

# Brushfield spots and Wölfflin nodules unveiled in dark irides using near infra-red light

## Introduction

In 1902 Wölfflin described whitish iris nodules in lightly colored eyes. Later, in 1924 Brushfield noticed the high prevalence of these nodules in patients with Down syndrome. Histologically they are accumulations of fibrous and collagen normal stromal tissue, surrounded by hypoplastic tissue ( Purtscher 1958, Jaeger 1980).

Brushfield spots and Wölfflin nodules have heretofore essentially only been described in individuals with lightly coloured irides (Wölfflin 1902; Brushfield 1924; Purtscher 1958; Solomon et al. 1965 Schmidt 1971; Jaeger 1980; Kim et al. 2002) with the discrepancy, as well as origin, effectively unaccounted for. In the course of iris photography, we employed both standard visible white as well as near-infrared light to better determine and characterize if such iris features were also present in darker coloured irides. We also evaluated the differences between the peripheral thinning contraction furrows in individuals with and without Down syndrome.

## Purpose

To determine if structures such as Wölfflin nodules, or Brushfield spots in Down syndrome, can be established in dark irides.

## Methods

Iris photography of 43 children with, and of 43 control children without Down syndrome, were taken with standard visible white ( 16x and 40x magnification using a digital DC-4 photographic module (Topcon, Tokyo, Japan), as well as with near-infrared light (Visucam R 500, Zeiss, Jena, Germany: 650-735 nm and Heidelberg Spectralis R Tracking Laser Tomography, Heidelberg, Germany 820 nm).

Figure 1: Visibility of Brushfield spots and Wölfflin nodules under white (Column A), versus near-infrared (Column B) illumination.

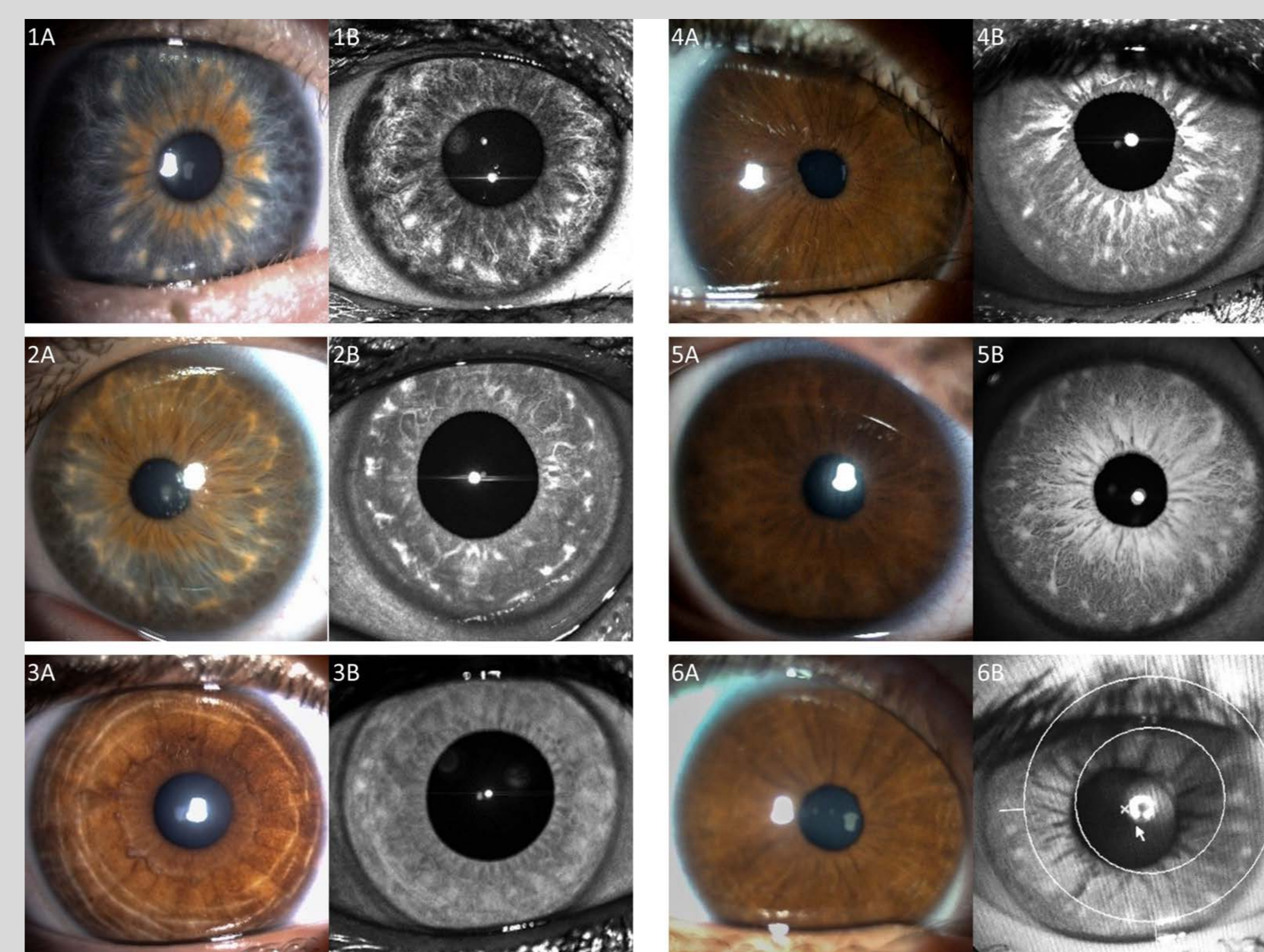
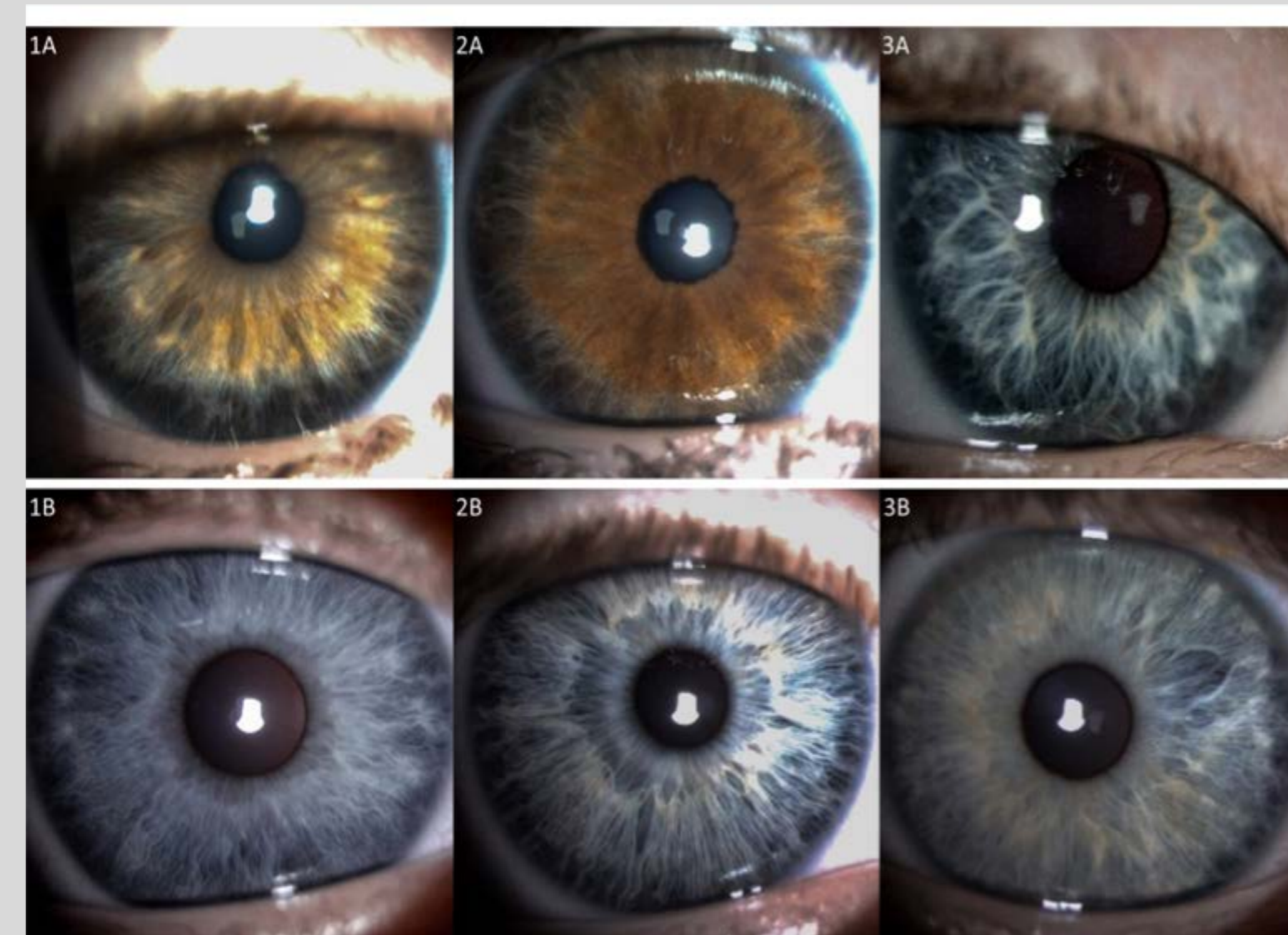


Figure 2. Peripherally thinned irides in children with Down syndrome (Row A) versus controls (Row B).



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Table 1. Brushfield spots and Wölfflin nodules based on white versus near-infrared light

Iris colour	Down syndrome		Control		p-value
	White light	Near-infrared light	White light	Near-infrared light	
Blue	7	7	3	3	
Hazel	2	4	1	1	
Brown	0	18	1	4	
All	9	29	5	8	<0.001*

p-value for both all detected Brushfield spots in Down syndrome versus Wölfflin nodules in controls and combined white versus near-infrared based light detection of iris spots and nodules

Table 2. Peripheral iris thinning and contraction furrows in Down syndrome versus controls

Iris colour	Down syndrome		Control		p-value
	Iris thinning	Iris contraction furrows	Iris thinning	Iris contraction furrows	
Blue	8	0	6	4	
Hazel	4	0	3	3	
Brown	15	7	1	25	
All	27	7	10	32	<0.001*

\*p-value for both all iris thinning and contraction furrows in Down syndrome versus control

## Results

Using white light, no child with darkly coloured irides had visible Brushfield spots or Wölfflin nodules. Brushfield spots were seen in 21% of children with Down syndrome, whereas smaller iris spots known as Wölfflin nodules were seen in 12% of controls (p<0.001), all noted in those with lightly coloured irides. Using near-infrared light, Brushfield spots could, however, be seen in 58% of those with dark irides. Hence, using near-infrared light, Brushfield spots were detected overall in 67% of children with Down syndrome compared to 21% using white light (p<0.001). Peripheral iris thinning was present in 62% of children with Down syndrome but in only 23% of those without (p=0.001). Contraction furrows were less frequent in children with Down syndrome (16%) compared to controls (74%)(p<0.001).

## Conclusions

Infrared light unveils the presence of Brushfield spots and Wölfflin nodules in dark irides,. As melanin is relatively transparent to infrared wavelengths (Kollias,1995) , iris features situated under the pigmented anterior border layer are revealed at examination using near infrared light. Clearing this discrepancy should assist in the elucidation of their pathophysiologic origin.

A high prevalence of peripheral iris thinning is also present in children with Down syndrome along with a heretofore unreported reduction in iris contraction furrows.

## References:

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