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The Egyptian Society for the Glaucomas



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Colour Vision Defects in
Glaucoma

13-13

BY

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- Visual perception consists of light, form and color sense.
- Most of the previous glaucomatous investigations depend on light and form senses only.

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- Although Dyschromatopsia (color vision deficiencies – CVD) in glaucoma patients had been described since 1883¹, yet it is not routinely used during examination.
- It was understood, that color vision tests, are used to assess the central foveal vision which is the last area to be affected in glaucomatous damage.

¹ Albert Von Graefes Arch. Ophth, 1883, 29: 71-116

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This is NOT TRUE

The color vision is early **AFFECTED**
in glaucomatous damage

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This study deals with the effect of glaucomatous optic neuropathy on color sense using the new Pseudo-isochromatic color testing plates (NASSAR COLOR TESTING PLATES²) that deals with not only congenital CVD but also the acquired pathological color vision deficiencies too.

² Nassar Color Testing Plates. Bull Ophthalmol Soc Egypt, 1997; 90: 647-652

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- There are two different kinds of retinal receptors:
 - Rods
 - Cones
- Cones are specialized in color vision.
- Three different subgroups of cones exist.
- Each having a peak sensitivity at a certain wavelength.
 - **Long-wavelength (L)**, or **red-sensitive (R)** cones contain the photopigment Erythrolabe.
 - **Mid-wavelength (M)**, or **green-sensitive (G)** cones contain the photopigment Chlorolabe.
 - **Short-wavelength (S)**, or **blue-sensitive (B)** cones contain the photopigment Cyanolabe.

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Adams and Berton³ proved that the central visual functions are early involved in glaucoma .

But why both V A and apparently color sense were falsely seem to be maintained till late stage of glaucoma ?

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This is because, the blue cone system or the short wave pathway is the one that early and more susceptible to pathological damage by glaucoma, more than the red and green cone system, i.e. the long and medium pathway.

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Why this?

The blue cones are:

- few in number (32 R : 16 G : 1 B)
- Larger in size (magnocellular)
- Long connection (spatial and temporal summation)
- Thus they are more susceptible to damage

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Visual acuity is maintained in glaucoma thanks to **L** and **M** pathways

While

Color sense (blue or **S** short pathway) is early affected in glaucoma

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Patients and Methods:

- The study includes 13 control age-matched subjects and 26 patients with OH, NTG, POAG & CACG.
- Both groups were subjected to the new pseudo-isochromatic plates (Nassar Colour Testing plates).

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The "Nassar Color Testing Plates" can deal with both congenital CVD represented as protanomalous (R- long pathway) and deuteranomalous (G- medium pathway), and pathological CVD represented as tritanomalous (B- short pathway).

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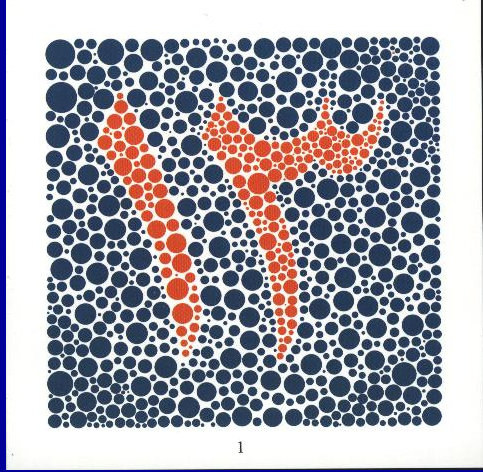
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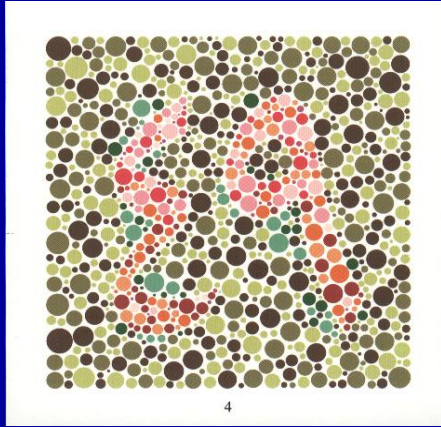
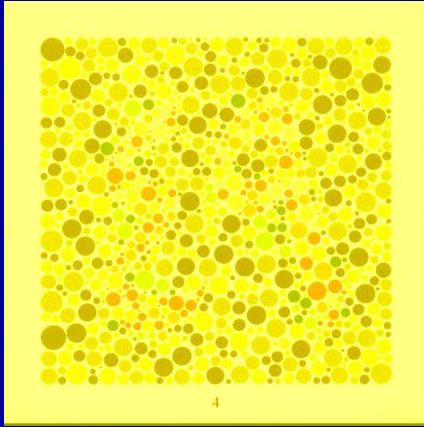


Could be read by any subject

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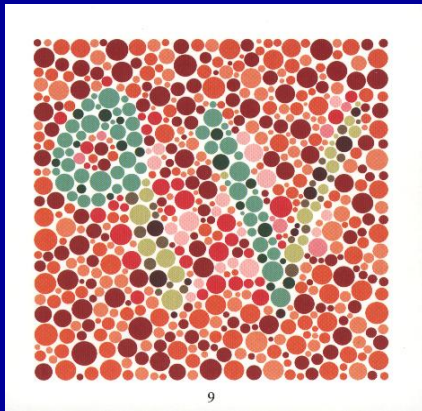
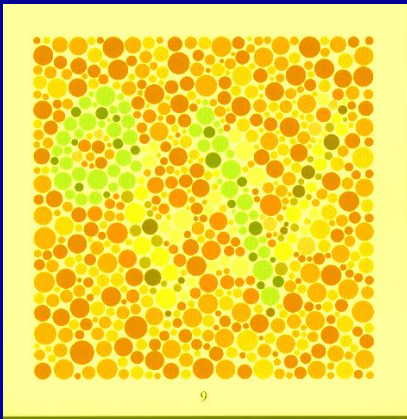


Red-Green Deficiencies

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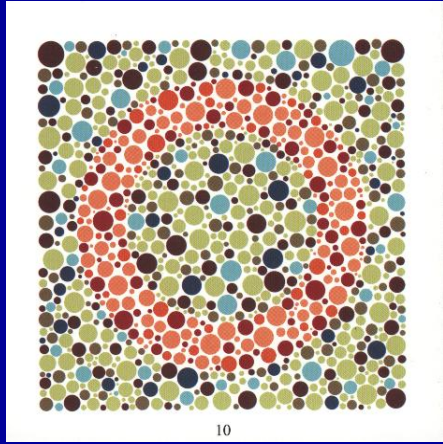
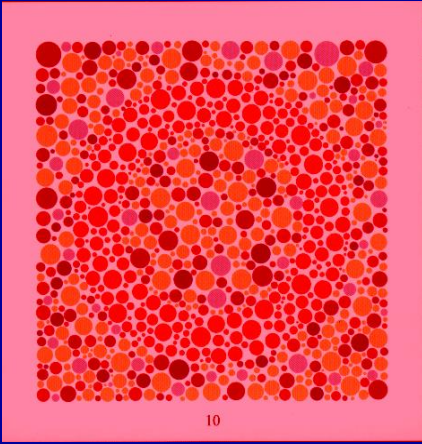


Red-Green Deficiencies

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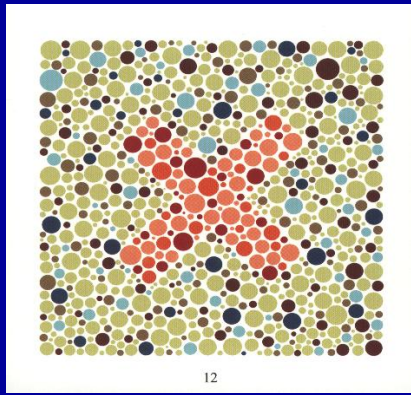
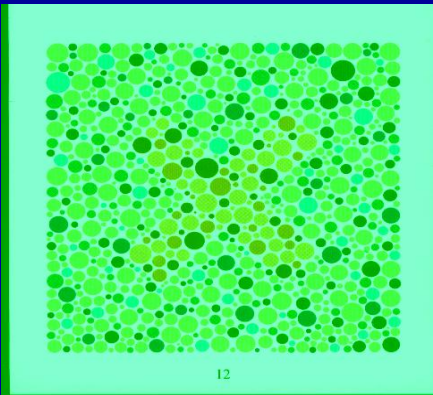


Red-Green Deficiency

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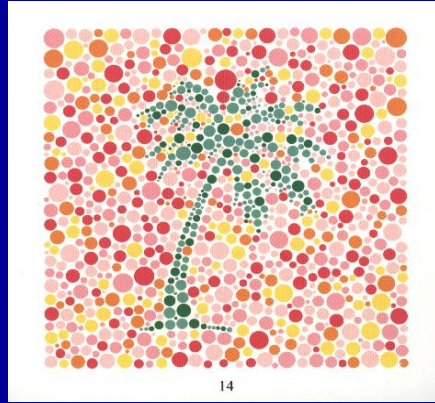
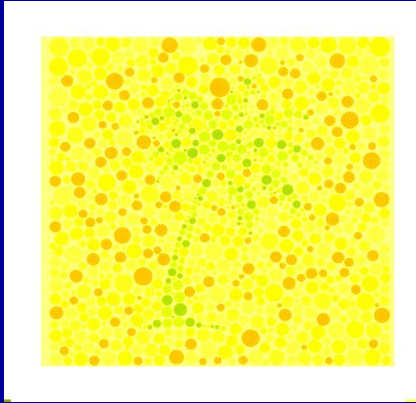


Red-Green Deficiency

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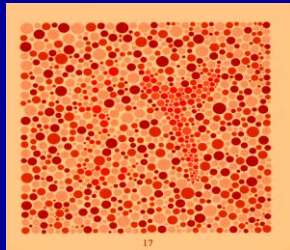


Red-Green Deficiency

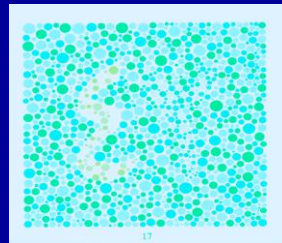
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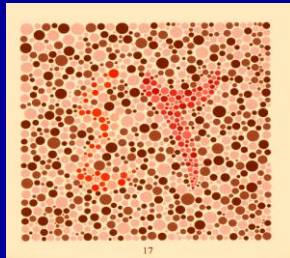
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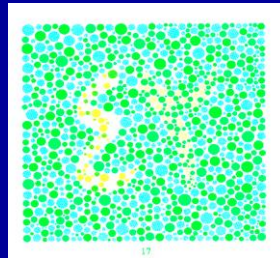
Protanopia



Deuteranopia



Protanomaly

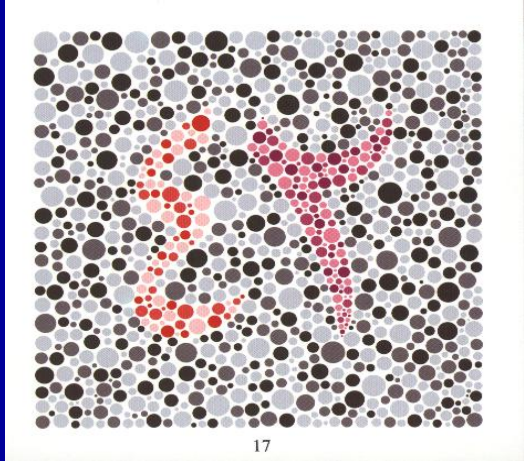


Deuteranomaly

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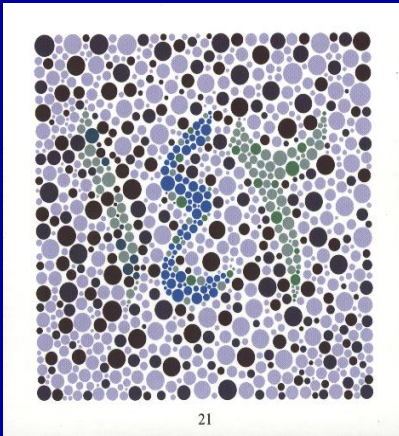


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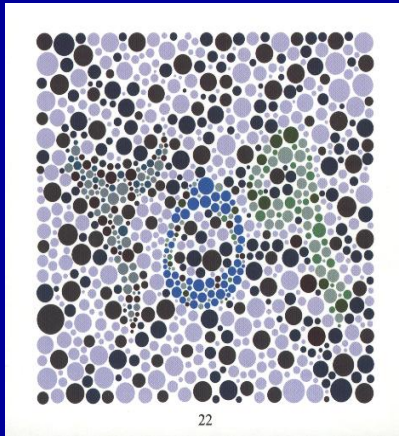
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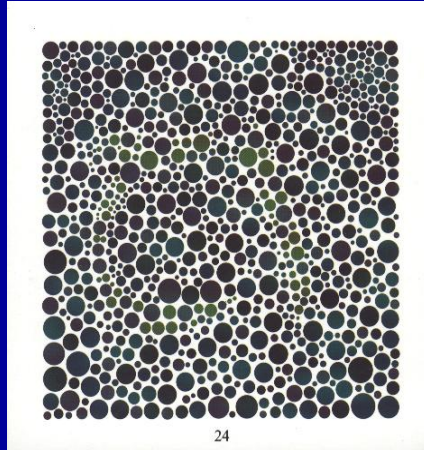
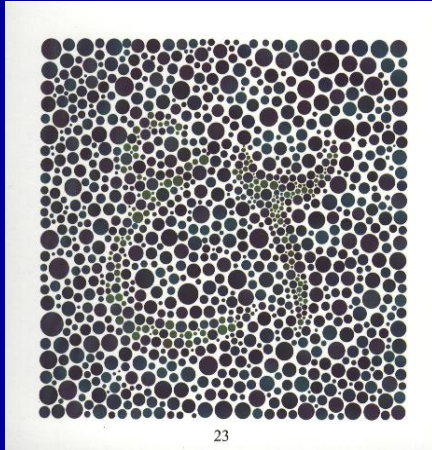
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Blue-Yellow Deficiencies
Tritanomaly and Tritanopia
short-wave length pathway

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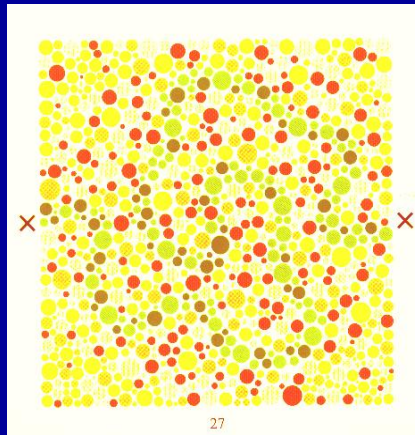
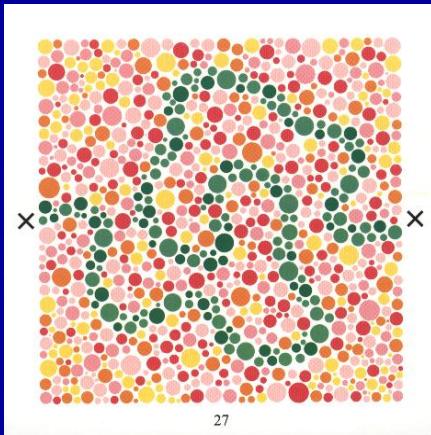


Blue-Yellow Deficiencies
Tritanomaly and Tritanopia
short-wave length pathway

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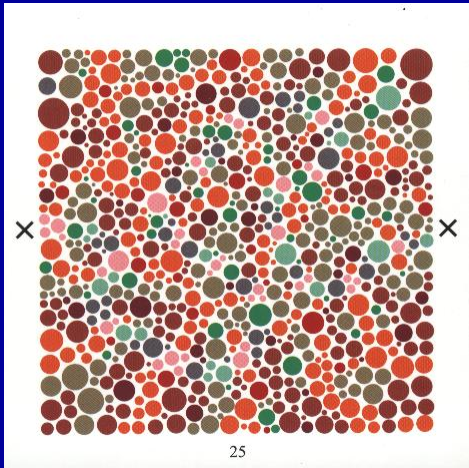


Form and color sense of Deuteranopia

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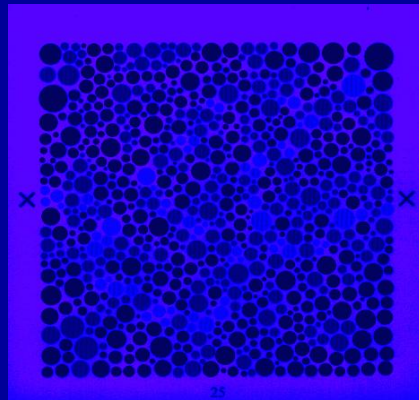
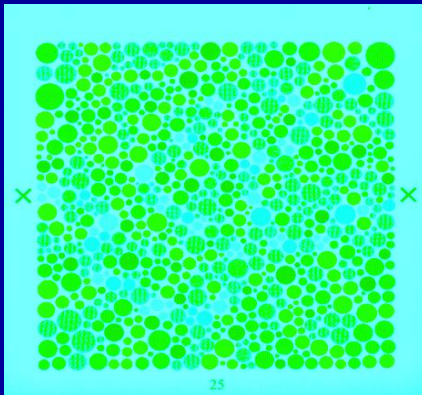


Can not be traced by normal subjects

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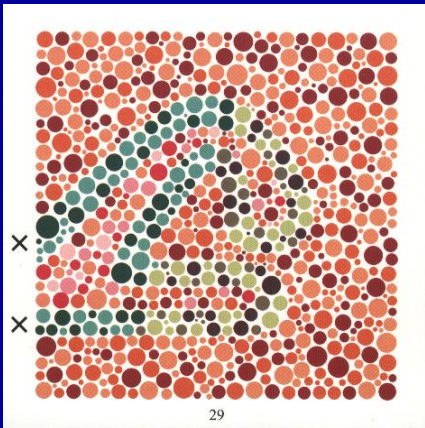


Can be traced by Red-Green deficient only

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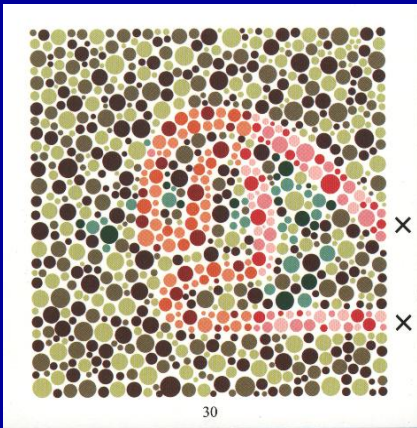


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A




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B

Form and color sense to differentiate between :

- deuteranomaly and deuteranopia (A)
- protanomaly and protanopia (B)

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Results:

- The group of patients who manifested CVD in glaucoma group were below the extreme limits of the control group.
- The tritanomal portion of CVD or the short pathway – **B** cones, was prominent and increased with the increase of the severity of the VF in glaucoma.
- The incidence of B/Y deficiencies were significantly high in both POAG and CNAG while it is mild in OH and NTG.
- Red-green deficiencies were noticed in the advanced stages of glaucoma.

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Conclusion

Colour sense, is an important component in visual perception and can be used as an indicator, of how serious is the damage in glaucomatous optic neuropathy.

Tritanomalous colour plates or blue-yellow deficiency can predict the existence of glaucoma. This explains why achromatic contrast sensitivity loss, can be seen in patients with preserved visual acuities.

Colour sense, should be routinely tested as VA, so as to be able to test, not only light & form senses but also the colour sense.



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Thank you



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