Ophthalmic findings in dyslexic schoolchildren

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Abstract

The ophthalmic findings of 55 dyslexic 12 to 13-year-old Finnish schoolchildren and 50 age, sex, and social class-matched control children were evaluated. On a neuropsychological basis the children could be divided into six subgroups: general deficiency, general language, visuomotor, naming, mixed, and normal. The two groups did not differ significantly from each other in visual acuity, cycloplegic refraction, the amount of phorias and tropias, stereo acuity, fusion, or accommodation. Convergence near point ≥ 8 cm was, however, statistically more frequent in the dyslexic group. This finding was also significant in the general deficiency subgroup compared with the other subgroups. The most conspicuous common denominator in those with dyslexia was revealed to be the convergence insufficiency type of exodeviation, occurring in 38% of the general deficiency dyslexic subgroup and in 36% of the visuomotor dyslexic subgroup. This finding suggests a low accommodative convergence/accommodation ratio in these children.

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Approximately 5% to 10% of schoolchildren are in need of special education services for specific difficulties in reading and writing. This is in spite of their normal intelligence, apparent health, profitable sociocultural environment, and conventional instruction. Neuroanatomical studies¹ and neuroradiological studies on people with dyslexia²⁻⁴ have revealed cortical cytoarchitectural changes and exceptional symmetry or reversed asymmetry in the language associated planum temporale or angular gyrus regions in the brains of those with dyslexia. Functional studies using positron emission tomography⁵ and brain electrical mapping techniques⁶ have, in addition, shown changes in the frontal motor areas and in the inferior, visually related regions of both occipital lobes. The active brain areas are also mutually different in different dyslexic subtypes.^{6,7}

Many researchers have considered the basic difficulty in dyslexia to be in the processing of phonemic information or in retrieving information from the verbal memory.⁸⁻¹³ The latest findings have also shown sluggish visual information transfer at least in some dyslexics.¹⁴ References to this are seen in some previous visual evoked potential (VEP) studies.^{15,16} Underdevelopment of the magnocellular pathway, which carries transient visual information in the low and middle spatial frequency ranges, has been revealed also neuroanatomically.¹⁴

Clinically, dyslexic children have been subgrouped according to psychoeducational or neuropsychological measures, achievement test

results, or the types of reading and spelling errors. Two of the latest studies come from Scandinavia. In the Norwegian study¹⁷ dyslexic children were divided into four subgroups on the basis of educational psychological tests and examined also ophthalmically. In Finland, Korhonen evaluated learning disabled schoolchildren and matched controls on a neuropsychological basis.¹⁸ These children could be divided into six subgroups, resembling those found earlier among English speaking children.

The ophthalmic and orthoptic studies on dyslexic children are contradictory. In many studies dealing with dyslexics and controls without subgrouping them, no essential differences in visual acuity, refraction, or strabismus have been found.¹⁹⁻²² Some studies have shown weak evidence of poor binocularity or deficient oculomotor control mechanisms.²³⁻³⁰ Vellutino found no basic differences between the visual perception of dyslexic and normal children,⁹ neither did Valtin.³¹ Haddad reported reduced fusion ability among many individual poor readers.²⁹ Orthoptic exercises improved fusion and relieved subjective troubles without any effect on dyslexia. Stein *et al*³² found unstable vergence control for small targets in 64% of 10-year-old dyslexic children compared with stable ocular motor dominance in nearly all normal readers. Their findings were supported by Bigelow and McKenzie³³ but were considered questionable by Newman *et al*³⁴ and Bishop.³⁵ Geiger and Lettvin³⁶ found that dyslexic people identified letters extrafoveally better than normal readers and showed parafoveal masking. Their research has been criticised for study arrangements, however.³⁷ Abnormalities in the eye tracking movements which have sometimes been observed probably reflect the difficulties which many dyslexics possess when reading a strange text.^{38,39} Hyvärinen and Laurinen⁴⁰ found several abnormal ophthalmic findings such as great refractive errors, poor binocularity, or abnormal contrast transfer in severely dyslexic children.

The purpose of the present study was to evaluate whether ophthalmic findings could have contributed to the learning disability of schoolchildren, subgrouped on a neuropsychological basis, and whether some differences in that respect could be found between the subgroups.

Subjects and methods

The subjects in the present study came from a follow up study of empirically derived subgroups of children with learning disabilities (LD). In the initial study,¹⁸ a sample of 82 LD children and 84 sex, age, and social class-matched control children was drawn from the entire population of 1607 third grade, Finnish speaking, 9 to 10-year-old children. To be included subjects had to have difficulties with reading and/or spelling to such

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an extent that their teacher and a special teacher for reading and spelling problems agreed on the need of remedial teaching. Moreover, these difficulties had to have continued from the second school year into the middle of the third school year. Altogether, 56 teachers from 27 schools reported such children. When evaluating the learning disabilities the teachers used a rating scale from 1 to 4. A rating of at least 3 in reading and/or writing or a rate of 2 in both of these areas was used as the criterion for the inclusion of a subject in the study.

To avoid extreme cases, which may strongly have affected the method (cluster analysis) used to subgroup the subjects, children with a WISC-R full scale IQ of less than 80, children with neurological diseases, and children coming from very extreme family situations (for example, asocial families) were excluded. The learning disabilities in the present sample were relatively mild, and followed the definition of learning disability stated by the Joint Committee on Learning Disability.⁴¹ Only four of the LD children studied in a class for perceptual disorders; all others studied in the regular third grade classes. However, for 80% of the 82 LD children the reading and/or the writing error sum score on a reading and writing test^{42,43} was higher than the mean (+2 SD) of the control group.

A panel of 19 neuropsychological tests for a total of 32 measures was administered to the subjects. All children were also submitted to a conventional paediatric and neurological examination. Using cluster analysis⁴⁴ the sample could be divided into six subgroups (Table 1). The labels of the subgroups describe the neuropsychological weaknesses typical for each group.

About 3 years later, at the age of 12–13 years, 74 learning disabled and 57 control children participated in a neuropsychological as well as a neuropaediatric follow up examination.⁴⁵ In this phase they were also asked to undertake an ophthalmic evaluation; 55 learning disabled and 50 control children did so. The subgroups of these subjects are shown in Table 1. The proportion of boys to girls was 1.8:1 or about the same as in the initial study.

Visual acuity with best correction was tested both before and after cycloplegia, using a Snellen E-chart at 6 metres. Before cycloplegia, near visual acuity was also tested using a standardised reading card (Instru-card) at 33 cm distance. Eye movements were checked and the convergence ability was measured. Possible strabismus was

evaluated by the cover test and by Maddox wing near and Maddox rod far. The near point of accommodation was measured using an RAF ruler, with push up method, and the refraction corrected. Fusion amplitude was registered by prism bar at 6 metres and 33 cm distance, with a finding of unrecovering diplopia or turning out of one eye as the end point. Stereo acuity was examined by the Titmus test. Contrast sensitivity and central visual fields were evaluated using the LH contrast test and tangent screen, respectively. Colour vision was screened by the Panel D-15 test in artificial daylight illumination (Airam 60W), both eyes separately. Eyes in which visual acuity was ≤ 0.7 or spherical refraction ≥ 3 dioptres myopic were excluded to avoid misinterpretation of the results. The refractive power was determined by streak retinoscopy with and without cycloplegia – to test for cycloplegia, two drops of 1% cyclopentolate were instilled twice with a 5 minute interval and the measurement was carried out after at least 40 minutes. Ophthalmoscopy was performed through the dilated pupils. The anterior segments were examined using a Haag-Streit biomicroscope.

To evaluating the exophoria findings, the classification by Daum⁴⁶ was followed:

1 Equal exodeviation (EE): a change between the distant and near values of less than 4 Δ (prism dioptres), if the distance angle of exodeviation is from 0 to 5 Δ , and a change of less than 10 Δ if the distance angle of exodeviation is 6 Δ or more.

2 The convergence insufficiency type (CI): near exodeviation 4 Δ or greater than the distance deviation when the distance exodeviation is between 0 and 5 Δ , and the near deviation 10 Δ or greater if the distance exodeviation is 6 Δ or more.

3 The divergence excess type (DE): the same limits of change as in the convergence insufficiency type, but with the distance exodeviation being greater.

The statistical analysis is based on cross tabulations and χ^2 tests. We also performed logistic regression modelling, but the results were analogous to cross tabulations.

Results

In the control group, all children had visual acuity > 0.7 in both eyes. In the dyslexic group, two children (3.6%) had bilateral visual acuity ≤ 0.7 (one 0.6, the other 0.7) and two children (3.6%) had unilateral amblyopia ≤ 0.7 . This difference was not statistically significant. Figure 1 presents the spherical refraction in the dyslexic and control groups. In the dyslexic group, two subjects (3.6%) had astigmatism ≥ 1 D and two (3.6%) had anisometropia ≥ 1 D. None in the control group had astigmatism of that magnitude, three (6%) had anisometropia ≥ 1 D. Three children in both groups had an accommodation near point ≤ 7 D, and six subjects in both groups had some abnormality in colour vision by Panel D-15 test. Only one dyslexic child, with septum pellucidum anomaly and bilateral visual acuity of 0.6, had clearly abnormal contrast sensitivity. Four children in the dyslexic group had bilaterally abnormal optic discs: one was the above

Table 1 The proportion of ophthalmically examined dyslexic and control children in the six subgroups

Subgroup	Dyslexics			Controls			Total	
	n	%	(%)*	n	%	(%)†	n	%
General deficiency	13	24	(21)	1	2	(1)	14	13
General language	11	20	(22)	2	4	(5)	13	12
Visuomotor	11	20	(22)	12	24	(21)	23	22
Naming	8	14	(11)	0	0	(1)	8	8
Mixed	11	20	(18)	5	10	(10)	16	15
Normal	1	2	(6)	30	60	(62)	31	30
	55	100	(100)	50	100	(100)	105	100

*Percentage of the subgroup in the original group of dyslexic children (n=82). The difference between the percentage is not statistically significant.

†Percentage of the subgroup in the original group of control children (n=84). The difference between the percentages is not statistically significant.

Figure 1 The distribution of cycloplegic refraction in dyslexic and control groups (right eye, spherical equivalent).

mentioned girl with septum pellucidum anomaly, having hypoplastic discs; two had small optic discs but good visual acuities, and one had markedly tilted discs and good visual acuities. One child in the control group had pseudostasis papillae with good vision in both eyes. Table 2 presents the binocular function in both groups.

When the above mentioned variables were compared between the six neuropsychologically based subgroups consisting of dyslexic and control children, no remarkable differences were found. Nine variables were selected as being the most relevant to reading and writing abilities (referred to later as reading variables) (Table 3). At this stage, two dyslexic children with bilaterally reduced visual acuities were omitted: the girl from the general deficiency subgroup who had hypoplastic discs and visual acuity of 0.6 bilaterally, and another girl from the mixed subgroup who had astigmatism 3.5 D/2.0 D and bilateral acuity of 0.7. Distribution of the abnormal

reading findings in the subgroups of dyslexic and control subjects is shown in Table 3. The differences were of no statistical significance. The number of children in the dyslexic group was too small to allow reliable statistical evaluation of the reading findings between only the dyslexic subgroups. When the occurrence of individual reading variables in five other subgroups was compared with that of the normal subgroup, two statistically significant differences were found: convergence near point ≥ 8 cm in the general deficiency subgroup ($p=0.0470$) and unilateral visual acuity ≤ 0.7 in the naming subgroup ($p=0.0497$). When the exophorias at reading distance were evaluated further, some interesting observations were made. As Table 4 shows, the type of exophoria in the dyslexic group was invariably convergence insufficiency. In the control group it was more heterogeneous. In the dyslexic group the near exophoria was combined with hyperopic or emmetropic refraction in 9/13 (69%) of the cases, and with myopia in 4/13 (31%). In the control group the refraction was equally distributed.

Discussion

When defining specific dyslexia, clear external causes for reading difficulties such as significant uncorrected hypermetropia must be excluded. Many authors have failed to find any positive correlation between conventional ophthalmic status and dyslexia, and instead have found evidence of overtreatment of minor findings with unnecessary glasses, unnecessary orthoptic exercises, etc.²¹⁻⁴⁷ Comparing dyslexic and control persons as groups has, in general, not produced any remarkable differences. But this kind of approach has aroused criticism.³¹⁻⁴⁸⁻⁴⁹ The same finding may be more important for one individual, meaning, for example, a different binocular situation.⁴⁸ The crowding of many minor findings may also be important.

In this study, when comparing the two groups, slightly more cases with convergence insufficiency, exophoria at near, or a slight hypermetropia were found in the dyslexic group (Table 2, Fig 1). In this respect, the findings are comparable with, for example, those of Eames²⁴ and Bishop *et al.*⁵⁰ The dyslexics also had unilateral or bilateral amblyopia or mild bilateral disc anomalies more often. The number of colour confusions was unexpectedly high in both groups, most of the children, especially in the

Table 2 Binocularity in the dyslexic and control groups

	Dyslexics (n=55)		Controls (n=50)	
	%	n	%	n
Heterophoria at 33 cm:				
esophoria $\geq 3\Delta$	5.8	3/52	6.1	3/49
exophoria $\geq 6\Delta$	25.0	13/52	12.2	6/49
vertical phoria $\geq 2\Delta$	9.4	5/53	6.1	3/49
Heterotropia at 33 cm	3.6	2/55	2.0	1/50
Heterophoria at 6 m:				
esophoria $\geq 3\Delta$	11.3	6/53	8.2	4/49
exophoria $\geq 6\Delta$	1.9	1/53	2.0	1/50
vertical phoria $\geq 2\Delta$	3.8	2/53	4.1	2/49
Fusion amplitude:				
$\leq 32\Delta$ at 33 cm	7.5	4/53	6.1	3/49
$\leq 15\Delta$ at 6 m	9.4	5/53	12.2	6/49
Convergence near point ≥ 8 cm	12.7	7/55	2.0	1/50
Stereo acuity lacking or deficient (>60 seconds of arc)	9.1	5/55	8.0	4/50

$p=0.0385$

Table 3 Reading variables in the dyslexic and control children

Abnormal reading variables	Subgroup	Number of abnormal reading variables				
		0	1	2	≥ 3	n
1 Refraction (right eye), spherical equivalent, $\geq +2$ D	Dyslexics:					
2 Anisometropia ≥ 1 D	general deficiency	3 (25%)	4	3	2 (17%)	12
3 Astigmatism (right eye) ≥ 1 D	general language	7 (64%)	2	1	1 (9%)	11
	visuomotor	5 (45%)	4	2	0	11
	naming	5 (63%)	2	0	1 (13%)	8
4 Horizontal phoria/tropia at 33 cm	mixed	7 (70%)	3	0	0	10
5 Fusion $\leq 32\Delta$ at 33 cm	normal	0	1	0	0	1
6 Convergence near point ≥ 8 cm	total	27 (51%)	16 (30%)	6 (11%)	4 (8%)	53
	Controls:					
7 Reduced stereo acuity	general deficiency	0	1	0	0	1
8 Accommodation ≤ 7 D	general language	1 (50%)	1	0	0	2
9 Visual acuity ≤ 0.7 (unilateral)	visuomotor	10 (83%)	1	0	1 (8%)	12
	mixed	4 (80%)	1	0	0	5
	normal	18 (60%)	7	3	2 (7%)	30
	total	33 (66%)	11 (22%)	3 (6%)	3 (6%)	50

Table 4 Evaluation of dyslexic and control children with near exophoria

Patient No	Refraction (spherical)	Type of exophoria	Reduced stereo acuity	Fusion ≤ 32	Deficient convergence ≥ 8 cm	Accommodation ability ≤ 7 D	Subgroup	Proportion of convergence insufficiency type of exophoria in the subgroup
Dyslexics:								
1	-2.37/-1.75	CI					General deficiency	
5	+1.0/+1.0	CI	+				General deficiency	
8	+0.75/+0.75	CI					General deficiency	5/13=38% of the subgroup
9	-2.75/-2.5	CI					General deficiency	
10	+1.0/+0.82	CI	+	+	+		General deficiency	
14	+1.0/+1.0	CI					Visuomotor	
15	+0.5/+0.5	CI			+		Visuomotor	4/11=36% of the subgroup
18	$\pm 0/+0.25$	CI					Visuomotor	
20	+1.37/+1.12	CI					Visuomotor	
29	-1.25/-1.5	CI					Mixed	1/11=9% of the subgroup
37	-2.87/-3.0	CI					General language	2/11=18% of the subgroup
42	+2.25/+2.0	CI					General language	
55	+0.75/+0.5	CI					Normal	1/1=100% of the subgroup
Controls:								
69	+1.0/+1.0	CI					Mixed	1/5=20% of the subgroup
97	+1.12/+0.87	EE					Normal	
99	+0.75/+0.75	EE				+	Normal	
100	-0.87/-0.37	EE	+			+	Normal	
103	-5.0/-4.5	CI		+	+		Normal	2/30=6% of the subgroup
105	-2.5/-2.5	CI					Normal	

CI=convergence insufficiency.
EE=equal deviation.

dyslexic group, showing unspecific errors. This may be caused by inattentiveness after numerous other tests. The Panel D-15 test in this age group may not be very reliable, either.⁵¹ Quite a high proportion of children in the control group also had some positive findings. In this respect the conclusions coincide with those by Aasved,¹⁷ Norn,¹⁹ and Blika.²¹

Subgrouping dyslexic children allows a more individual approach to the problem. A neuropsychological basis for subgrouping is relevant, giving comprehensive information of an individual's functional and developmental profile. In the Bergen study,¹⁷ no statistical differences were found between the subgroups. Their subgroups – auditory, audiovisual, visual, and others – were different from those in this study, however. Comparing independent ophthalmic variables between our subgroups did not give remarkable differences either. Only a slight accumulation of the findings in the general deficiency subgroup was noticed. One should, however, realise that the subgroups that emerged were so small that the statistical analysis does not have enough power to detect dependence structures, and, accordingly, certain conclusions must be made without statistical support.

The IQ difference between LD subjects and control subjects in this study (the mean for the LD children being 97.7 and for the control children 110.2) reflects the common fact that most of the LD subjects had specific or, as in the general deficiency subgroup, general neuropsychological and cognitive disorders. This also affected the IQ results, and similarly caused some IQ differences between the subgroups. The general deficiency and the naming subgroups

were the most impaired showing also the greatest amount of neurological soft signs (50% and 40% with two or more, respectively).¹⁸ These subgroups also had the most unfavourable prognosis in reading and spelling, the naming subgroup being more specified in its function deficits.⁴⁵ The finding that control subjects in the visuomotor subgroup also had visuomotor spatial problems is interesting. It has been hypothesised that mild visuomotor spatial difficulties may not directly cause reading problems.¹⁸ The LD subjects, but not the control subjects, in the visuomotor subgroup also showed attentional and some mild language difficulties, which may primarily have caused the reading problems. Comparison of the eye findings in the dyslexic and normal visuomotor subgroups revealed only slightly more positive findings in the dyslexics. During follow up the visuomotor dyslexic subgroup made good progress in reading.⁴⁵

The most conspicuous common denominator for the dyslexic children was revealed to be the convergence insufficiency type of exodeviation, seen in 25% of these children. It means that their accommodative power is relatively small and the accommodative convergence/accommodation ratio (AC/A) low. However, no regular decrease in accommodation amplitude could be detected in these children. This refers to other aspects in accommodation being probably more important but more difficult to measure as also suggested by Lennerstrand.³⁹ The four exophoric children in our dyslexic visuomotor subgroup were all also hyperopic or emmetropic while the two esophoric children were myopic. In the control visuomotor subgroup no children had exophoria; one with deviation had esophoria (far) combined

with hyperopic refraction and the other had esotropia, myopic anisometropia, and no fusion. References to poor vergence control or slight overpresentation of near exophoria in dyslexic children are not uncommon in previous reports,^{19 24–26 30 32} either, although in a recent carefully performed study³² no statistical differences were found. One could, however, speculate that the combination of hyperopic refraction and low AC/A ratio at the critical age constitutes an unfavourable basis for learning to read. Associated with some developmental delays or mild neurological problems its importance may increase.

The present study shows that ophthalmic factors ought not be overlooked as a contributing factor to dyslexia in at least some individuals. Maybe they sometimes constitute part of the dyslexic syndrome and become more significant when crowding together. A dyslexic child would benefit from individual, also ophthalmic, evaluation. Correcting ophthalmic abnormalities, when possible, creates more favourable opportunities for special education. This is, by far, the best means of rehabilitation.

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A clinical trial to study traumatic optic neuropathy is to take place randomising to megadose steroids alone v megadose steroids with extracranial optic nerve decompression. For details: Michael P Joseph, MD, Massachusetts Eye and Ear Infirmary, 243 Charles St, Boston, MA, 02114, USA. (Tel: 617-573-3192; Fax: 617-573-3914.)

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The Proceedings of the International Conference on Low Vision held in Groningen, the Netherlands, 1993, have now been published under the title 'Low Vision: Research and New Developments in Rehabilitation', edited by A C Koosman, P L Looijestijn, J A Welling, and G J van der Wildt. Further details: IOS Press/Lavis Marketing, 73 Lime Walk, Headington, Oxford OX3 7AD. (Fax: +44 865 74 2024.)

American Academy of Ophthalmology

The third annual summer institute will be held the weekend of 5–7 August 1994, in Seattle, Washington at the Sheraton Seattle Hotel and Towers. Further details: Sarah Samuels, American Academy of Ophthalmology, 655 Beach Street, San Francisco, CA 94109-1336, USA. (Tel: (415) 561-8515.)

Welsh Cataract Congress 1994

The Welsh Cataract Congress 1994 will be held on 8–10 September 1994. Details from: Eula Mae Childs, coordinator, Cullen Eye Institute, Baylor College of Medicine, 6501 Farnin, NC200, Houston, TX 77030, USA. (Tel: (713) 798-5941; Fax: (713) 798-4364.)

Frontiers in Penetrating Keratoplasty

The German Ophthalmological Society will hold an international symposium on 'Frontiers

in penetrating keratoplasty' on 22–24 September 1994 in Heidelberg, Germany. Further details: Prof Dr R Sundmacher, University Eye Hospital, Moorenstrasse 5, 40225 Düsseldorf, Germany.

Screening for diabetic retinopathy in Europe: four years since the London protocols

Protocols to screen for and treat diabetic retinopathy were agreed upon on 9–10 October 1990 in London, as a step towards implementing the Saint Vincent Declaration and, in particular, its target of reducing new blindness due to diabetes by one third or more in the next five years. These protocols have been widely distributed with the help of the European Office of the World Health Organisation, the European Region of the International Diabetes Federation and the European Association for the Study of Diabetes. Time is about ripe to assess how much work has been done and to decide whether the protocols need to be updated or modified.

A new meeting is being organised for this purpose. It will be held on 25–26 September 1994 in Turin, Italy, as a satellite event to the 30th annual meeting of the EASD and will be organised jointly by the Working Group on Blindness of the WHO/IDF Saint Vincent Declaration Initiative and the Study Group on Eye Complications of the EASD (EASDEC). Further details: Massimo Porta, MD, PhD, Istituto di Medicina Interna, Università di Torino, Corso AM Dogliotti 14, I-10126 Torino, Italy. (Tel: +39 11 6635318; Fax: +39 11 6634751.)

British and Eire Association of Vitreo-Retinal Surgeons

The next meeting of the British and Eire Association of Vitreo-Retinal Surgeons (BEAVRS) will be held at the Marriott Hotel, Bristol, on 20–21 October 1994. Further details: Mr R H B Grey, Bristol Eye Hospital, Lower Maudlin Street, Bristol BS1 2LX. (Tel: 0272-230060; Fax: 0272-284686.)

Third International Symposium on Ocular Inflammation

The 3rd international symposium on ocular inflammation will be held on 22–25 October 1994 in Fukuoka, Japan. Further details: Registration Secretary, c/o JTB Communications Inc, New Kyoto Center Building, 5F, Shiokoji, Shinmachi, Shimogyo-ku Kyoto 600, Japan.

The First Asia-Pacific Symposium on Visual Sciences

The First Asia-Pacific Symposium on Visual Sciences (1st APS-VS) will be held in Guangzhou, China, on 2–5 November 1994. It is also a satellite symposium for the Third Congress of the Federation of Asian and Oceanian Physiological Societies. For further details: Professor De-Zheng Wu, Eye Research

Institute, Zhongshan Ophthalmic Center, Sun Yat-Sen University of Medical Sciences, 54 Xianlie Road, Guangzhou 510060, PR China. (Tel: +86-20-777 3370; Fax: +86-20-777 5271.)

Photonics West '95

The International Society for Optical Engineering (SPIE) will hold a conference entitled 'Photonics West '95' on 4–10 February 1995 at the San Jose Convention Center, San Jose, California, USA. This meeting consolidates three established California meetings, OE/LASE, Biomedical Optics, and the IS&T/SPIE Symposium on Electronic Imaging Science and Technology. Further details: SPIE, PO Box 10, Bellingham, WA 98227-0010, USA. (Tel: 206/676-3290; Fax: 206/647-1445.)

International Society for Clinical Electrophysiology of Vision

The 33rd ISCEV symposium will be held in Athens, Greece, 16–20 June 1995. The congress is organised by the International Society for Clinical Electrophysiology of Vision. Further details: Secretariat, Erasmus Conference Centre, International Congress Organisers, 227 Kifissias Ave, 145 61 Kifissia, Greece. (Tel: (01) 6125022/3, 8054004; Fax: (01) 6125021.)

The Jules François Prize, 1997

The Jules François Prize of the Belgian ophthalmological societies of \$US 10 000 will be awarded for the sixth time in 1997 to a young scientist who has made an important contribution to ophthalmology. The aim of the prize is to encourage scientific research in ophthalmology. There is no special theme. Fundamental as well as clinical research will be considered. The age limit is 40 years by 31 December 1995. The application: a curriculum vitae, and three copies of published papers must be forwarded to the secretary of the Jules François Foundation. The closing date for applications is 31 December 1995. Further details: Dr J D'Haenens, Secretary of the Jules François Foundation, E Beernaertstraat 34, B-8400 Oostende, Belgium.

Correction

We regret that there was an omission in the paper by Latvala and colleagues that appeared in the May issue (1994; 78: 339–43). The separate addresses of the authors were not included on the title page of the paper. They are:

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M-L Latvala
M Penttinen

Departments of Pediatrics and Child Psychiatry, University of Turku, Finland
T T Korhonen

Department of Public Health/Biometry Unit, University of Tampere, Finland
P Laippala