microsatellite markers on 3q27-qter. RESULTS: Based on the results of the ophthalmic examination, 15 members could be classified as definitely affected, 1 probably affected, and 25 unaffected. Two-point linkage analysis gave significant maximum lod scores at u = 0. 00, with the markers D3S3669, D3S3590, and D3S3642. A haplotype segregating with the disease was identified in affected individuals, including the probably affected subject. Informative meioses defined the disease interval between markers D3S1601 and D3S1265. CONCLUSIONS: Domiciliary screening was effective in identifying all 16 affected members of a British family with dominant optic atrophy. The typical clinical features were present. The location of the OPA1 gene in this new British family seems to be in the 3q27-28 region and is the same as that reported in Danish, Cuban, and French families, suggesting no genetic heterogeneity in this disorder.