

Documenta Ophthalmologica Proceedings Series

VOLUME 59

The titles published in this series are listed at the end of this volume.

Colour Vision Deficiencies XIII

Proceedings of the thirteenth Symposium
of the International Research Group on
Colour Vision Deficiencies, held in
Pau, France
July 27–30, 1995

Edited by
C.R. Cavonius

with associate editors:
A.J. Adams, J. Birch, S.J. Dain, J.D. Mollon,
J.D. Moreland, J. Pokorny, V. Smith,
H.G. Sperling, E. Zrenner



Kluwer Academic Publishers
Dordrecht / Boston / London

Library of Congress Cataloging-in-Publication Data is available.

ISBN 0-7923-4224-0

Published by Kluwer Academic Publishers BV,
PO Box 17, 3300 AA Dordrecht, The Netherlands

Kluwer Academic Publishers BV incorporates
the publishing programmes of
D. Reidel, Martinus Nijhoff, Dr W. Junk and MTP Press.

Sold and distributed in the United States and Canada
by Kluwer Academic Publishers, PO Box 358,
Accord Station, Hingham, MA 02018-0358, USA

In all other countries, sold and distributed
by Kluwer Academic Publishers Group, Distribution Center,
PO Box 322, 3300 AH Dordrecht, The Netherlands

Printed on acid-free paper

All Rights Reserved

© 1997 Kluwer Academic Publishers

No part of this publication may be reproduced or utilized in any form or by any means, electronic, mechanical, including photocopying, recording or by any information storage and retrieval system, without written permission from the copyright owner.

Printed and bound in Great Britain by Hartnolls Ltd., Bodmin, Cornwall.

Contents

Preface	xi
---------	----

PART ONE: INTRAINDIVIDUAL DIFFERENCES: GENOTYPES AND PHENOTYPES

1. J.D. Mollon (<i>Cambridge, UK</i>): ‘... aus dreierley Arten von Membranen oder Molekülen’: George Palmer’s legacy	3
2. T. Yamaguchi, A.G. Motulsky and S.S. Deeb (<i>Seattle, WA, USA</i>): Levels of expression of the red, green and green–red hybrid pigment genes in the human retina	21
3. M. Neitz and J. Neitz (<i>Milwaukee, WI, USA</i>): Variety of photopigment genes underlying red–green colour vision	33
4. S.K. Shevell and J.C. He (<i>Chicago, IL, USA</i>): Phenotypes of anomalous trichromacy	45
5. S.A. Hagstrom, J. Neitz and M. Neitz (<i>Milwaukee, WI, USA</i>): Ratio of M/L pigment gene expression decreases with retinal eccentricity	59
6. G. Jordan and J.D. Mollon (<i>Cambridge, UK</i>): Unique hues in heterozygotes for protan and deutan deficiencies	67
7. W.H. Swanson and M. Fiedelman (<i>Dallas, TX, USA</i>): Sensitivity and spectral tuning of the red–green chromatic pathway in heterozygous carriers of congenital colour vision defect	77
8. J. Kremers, S. Weiss, E. Zrenner and J. Maurer (<i>Tübingen, Germany</i>): Rod and cone inputs to parvo- and magnocellular cells in the dichromatic common marmoset (<i>Callithrix jacchus</i>)	87
9. S. Tanabe and K. Hukami (<i>Nagoya, Japan</i>): Results of clinical colour vision tests of ‘Pigmentfarbenanomalie’	99

PART TWO: STRUCTURE AND FUNCTION IN COLOUR VISION

10. B.B. Lee and D.M. Dacey (*Göttingen, Germany; Seattle, WA, USA*): Structure and function in primate retina 107
11. P.K. Ahnelt, P. Röhlich and J.N. Hokoç (*Vienna, Austria; Budapest, Hungary; Rio de Janeiro, Brazil*): Four cone subtypes in a primitive mammal, the South American opossum – immunocytochemical characterization 119
12. S.L. Buck and M. Ayers (*Seattle, WA, USA*): Physical and sensory analysis of successive scotopic colour contrast 127
13. H.G. Sperling (*Houston, TX, USA*): Visual colour processing is completed in the retina 135
14. J.J. Kulikowski, A.G. Robson and D.J. McKeefry (*Manchester, UK*): Selective stimulation of colour vision in humans 141
15. H. Reitsamer, R. Pflug, P. Röhlich and P. Ahnelt (*Vienna, Austria; Budapest, Hungary*): Topographic differences of spectral sensitivity in rabbit retina. Evidence from small-field ERG and immunohistochemistry 151

PART THREE: ACQUIRED COLOUR VISION DEFICIENCIES

16. M. Mäntyjärvi and K. Tuppurainen (*Kuopio, Finland*): Colour vision in a family with butterfly-shaped pigment dystrophy of the fovea 159
17. M. Fossarello, I. Zucca, C. Bertini, M. Pirastu, M.S. Galantuomo, G.M. Contu and A. Serra (*Cagliari and Tramariglio, Italy*): Colour vision deficiencies in two unrelated Sardinian families with butterfly-shaped macular dystrophy 169
18. M.E. Schneck, E. Lee, B. Fortune, E.W. Switkes, M. Crognale and A.J. Adams (*Berkeley, CA and Santa Cruz, CA, USA*): Spatiochromatic VEPs in recovered optic neuritis and multiple sclerosis 179
19. W. Paulus, G. Schwarz and B.J. Steinhoff (*Göttingen, Germany*): The effect of carbamazepine, phenytoin and valproic acid anti-epileptic convulsive drugs on visual perception 187

20. A. Pinckers and M.A.D. Tilanus (*Nijmegen, The Netherlands*): Colour vision in macular gliosis, cysts, holes and oedema: An approach to depth localization 193
21. A. Kurtenbach, U. Schiefer, E. Zrenner and A. Neu (*Tübingen, Germany*): Juvenile diabetics and the colour vision meter 205
22. J.L. Barbur, V.A. Cole and G.T. Plant (*London, UK*): Chromatic discrimination in subjects with both congenital and acquired colour vision deficiencies 211
23. J. Birch (*London, UK*): Acquired tritanopia in diabetic maculopathy 225
24. J. Leid, J. Plantey and V. Leid (*Pau, France*): A protocol for monitoring treatment with synthetic anti-malarial drugs 231
25. A. Serra, I. Zucca, A. Tanda, V. Piras, S. Mulas, C.M. Dessy and M. Fossarello (*Cagliari, Italy*): Visual function in patients affected by multiple sclerosis: visual field and colour vision 239

PART FOUR: CONGENITAL COLOUR DEFICIENCIES

26. H. Scheibner and A. Orazem (*Düsseldorf, Germany*): Features of foveal dichromacy illustrated by deuteranopia 245
27. B.C. Regan and J.D. Mollon (*Cambridge, UK*): The relative salience of the cardinal axes of colour space in normal and anomalous trichromats 261
28. K. Knoblauch, F. Vital-Durand and J.L. Barbur (*St Etienne, France, Bron, France and London, UK*): Age-matched comparisons of chromatic thresholds between normal and strabismic observers 271
29. M.L. Bieber, K. Knoblauch and J.S. Werner (*Boulder, CO, USA and Bron, France*): Detecting colour vision deficiency in 4- and 8-week-old human infants 277
30. L. Vajoczki and P.L. Pease (*Houston, TX, U.S.A*): Cone monochromacy: A case report 283
31. J.D. Moreland and C. Bradshaw (*Keele, UK*): A new phenotype? Nagel 'dichromats' who reject 'red matches green' for a 2° field 291

PART FIVE: PLATE TESTS, ARRANGEMENT TESTS,
AND AUTOMATED TESTS

32. J. Sommerhalder, M. Pelizzone, J.D. Moreland and A. Roth (*Geneva, Switzerland; Keele, UK*): Influence of stimulus luminance on automated Moreland matches 299
33. J. Birch (*London, UK*): The clinical use of saturated and unsaturated Munsell panel tests 307
34. M.V. Danilova and J.D. Mollon (*St. Petersburg, Russia; Cambridge, UK*): The pseudoisochromatic plates of E. N. Yustova 313
35. C. Erb, M. Adler, N. Stübiger, M. Wohlrab and H.-J. Thiel (*Tübingen, Germany*): Evaluation of the desaturated Roth 28 HUE colour test – preliminary results 323
36. J. Leid, J. Poletti and Y. Souleymanou (*Pau and Tarbes, France*): Evaluation of Yu's Chinese pseudoisochromatic plates for acquired dyschromatopsia 331
37. F. Viénot, A. Ben M'Barek and L. Ott (*Paris, France*): Screening colour vision with an LMS calibrated display 339
38. Ch. Nimsgern, H. Lang, G.U. Auffart and H. Krastel (*Heidelberg and Darmstadt, Germany*): Coldef and tritan flicker test: PC-based evaluation of central and peripheral colour vision 351

PART SIX: GENERAL CONSIDERATIONS
IN TESTING COLOUR VISION

39. J.D. Moreland and E.C. Alexander (*Keele, UK*): Effect of macular pigment on colour matching with field sizes in the 1° to 10° range 363
40. A. Watanabe, V.C. Smith and J. Pokorny (*Chicago, IL, USA*): Psychometric functions for chromatic discriminations 369
41. A.J. Vingrys and A.B. Metha (*Melbourne, Australia*): Psychometric functions in the central visual field 377
42. G. Jordan and J.D. Mollon (*Cambridge, UK*): Sons and mothers: Classification of colour-deficient and heterozygous subjects by counterphase modulation photometry 385

43. P. Lanthony and M. Goberville (*Paris, France*): Influence of lightness (Munsell value) on desaturated Panel D15 393
44. J.D. Moreland and E.C. Alexander (*Keele, UK*): Temperature and Rayleigh matching on Moreland's anomaloscope 397
45. S. Pefferkorn, A. Chiron and F. Viénot (*Paris, France*): Effect of longitudinal chromatic aberration on photometric matches using a heterochromatic square-wave grating 403
46. M.S. Roy, P. Gouras and C. MacKay (*Newark, NJ, and New York, NY, USA*): Detecting blue-cone monochromats by electroretinography 409
47. V. Bonnardel, D.L. Ruderman and H.B. Barlow (*Cambridge, UK*): Fast determination of the spectral modulation sensitivity function: a comparison between trichromats and deuteranopes 415
48. L. Rüttiger, A. Kurtenbach and E. Zrenner (*Tübingen, Germany*): Colour discrimination in a monoptic and dichoptic task 425
49. A.J. Vingrys and L.E. Mahon (*Melbourne, Australia*): Optimal step sizes for colour and luminance staircasing 431
50. J.L. Barbur, J.A. Harlow and C. Williams (*London, UK*): Light scattered in the eye and its effect on the measurement of the colour constancy index 439

PART SEVEN: INTERACTIONS AMONG SYSTEMS
AND APPLIED PROBLEMS

51. S.L. Buck, E. Sanocki and R. Knight (*Seattle, WA, USA*): Do rod signals add with S cone signals in increment detection? 451
52. J. Le Rohellec and F. Viénot (*Paris, France*): Distant colour induction on Fechner–Benham top 459
53. T.E. Frumkes, E. Lembessis, J. Vollaro, D. Moshe and T. Eysteinnsson (*Flushing, NY, USA; Reykjavik, Iceland*): Influence of rod adaptation upon chromatic and achromatic cone-vision 465
54. B.L. Cole and J.D. Maddocks (*Melbourne, Australia*): Defective colour vision is a risk factor in driving 471

55. J.A.B. Spalding (<i>Weybridge, UK</i>): Doctors with inherited colour vision deficiency: their difficulties in clinical work	483
--	-----

THE VERRIEST LECTURE

56. J. Pokorny and V.C. Smith (<i>Chicago, IL, USA</i>): How much light reaches the retina?	491
---	-----

Author Index	513
--------------	-----