

DALTONIANA

NEWSLETTER

OF THE INTERNATIONAL RESEARCH GROUP ON COLOUR VISION DEFICIENCIES

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LITERATURE SURVEY

The biophysical process of colour vision (Le processus biophysique de la vision des couleurs), by R. CROUZY (Lab. Muséum nat. Hist. nat., Paris, France), Lux (Paris) 82, 2-8, 1975.

A very clear survey of the fundamental facts, theories and recent advances in the knowledge of normal human colour vision. - Guy Verriest.

Proximity factor in color-difference evaluations, by L.T. SHARPE and G. WYSZECKI (Department of Psychology, University of British Columbia, Vancouver 8, Canada and National Research Council, Ottawa, Canada K1A 0R6) J. opt. Soc. Amer. 66/1, 40-49, 1976.

The effects of dividing-strip width (sample proximity) upon sensitivity to suprathreshold and threshold color differences is explored by three methods that involve (1) equating suprathreshold color differences (2) deriving difference limens by the method of constant stimulus differences and (3) determining color-matching ellipsoids. In the experiments, carried out on normal trichromats, a NRC 7-field colorimeter was used with colors based on the Munsell color order system. The results suggest, in general, that sample separation impairs lightness discrimination more than chromaticness discrimination and that it may be necessary to introduce a proximity factor in color-difference formulas when evaluating threshold or small-size color differences. However, more experiments of this kind are necessary to confirm the findings. - Ingeborg Schmidt.

A line, not a space, represents visual distinctness of borders formed by different colors, by B.W. TANSLEY and R.M. BOYNTON (Center for Visual Science, Univ. of Rochester, Rochester, New York 14627 and Dept. of Psychol., Univ. of California, San Diego, La Jolla 92037), Science, 191, 954-957, 1976.

All possible combinations of pairs of 36 non-spectral colors were presented in a bipartite circular field subtending 1.35° at

25 trolands. The luminance of one of the pair was adjusted so that the border between them was minimally distinct. Distinctness was then judged on an eight point scale. Sets of stimuli whose members do not form borders with each other map as single points along a curved line where the Euclidean distance between pairs of points representing the two stimuli is nearly proportional to the rated distinctness of the border formed between them. A second experiment demonstrated that each of these non spectral colors is in its border forming properties equivalent to some monochromatic stimulus. An inspection of the sets of stimuli arranged in the chromaticity space suggested that, in rating visual distinctness of borders formed by the function of two photic stimuli, normal trichromats behave in a manner similar to that of a tritanope in a color mixture experiment. The tritanopes' fan of lines in the chromaticity space can be used to determine which spectral color is equivalent to any given nonspectral color with respect to contour-producing ability. Artificial tritanopia was obtained by exposing the observers for 5 minutes to an intense blue light (436 nm, 10^5 trolands), which they continued to view between settings. In the absence of luminance differences the perception of contour apparently depends on the stimulation of only two cone types. - Ingeborg Schmidt.

Spatial frequency-contingent color aftereffects, by J.G. MAY and H.H. MATTESON (Dept. of Psychology, Univ. of New Orleans, New Orleans, Louisiana 70122 and Dept. of Psychology, Tulane Univ., New Orleans 70118, USA) Science 192, 145-147, 1976.

After adapting to chromatic checkerboards, subjects who viewed achromatic grating stimuli reported that complementary color aftereffects are aligned with spatial frequency components rather than with the edges in the pattern (see also the abstracts Daltoniana No. 19 p. 3 and No. 21 p. 4). - Ingeborg Schmidt.

A comparison of Fourier analysis and feature analysis in pattern-specific color aftereffects, by M. GREEN, Th. CORWIN and V. ZEMON (Psychology Dept. Northeastern Univ. Boston, Mass. 02115, U.S.A.) Science 192, 147-148, 1976.

After adaptation to alternating upright red and oblique green checkerboards vertical and horizontal gratings appeared pink and oblique gratings appeared green. The results show an orientation and spatial frequency selectivity which could be predicted by a two-dimensional Fourier analysis. - Ingeborg Schmidt.

Dependence of the peripheral vision on the speed of displacement of the retinal image, by G.I. ROZHKOVA and A.L. YARBUS, Biophysics 19 (No. 5) 929-934, 1974 (published July 1975).

Finds each region of the retina has its own range of speeds which is optimal from the view-point of detection of objects and analysis of their properties. However, as regards foveal vision, optimal speeds are very low and the difference in perception of

quickly presented fixed and moving stimuli is difficult to notice. Authors regard incorrect color perception theories concerning the periphery of the retina, specif. color blindness and color distortions (for photopic luminosities). They write : "In the course of experiments all the color distortions observed at the periphery could be reproduced by us at the center with a corresponding change in scales" (that is, the whole retina is engaged in color evaluation). Note : A.L.Y. has authored "Role of eye movements in vision" (Russian) published by Nauka, Moscow, 1965. - From Rev. sens. Disabil., n° 22, 1975.

The qualitative and quantitative effects of surround color fields on the visual matching of a target color by J.F. MacMILLAN, Ph. D. thesis, Rensselaer Polytechnic Institute, 1975. 189 pp. Univ. Microfilms 75-25,872.

Apparently experience is a factor in performance (free color matching influenced by simultaneous contrast). When the difficulty of the three-color matching procedure - that is, from a combination of surrounds and a number of target colors - was reduced, agreement with predicted classical results followed. - From Rev. Sens. Disab. 23, 1976.

Derivation of the photopigment absorption spectra in anomalous trichromats by J. POKORNY and V.C. SMITH (Eye Res. Lab., Univ. of Chicago, 950 E 59th St. Chicago, Illinois 60637) and I. KATZ (School of Chem. Sciences, Univ. of Illinois, Urbana, Illinois 61801) J. opt. Soc. Amer. 63/2, 232-237, 1973.

The absorption curves of the anomalous pigments of sex-linked anomalous vision are derived combining Rayleigh equation data with standard shapes for the visual pigments. For normal pigments a standard shape was used derived from corrected dichromatic sensitivity curves, with $\lambda_{max} = 534$ and 560 nm for the middle- and long wavelength-sensitivities respectively. For anomalous pigments two shapes were evaluated : when the anomalous pigments are assumed to have the absorption spectrum of rhodopsin no solutions fitting the protanomalous and deuteranomalous Rayleigh equations were possible. When the anomalous pigments are assumed to have the absorption spectrum of the normal middle and long-wavelength sensitive human cone photopigments, the solutions were an anomalous long-wavelength sensitive pigment for the protanomalous ($\lambda_{max} = 541.6$ nm) and an anomalous middle-wavelength sensitive pigment for the deuteranomalous ($\lambda_{max} = 554.6$ nm). - Ingeborg Schmidt.

Photopigments in anomalous trichromats by J. POKORNY, J.D. MORELAND and V.C. SMITH (Eye Res. Lab. Univ. of Chicago, 950 E 59th Str., Chicago, Illinois 60637 and School of Optometry, Univ. of Waterloo, Ontario, Canada N2L3G1) J. opt. Soc. Amer. 65/12, 1522-1524, 1975.

MacLeod and Hayhoe (see Daltoniana No. 16 p. 1) have derived an absorption spectrum for an anomalous visual pigment common to protanomalous (PA) and deuteranomalous (DA) while Pokorny, Smith and

KATZ (see the preceding abstract) have shown that the Rayleigh equations for PA and DA required two distinctly different anomalous pigments. The absorption spectra of the anomalous pigments were recalculated from the relative energy spectra of the stimuli of an anomaloscope resulting in λ_{max} for PA of 542.1 \pm nm and of 553.3 \pm 1.5 nm for DA, thus separated by over 10 nm. Also consideration of systemic errors and uncertainties does not lead to a single anomalous photopigment consonant with both, protanomalous and deuteranomalous Rayleigh matches. The authors conclude that they cannot refute the single-pigment hypothesis but they do assert that the single function derived from the PA and DA color matching functions by the use of the MacLeod and Hayhoe procedure is not the photopigment that mediates anomalous color vision. - Ingeborg Schmidt.

A single anomalous photopigment? by M.H. HAYHOE and D.I.A. MacLEOD (Dept. of Psychology, Univ. of California at San Diego, La Jolla, California 92093), J. opt. Soc. Amer. 66/3, 276-277, 1976.

Pokorny, Moreland and Smith (see the preceding abstract) have shown that the anomalous spectral sensitivity derived on the assumption that the anomalous pigment is the same in deuteranomaly as in protanomaly incorrectly predicts anomalous color matching functions. Hayhoe and McLeod believe that the evidence brought forward by these authors is not conclusive. - Ingeborg Schmidt.

Chromatic vision in human infants : conditioned operant fixation to "hues" of varying intensity, by M.J. SCHALLER (Univ. Wisconsin, Madison 53706, USA), Bull. psychonomic Soc. 6/1, 39-42, 1975.

Infants discriminated between red and green, not on basis of luminosity differences, but of hue. The method seems applicable to general investigations of infant perception. See also BORNSTEIN, M.H. (presently Dept. of Psychology, Princeton Univ., Princeton, N.J. 08540, USA), KESSEN, and WEISKOPF, The categories of hue in infancy, Science 191, 201-202, 1976. - From Rev. sens. Disab. 23, 1976.

Screening of congenital colour defects by Farnsworth's Tritan Plate, by K. OHTANI, Y. OHTA, S. KOGURE, H. KATO and K. SHIMIZU (Dept. Ophthal., Tokyo Med. Coll., Japan), and R. SEKI (Dept. Ophthal., Dokkyo Med. Coll., Japan), Jap. J. clin. Ophthal. 28, 1217-1222, 1975.

Farnsworth's Tritan Plate was clinically evaluated with 38 colour-defective males as test subjects.

The detection rate for protans and deutans with the plate was respectively 100% and 67.8%, resulting in an overall detection rate of 76.3%. Only the green square could be identified by the

protan subjects who were diagnosed as such by means of anomaloscope, Ishihara's plates, Okuma's plate, TMC plates, 100 Hue test, Panel D-15 and Ichikawa's Lantern test. Some of the deutan subjects, on the other hand, were able to identify the green and blue squares independent of the severity of the colour defectiveness.

The latter finding is attributed to the fact that the blue square and the chromaticities of the background colour are located on a confusion line for the protans but not for the deutans. - Yasuo Ohta.

Constant lightness 100-hue set under monochromatic illumination(Na), by L. RONCHI and S. STEFANACCI (Ist. Naz. Ott., Arcetri/Firenze, Italy), Atti Fond. G. Ronchi, 30, 1035, 1975).

The present paper deals with a technique which allows to estimate the lightness of the 100-hue caps under monochromatic Na illumination. Then, the addition of neutral filters of suitable density leads to a "constant" lightness set of 100-hue caps. Five normal observers confirm, after careful visual inspection, the validity of our procedure. Three non-normal subjects, on the other hand, assert that there is a "modal" lightness level; however some caps appear darker, other appear brighter. - Lucia Rositani-Ronchi.

Two filter method for dark-adaptation measurements, by M. IKEDA, S. KANEKO and M. OHMI (Imaging Science and Engineering Lab., Tokyo Inst. Technol., Tokyo, Japan), Jap. J. clin. Ophthal. 28, 1199-1202, 1975.

Measurement of the dark-adaptation curve normally takes about half an hour to complete if one requires certain values necessary for clinics, such as the absolute threshold for cones and rods, and the transition point from cone vision to rod vision. To shorten the test time color filters of 560 nm and 510 nm were alternately inserted in the test flash : this provided different curve traces for the cones and the rods, the transition point from cones to rods is found easily, although the whole curve did not necessarily show the Kohlrausch break. The whole dark-adaptation process was completed in only a few minutes, which assured a great advantage in clinical applications. - Yasuo Ohta.

Achromatopsia with amblyopia. I. A clinical and electroretinographical study of 39 cases, by E. AUERBACH and S. MERIN (Vision Research Lab., Hadassah Univ. Hosp. and Med. School, Israel), Docum. ophthal. 37, 79-117, 1974.

39 patients suffering from congenital achromatopsia were investigated by various methods, including electroretinography, during both light and dark adaptation. In most cases the fundus showed various macular or foveal abnormalities. Nearly all patients displayed the 'scotopic axis' in the Panel D-15 test.

The ERG was extinct in light. In the dark, in most patients the ERG displayed the scotopic mechanism solely, but some ERGs indicated subnormal photopic components either at the beginning or during all dark adaptation. This presence of photopic activity in the ERG of achromats was verified by 2 additional experiments : a) the recovery of the positive wave of 4 achromats was compared on a percentage scale with that of 4 normal subjects and found to be similar, although the slightly faster course in achromats indicates less photopic activity than in normals; b) the positive amplitudes of the ERGs of 12 achromats with purely scotopic ERGs were recorded at completed dark adaptation as function of increasing stimulus intensities, all above the photopic threshold, and compared with those of 16 normal subjects : the amplitudes increased linearly with the 1.2 log intensity range in both groups, though the slope of the curve of the achromats was 1/4 that of the normals. In another experiment, the positive wave of the ERG, as elicited by light over 5 log units in the scotopic range, was found in an achromat to be of very similar shape as that of a normal, indicating scotopic activity to be similar in both subjects.

The fact that, nevertheless, photopic components were not demonstrable in most ERGs, despite present photopic activity, can be explained by the relatively insensitive electrical method coupled with the subnormality of the retinal photopic mechanism in every achromat. - Guy Verriest.

Achromatopsia with amblyopia. II. A psychophysical study of 5 cases, by E. AUERBACH and B. KRIPKE (Vision Research Lab., Hadassah Univ. Hosp. and Med. School, Israel), Docum. ophthalm. 37, 119-144, 1974.

In 3 of the 5 cases 3 high-level plateaux were evidenced before the low-level scotopic part of the dark adaptation curve. These 3 plateaux are photopic as to the kinetics and scotopic as to their spectral sensitivity, indicating that they are due to cones containing rhodopsin. The author discusses why rhodopsin seems to regenerate faster in cones than in rods or in vitro. Other cases show only 1 high-level plateau, as described in the literature. - Guy Verriest.

The phenotype of heterozygotic females in congenital red-green colour blindness, by K. FAHRENKAMP-RICHNER (Univ. - Augenklinik, Kantonsspital Zürich), Klin. Mbl. Augenheilk. 168, 128-134, 1976.

Varying degrees of deficient colour discrimination along the deutan axis within one family have been studied and presented. All 7 family members exhibit manifest colour blindness. The question of the phenotype among heterozygotic females is discussed on the basis of the data found by anomaloscope testing and the F.M. 100 Hue-Test. - Marion Marré.

The transparency of the lens of the eye, by R.A. SCHACHAR, Ph. D. Thesis, Univ. of Chicago, 1975. Obtainable from the University Photoduplication Dept.

Relates cortical cataracts to fluctuations in protein orientational order. Study (utilized polarized Raman spectroscopic technique) reveals uniaxial qualities of lens are due to microscopic anisotropy. The biochemical aspects (lens proteins) are uppermost in treatment. See also van KLEEF, F.S.M., DE JONG, W.W., and HOENDERS, H.J., Stepwise degradations and deamidation of the eye lens protein alpha-crystallin in ageing, Nature 258, 264-266, 1975. - From Rev. sens. Disab. 23, 1976.

The laser as a source in visual experiments, by L. RONCHI, Atti Fond. Ronchi 30/4, 565-581, 1975.

A review by subject area evincing the author's excellent command of technique. - From Rev. sens. Disab. 1976.

Retinal sensitivity to damage from short wavelength light (laser beam), by W.T. HAM Jr. (Dept. of Biophysics, Virginia Commonwealth Univ., Richmond 23298, U.S.A.), Nature 260, 153-155, 1976.

Attributed to thermal and photochemical effects (rhesus monkeys). Identifies sites of lesions. Previous reports (--- et al.) in Applied Optics 12, 2122-2129, 1973 : Ocular hazard from sun-viewing (simulated). - From Rev. sens. Disab. 24, 1976.

Amblyopia and chromatic vision (Amblyopia y visión cromática), by A.F. GONELLA, A. CIANCIA and E. FISCHER, Arch. Oftal. Buenos-Aires 50, 195-201, 1975.

Amblyopia and alterations of colour vision were found associated, with some clinical and therapeutical implications. 1) In some squinting subjects with unilateral irreducible amblyopia, there are alterations of colour vision, more marked in the amblyopic eye, that shows us the presence of a retinal abiotrophy. In general the visual acuity is also diminished, in less degree, in the dominant eye, that shows a slight dyschromatopsia, with the fixation being foveal or parafoveal. 2) In patients with bilateral amblyopia and eccentric fixation, bilateral alterations of colour vision are found and allow the diagnosis of organic amblyopia. 3) The squinting patients may present reduced colour discrimination in the blue-yellow axis or without evident axis (chromatic amblyopia); this defect is stronger when fixation is more eccentric. - Maria de Mattiello.

Congenital syndrome of cone dysfunction (Síndrome congénito de disfunción de conos), by J.L. MUNOZ, Arch. Soc. Esp. Oftal., 33/7, 579-582, 1973.

After presenting the general features of the cone dysfunction syndrome, the case of a 3 1/2 y old child is analyzed. As in most cases, a decrease in visual acuity, nystagmus, photophobia, lack of colour discrimination and refractive defects were observed. Night vision, on the contrary, remained normal. Colour vision

was studied by means of the Ishihara test, in which the patient could recognize no figures at all, and by the Farnsworth-Munsell test, which could not be achieved by the patient. - Maria de Mattiello.

Progressive cone dystrophy, by N. OHBA and F. LIAO (Dept. Ophthal., Med. Univ. of Tokyo, Japan), Jap. J. Clin. Ophthal. 28, 799-803.

Four cases were reported having selective involvement of the cone mechanisms. Their ages at the initial visit were 23, 22, 45 and 41 y respectively (2 males and 2 females). Visual disturbances began at second to fourth decade of life, after some period of normal vision, and the main symptoms were poor visual acuity, acquired colour vision defect and day-blindness, whereas scotopic vision remained intact. Dark adaptation and ERG studies revealed severe involvement of the cone mechanisms throughout the entire retina with little or no defect of the rod mechanisms. - Yasuo Ohta.

A railway accident a hundred years ago as reason for systematic testing of colour vision, by R.G. FREY (Gersthofer Str. 142 - 146/20, A - 1180 WIEN), Klin. Mbl. Augenheilk. 167, 125-127, 1975.

Holmgren's supposition that colour blindness was one of the causes for the train-disaster which happened on 15th November 1875 near Lagerlunda had been passed on as an established fact. The course of the accident is outlined on the basis of the court records. It shows that not colour blindness, but the fact that the engine-driver and the station-master were acting contrary to regulations resulted in the head-on collision with the opposite train. After this event systematic testing of colour vision in railway-men was instituted. - Marion Marré.

Long-term observation of Sanvista treatment for congenital colour vision deficiencies, by R. SEKI (Dept. Ophthal., Dokkyo Med. coll., Japan), Jap. J. clin. Ophthal. 28, 653-657, 1975.

Five juvenile cases with congenital color vision deficiencies were treated by SANVISTA (selective stimulation of the retina by AC current) and were followed up for over 6 years. All cases but one showed improved color vision as evaluated by Nagel's anomaloscope, lantern test (Ichikawa), pseudoisochromatic plates (Ishihara, Okuma & TMC), 100 hue test and Panel D-15 test. The treatment was ineffective in one case with deuteranopia. The subject was not intelligent and lacked zeal for the treatment. The author is of opinion that the SANVISTA treatment is effective for both protan and deutan color deficiencies. The resultant improvement in color vision is retained after discontinuation of the treatment. - Yasuo Ohta.

Spectral sensitivity in a female Cebus griseus, by F. LEPORE, M. LASSONDE, M. PTITO and B. CARDU (Department de Psychologie, University de Montréal, 90 Vincent d'Indy, Montréal H3C 3J7) Percept. Motor Skills 40/3, 783-788, 1975.

The photopic spectral sensitivity of one female Cebus griseus monkey was determined by using a method of limits. The animal had learned to choose between a colored and a white stimulus on the basis of their relative brightness independent of hue and saturation, always choosing the brighter of two unevenly illuminated patches. During the test the brightness of the chromatic stimulus was kept constant while that of the white was randomly varied such that it was brighter in some trials and dimmer in others. The result suggests that this monkey might be a normal trichromat confirming published results showing that this species did not demonstrate the red deficiency typical of most New World monkeys. (See also the abstract of the paper by M. PTITO, B. CARDU and F. LEPORE in *Daltoniana* No. 14, p. 3). - Ingeborg Schmidt.

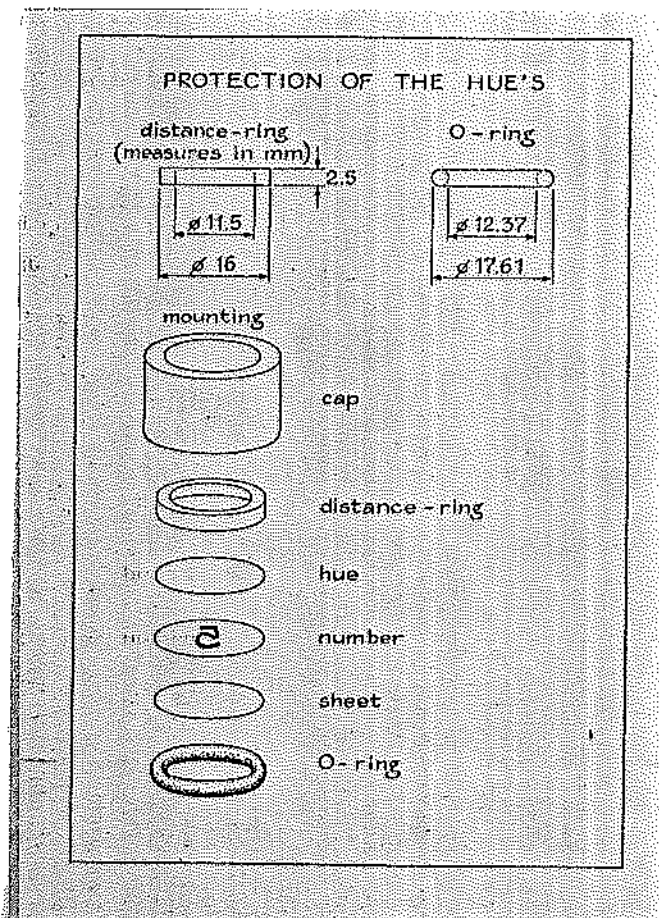
Color receptor identities of goldfish cones, by R.E. MARC and H. SPERLING (Sensory Sciences Center, University of Texas, Health Science Center at Houston, Houston 77025), Science 191, 487-489, 1976.

Retinas from dark adapted goldfish were isolated under infrared light and mounted receptor side up. Then they were exposed for 5 minutes to spectral lights and subsequently incubated with nitroblue tetrazolium chloride. Diformazan deposits revealed that according to the response to colored lights of 750, 650, 535, 470 and 400 nm five morphologically distinct cone types were segregated into three color classes : red long double and long single cones, green short double and long single cones and blue short single and miniature short single cones. - Ingeborg Schmidt.

PRACTICAL NOTES

(please send more of such notes to the editor)

PROTECTION OF THE HUES, by A.J. PINCKERS and B. NABBE (Universiteitskliniek voor Oogheelkunde, St.-Radbouds-ziekenhuis, Nijmegen, The Netherlands). The joined figure, which is self-explanatory, shows how smudging by the fingers of the hues of the Farnsworth Panel D-15, Farnsworth-Munsell 100 hue, and Lanthony desaturated Panel and New Color Test can be prevented by inserting a distance-ring in each cap.



SIMPLE WAY TO TEST ULTRAVIOLET TRANSMISSION.

Buy some fluorescing paper from most any art supply store. It comes in a number of different colors but yellow is better for this purpose. Place your lenses, either full size spectacles, contact lenses or even plastic for windows on the paper. Shine an ordinary blacklight ultraviolet light on the plastic. You will see the paper fluoresce brilliantly. This should be done in a dark room or where the light is very subdued.

If the plastic is ultraviolet transmitting, the paper underneath it will fluoresce equally as bright but if there is a deep shadow from the plastic, this indicates it is not ultraviolet transmitting. This type of paper has a very broad response to ultraviolet wavelengths and some glass will transmit a little UV in the wavelengths close to visible light which will cause the paper to fluoresce. Accordingly, this test method cannot be used for glass. The plastic material used in most lenses is normally ultraviolet transmitting and a very efficient UV inhibitor is added into the plastic that stops all the UV, including the small amount that does pass through some types of glass.

Most optical stores have small blacklight lamps and many are now also using this fluorescing paper test to illustrate the ultraviolet transmitting characteristics of Full Spectrum lenses.- From EHLRI News 5/1, 1975.

INTERNATIONAL DIRECTORY OF CALIBRATION SERVICES IN THE FIELD OF PHOTOMETRY AND RADIOMETRY, by C.L. SANDERS. Nat. Res. Council Canada Report no. PO-121, Ottawa K1A 0R6, Canada. Price \$5.00

The directory was compiled by the Optics Section, Division of Physics, National Research Council of Canada, at the request of the International Commission on Illumination, Technical Committee on Photometry and Radiometry (CIE TC-1.2). It is published as NRC Physics Division Report No. PO-121. The directory gives information on the calibration services available from 26 laboratories in 16 countries (Argentina, Italy, Poland, Hungary, Canada, Japan, Sweden, Belgium, Austria, FRG, Czechoslovakia, USA, England, France, Switzerland, DDR). It is divided into three parts : the calibration of sources, the calibration of receivers or measuring devices and the calibration of reflecting or transmitting materials. Copies are available at a nominal fee from the Physics Division, National Research Council, Ottawa, Canada K1A 0R6. It is hoped that this information will help many specialists of colour vision for their photometric and radiometric calibration problems. - Guy Verriest.

