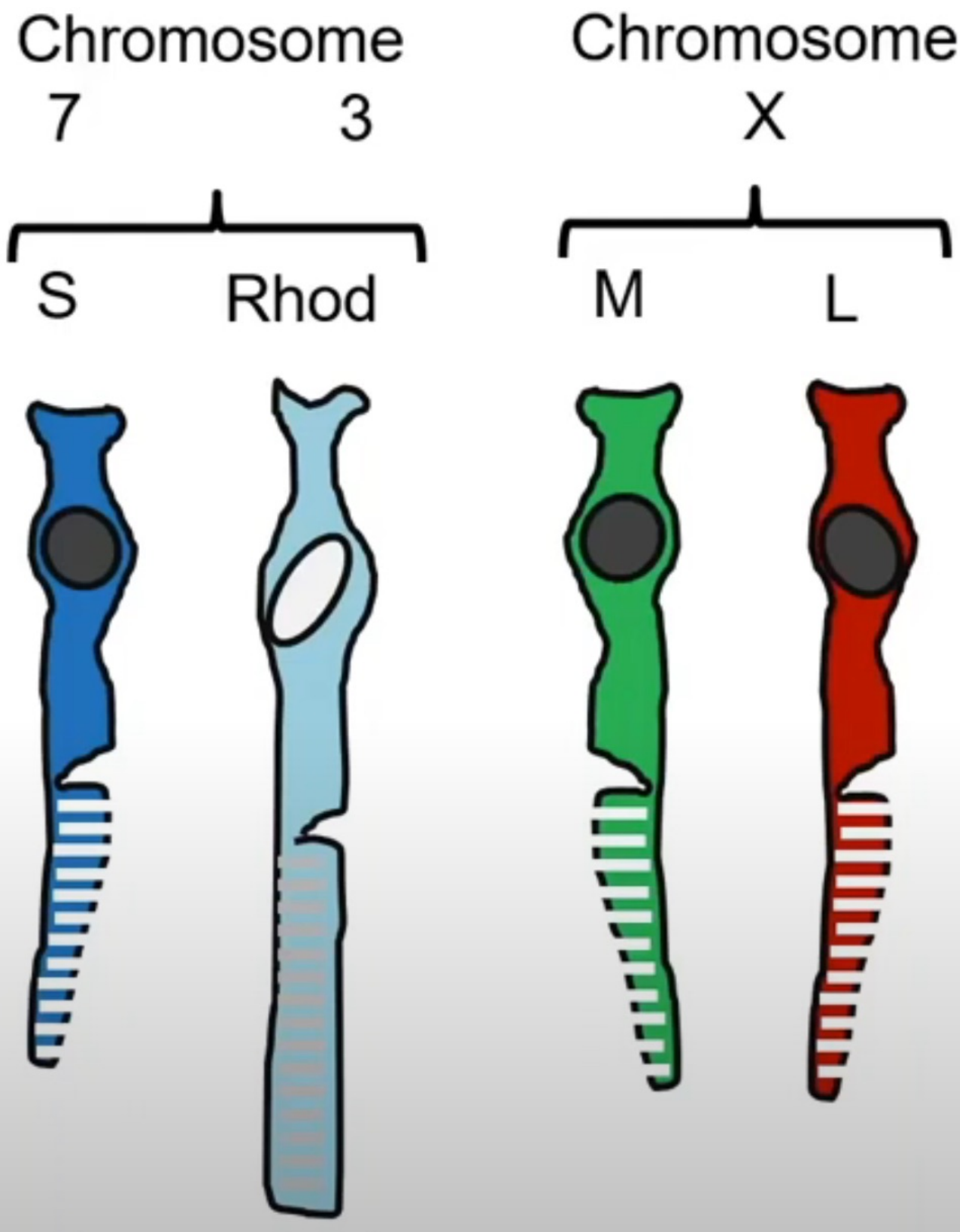
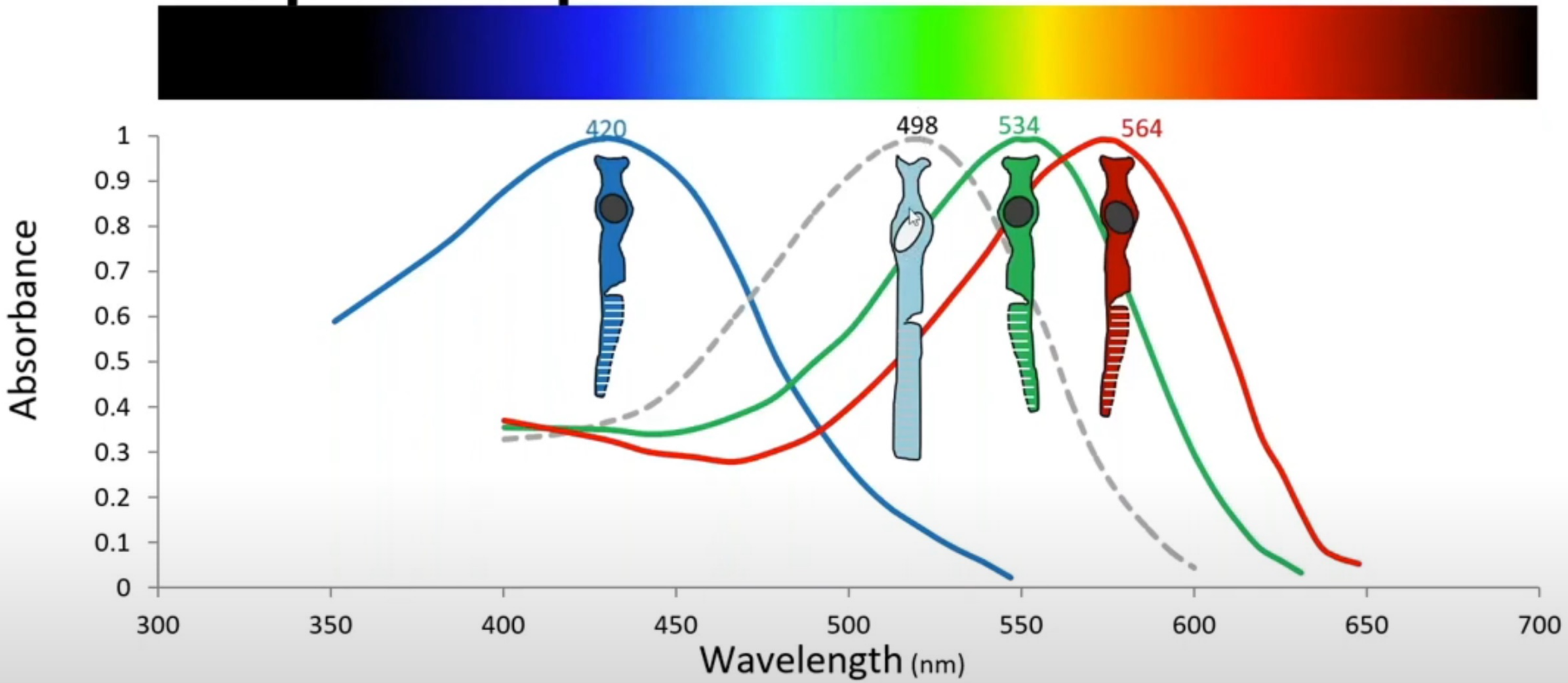
Primates

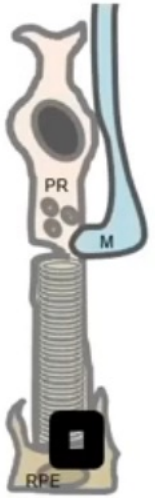


Opsin Spectral **Absorbance**



Retinoid Cycle

Largely Conserved in both Rods and Cones



Rod

hν

Opsin

Retinoid Released

all-trans-retinal

NADPH

NADP+

RDH8

RDH12

N-retinylidene-PE

ABCA4

all-trans-retinal

11-cis-retinal

all-trans-retinol

IRBP

CRALBP

RDH5

RDH11

NADH

NAD+

IRBP

CRBP1

LRAT

RPE65

11-cis-retinol

all-trans-retinyl ester

all-trans-retinol

RPE

STRA6 (RBPR2)

Vasculature

TTR

RBP

Transthyretin Tetramer

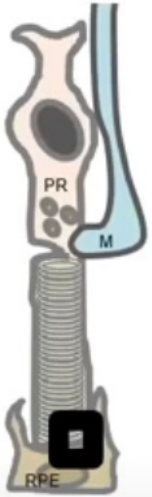
all-trans-retinol

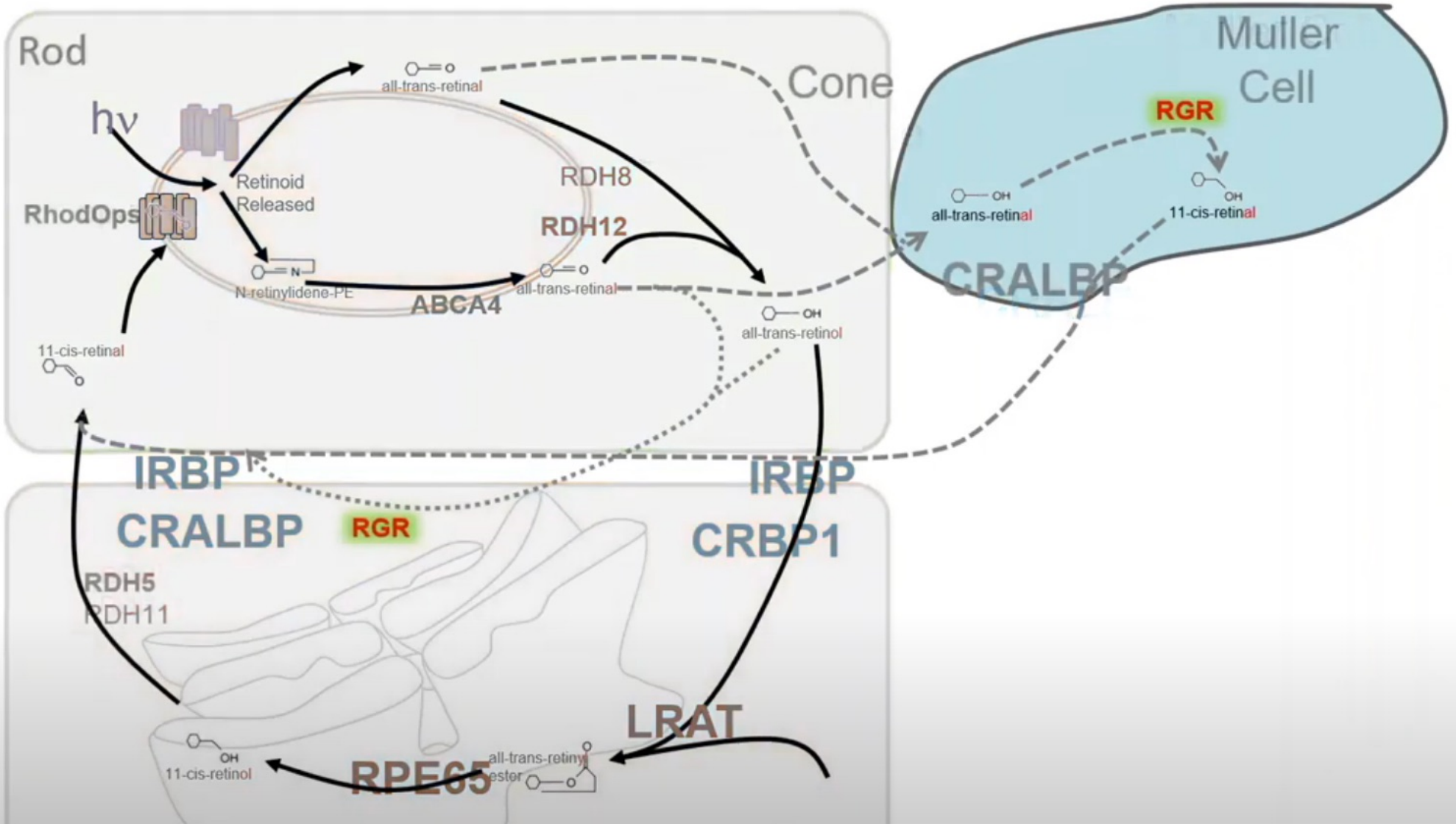
From Liver

Enzymes

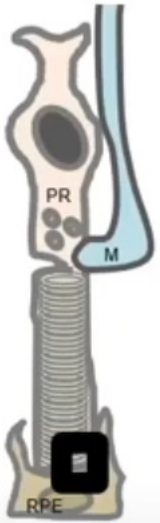
Binding proteins

Disease States





Disease States



Rod

Cone

Muller Cell

hν

RhodOps

Retinoid Released

all-trans-retinal

RDH8

RDH12

N-retinylidene-PE

ABCA4

all-trans-retinal

all-trans-retinol

11-cis-retinal

RGR

all-trans-retinal

11-cis-retinal

CRALBP

IRBP

CRALBP

RGR

IRBP

CRBP1

RDH5

RDH11

LRAT

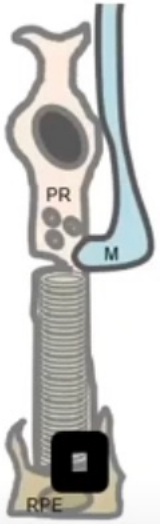
11-cis-retinol

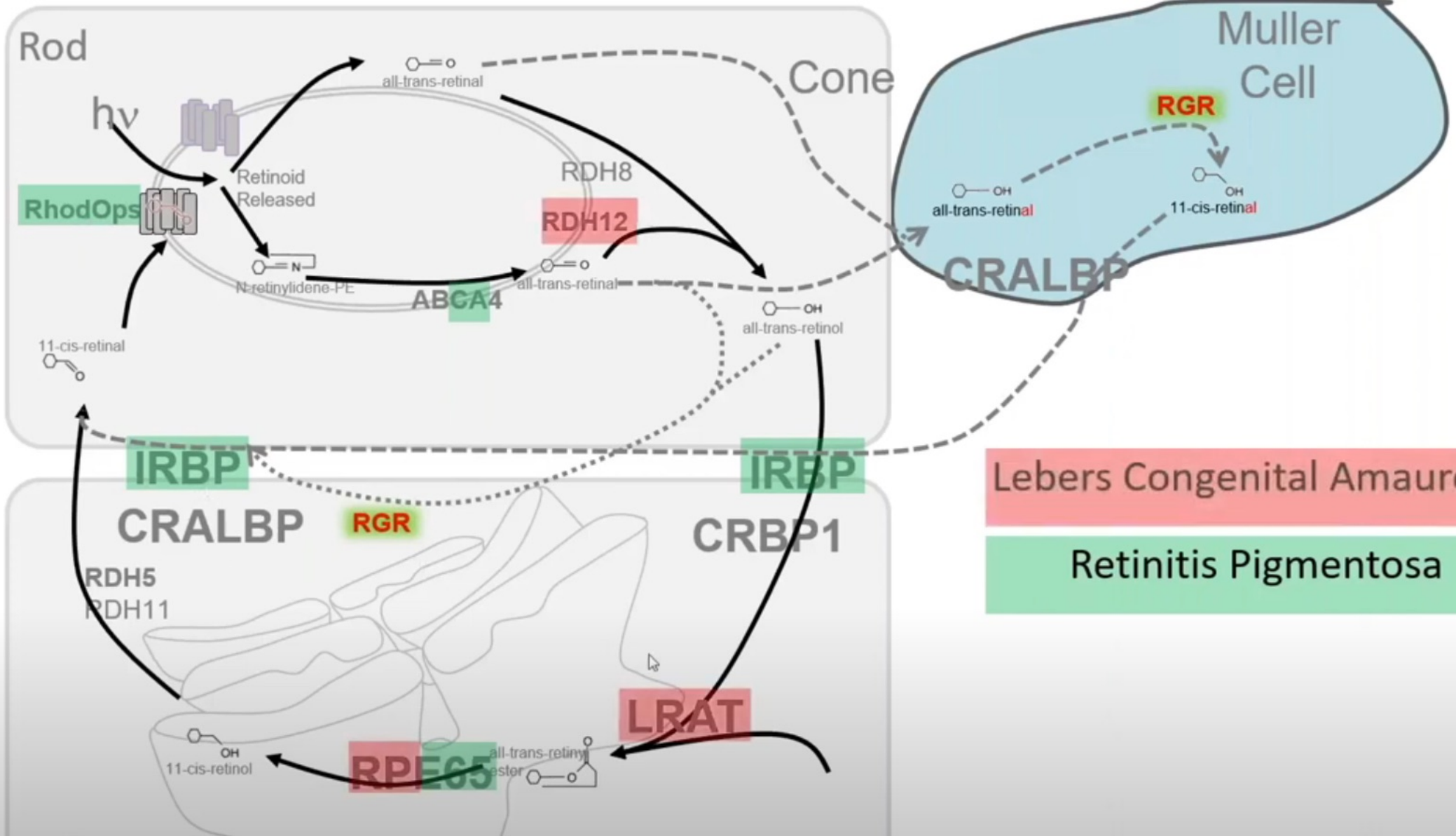
RPE65

all-trans-retinyl ester

Retinitis Pigmentosa

Disease States

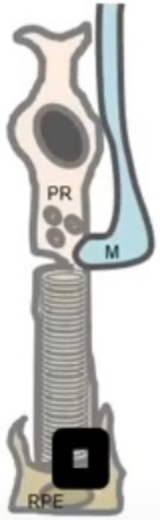


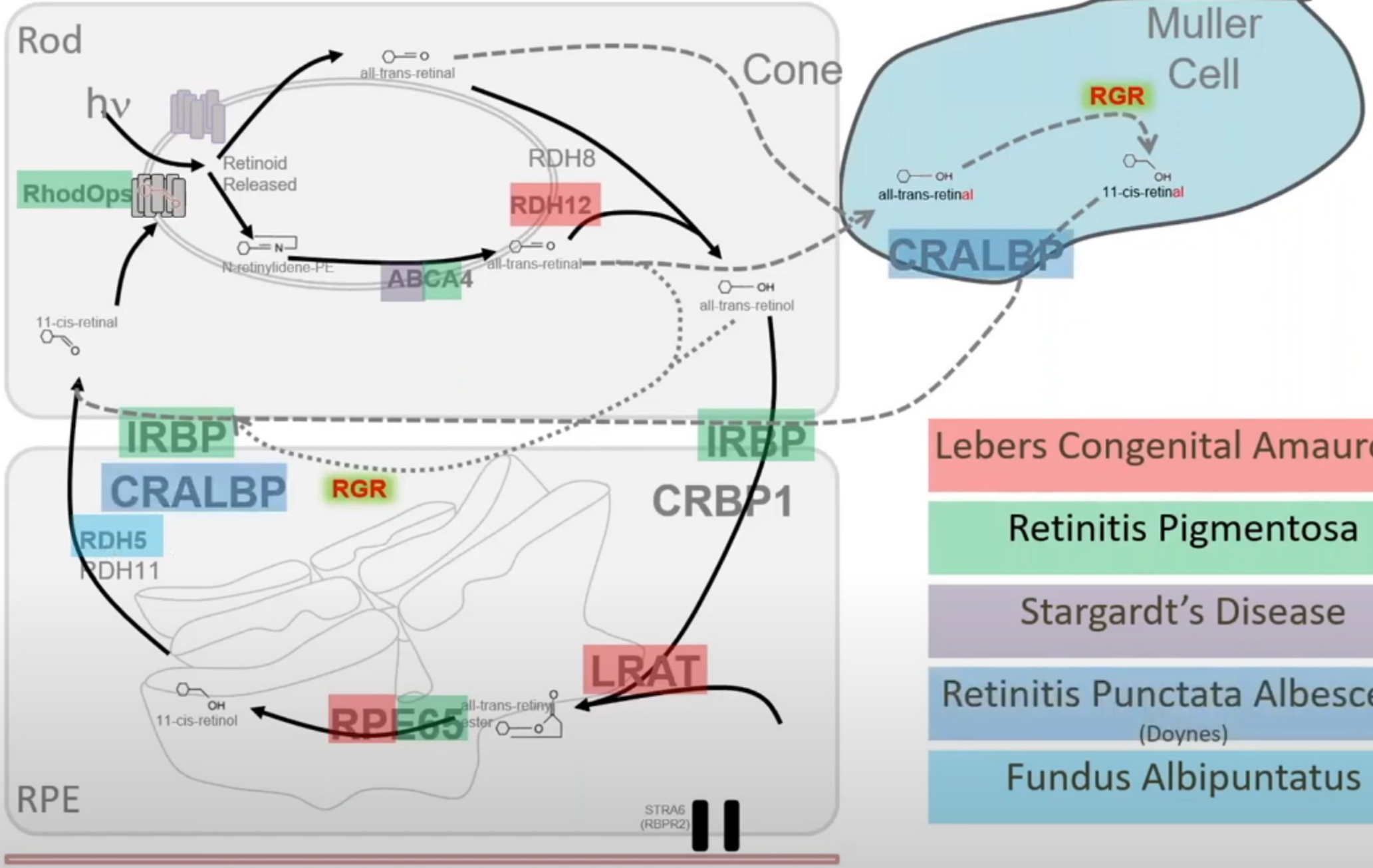


Lebers Congenital Amaurosis

Retinitis Pigmentosa

Disease States





- Lebers Congenital Amaurosis
- Retinitis Pigmentosa
- Stargardt's Disease
- Retinitis Punctata Albescens (Doynes)
- Fundus Albipuntatus

Normal

Blue Cone
Monochromacy

Protanomalous

Deuteranomalous

Tritanomalous

Achromatopsia

Protanopia

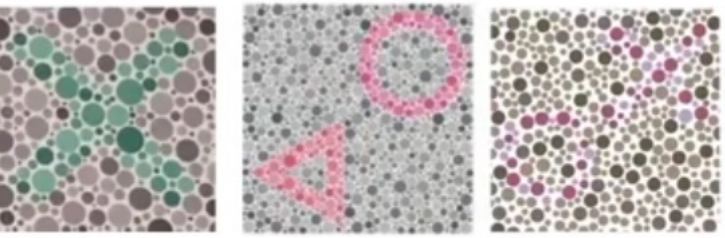
Deuteranopia

Tritanopia

Color Vision Testing

Ishihara

Hardy-Rand-Rittler



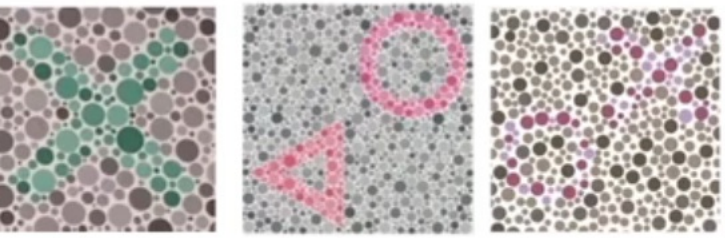
Sensitive for screening

Color vision loss

Color Vision Testing

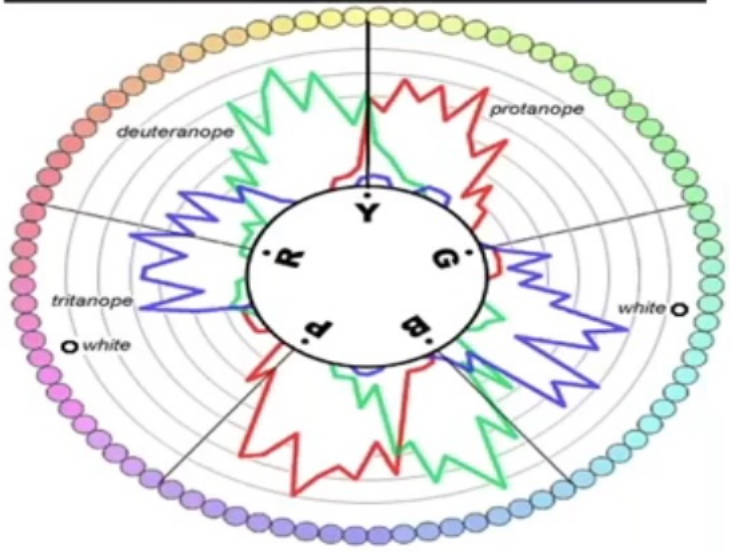
Ishihara

Hardy-Rand-Rittler



Sensitive for screening
Color vision loss

Farnsworth-Munsell D100

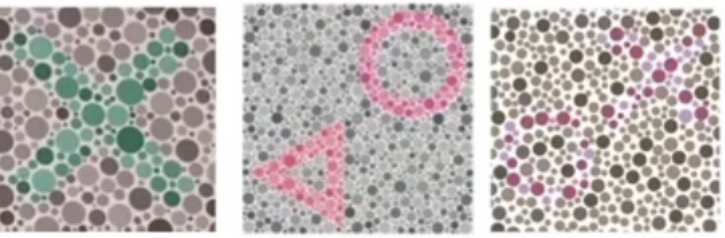


Specific for type of Color vision loss

Color Vision Testing

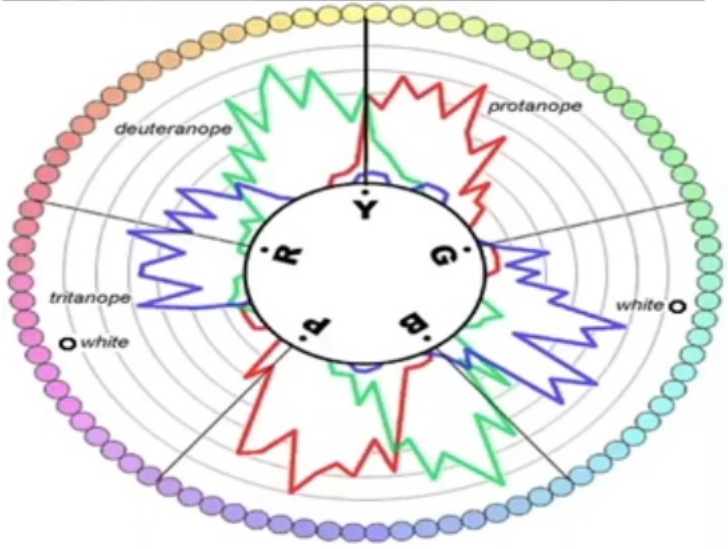
Ishihara

Hardy-Rand-Rittler



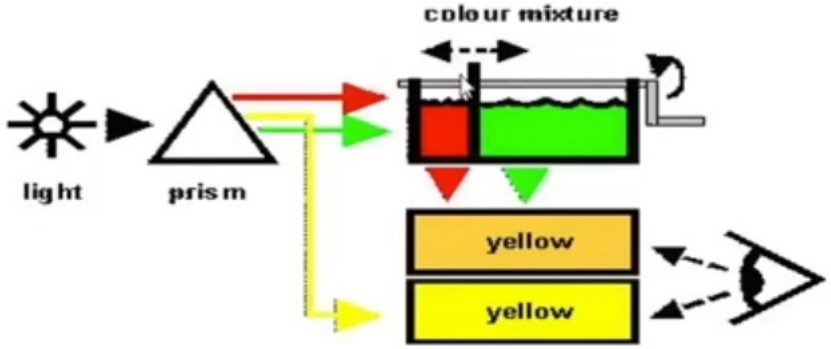
Sensitive for screening
Color vision loss

Farnsworth-Munsell D100



Specific for type of Color vision loss

Anomaloscope

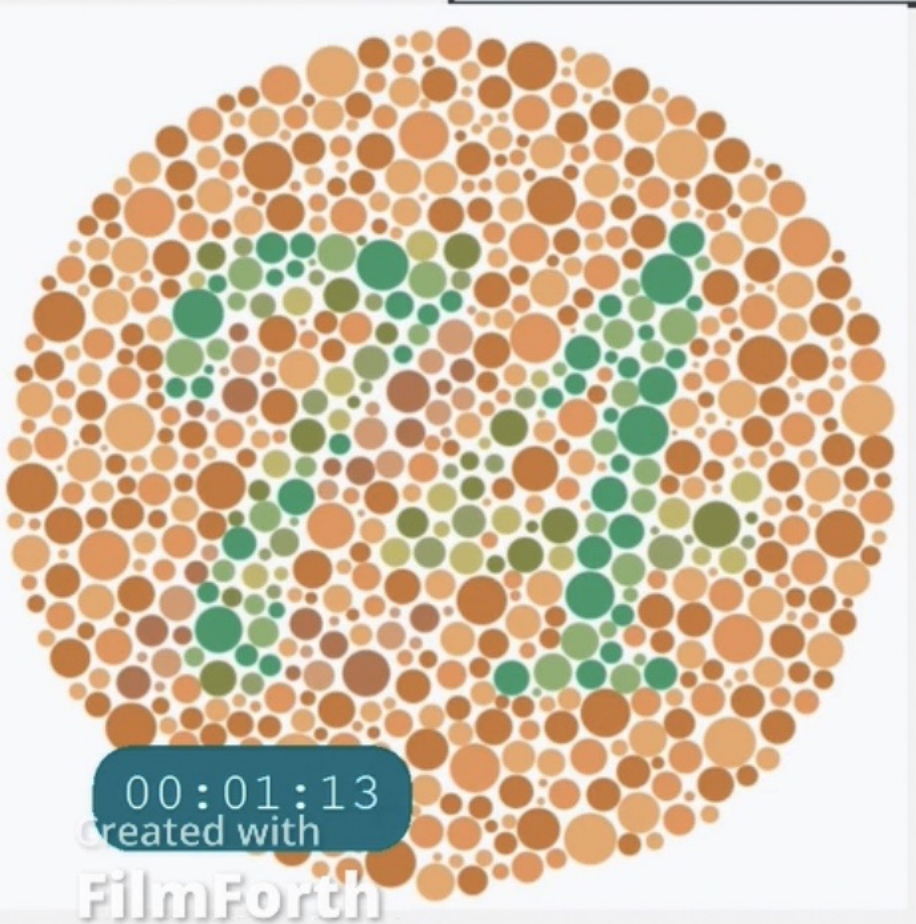


ISHIHARA CHART

- Named after its designer, Shinobu Ishihara, who first published his tests in 1917.
- **PSEUDOISOCHROMATIC PLATES**

COLOR PLATES which have letters written on them, appear isochromatic to individuals with color-vision abnormality

WHAT ARE ISHIHARA PLATES



CIRCLE WITH randomised COLOR DOTS

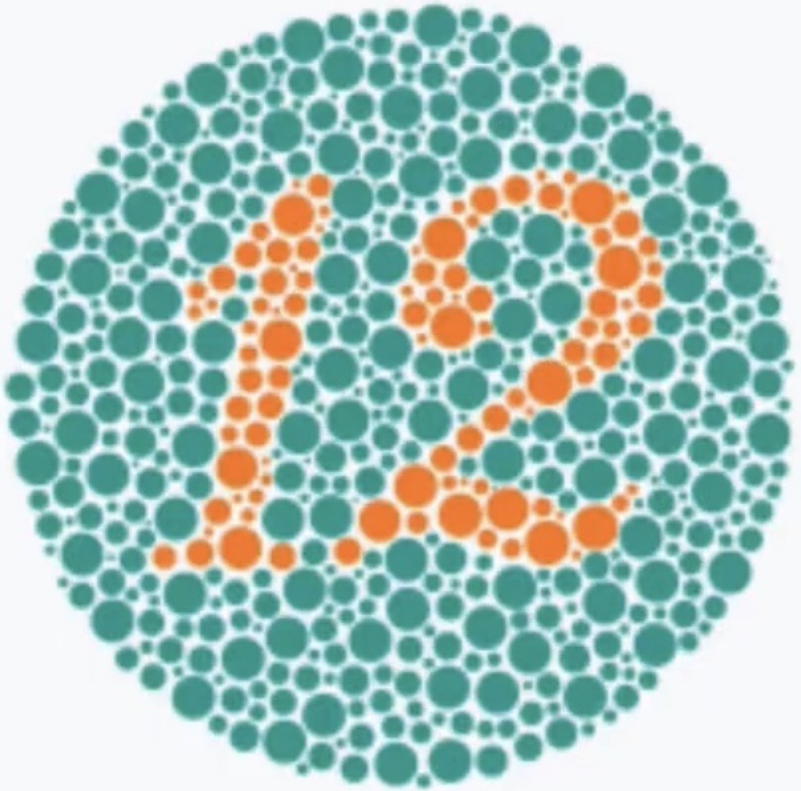
SPECIAL PLATES

Some visible only to color blind
And some are not visible to color blind patients

FULL TEST CONSISTS OF 38 PLATES

DEMONSTRATIVE PLATES

- Plate number one, typically the numeral "12"); designed to be visible by all persons, normal or color blind

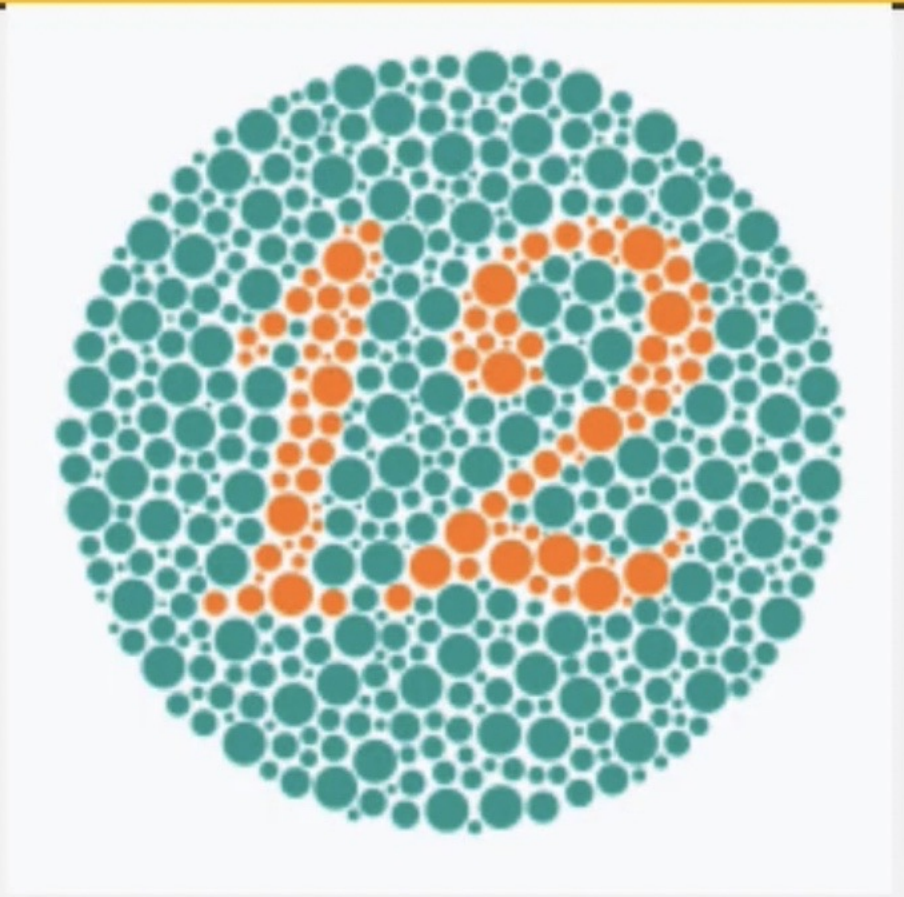


TYPES OF PLATES IN ISHIHARA TEST

- DEMONSTRATION
- TRANSFORMATION
- VANISHING PLATES
- HIDDEN DIGITS
- DIAGNOSTIC PLATES
- TRACING PLATES

DEMONSTRATIVE PLATES

- Plate number one, typically the numeral "12"); designed to be visible by all persons, normal or color blind

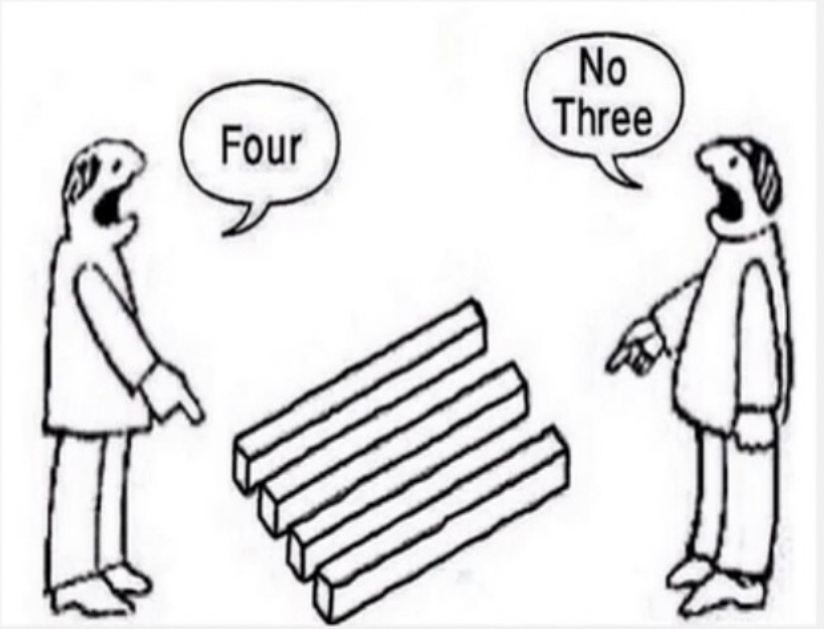


TRANSFORMATION PLATES

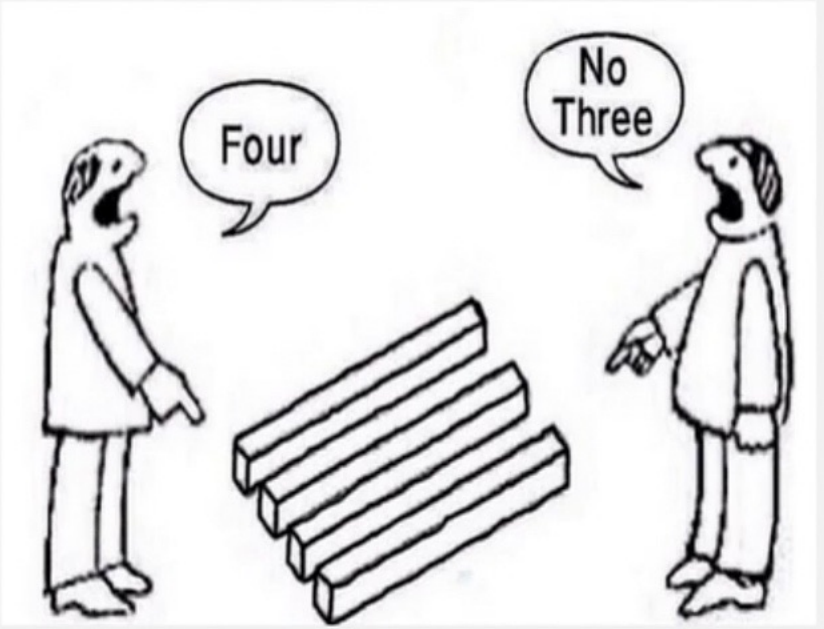
- Individuals with color vision defect should see a **different figure from** individuals with normal color vision.
- PLATES 2-9

Number of Plate	Normal Person	Person with Red-Green Deficiency	Person with Total Colour Blindness
1	12	12	12
2	8	3	X
3	6	5	X
4	29	70	X
5	57	35	X
6	5	2	X
7	3	5	X

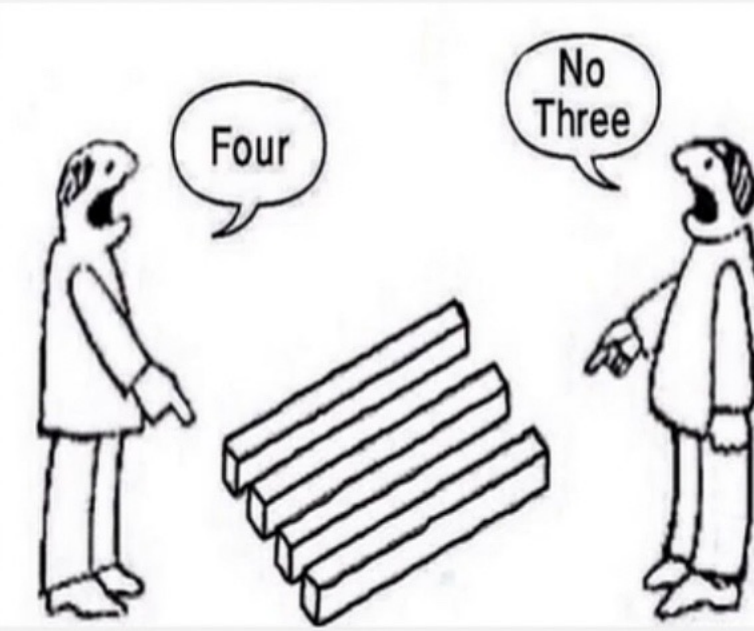
TRANSFORMATION PLATES



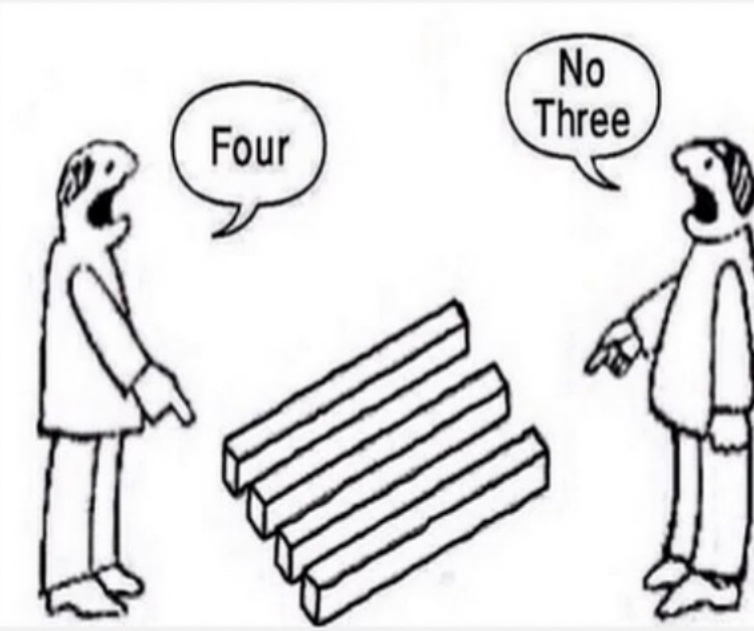
TRANSFORMATION PLATES



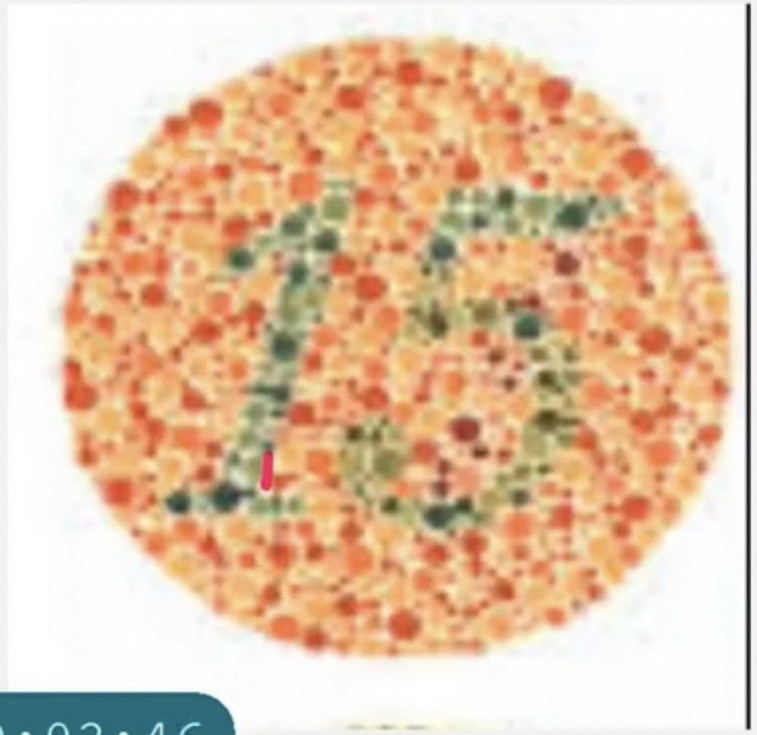
TRANSFORMATION PLATES

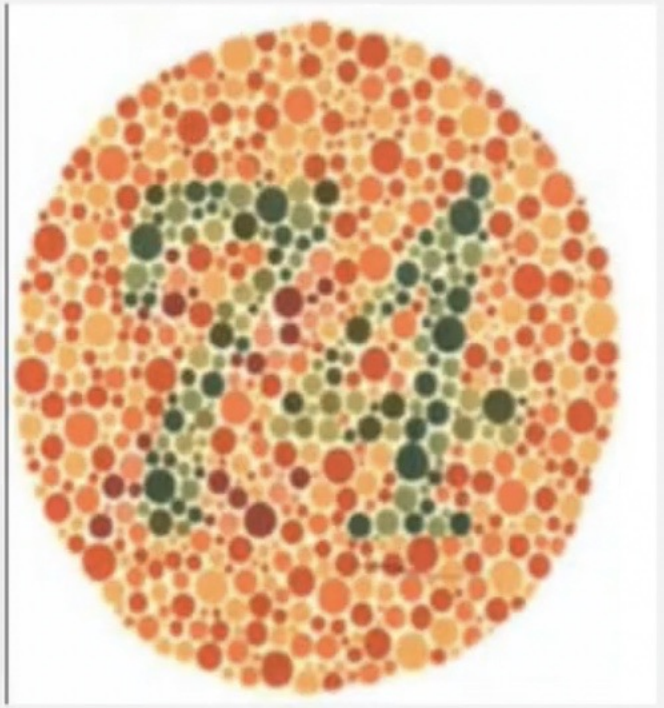


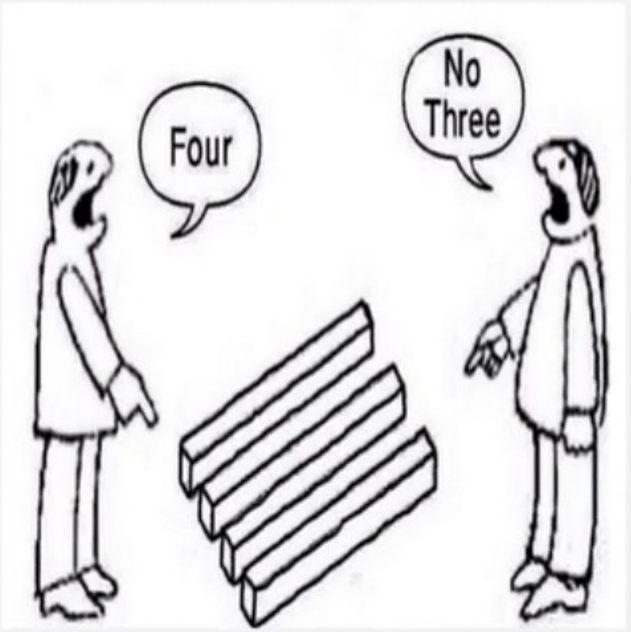
TRANSFORMATION PLATES



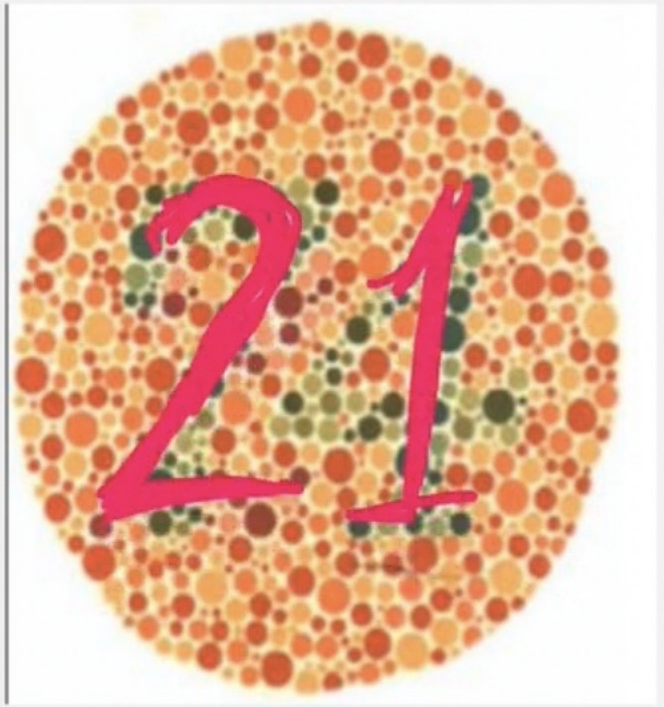
TRANSFORMATION PLATES

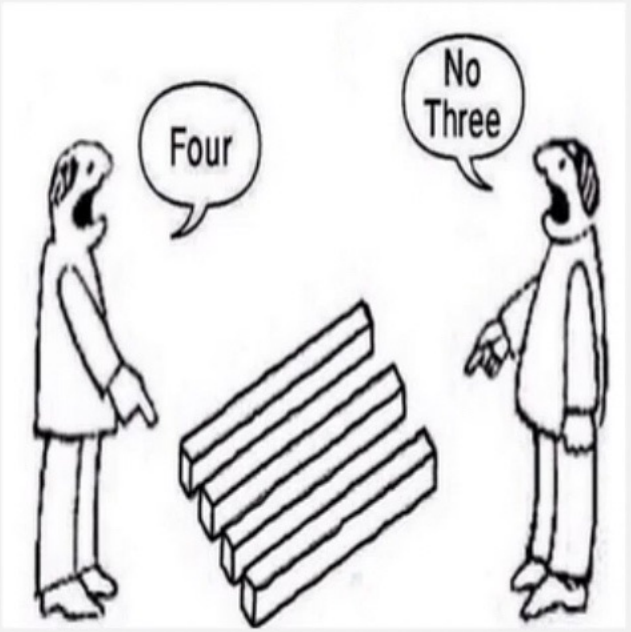






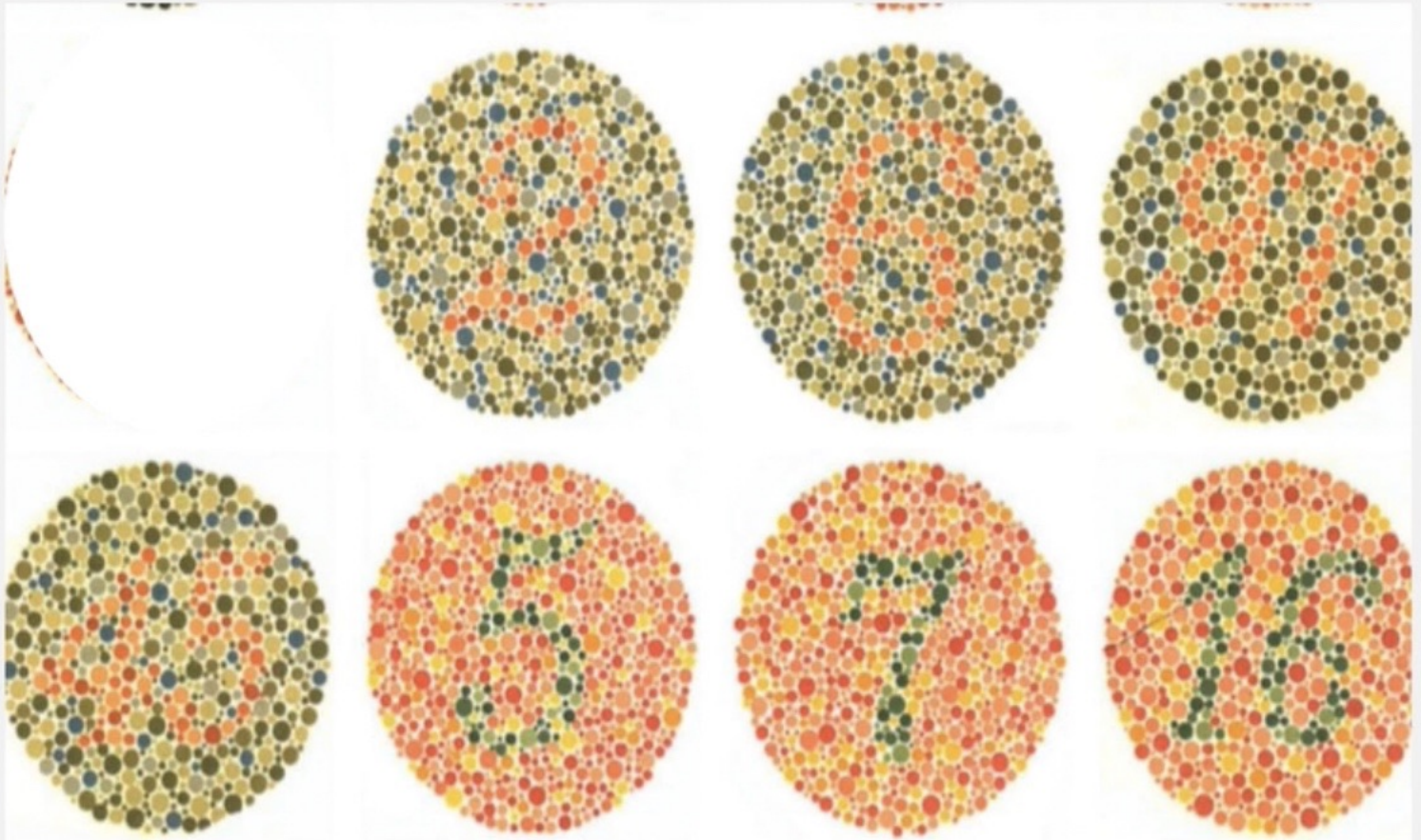
TRANSFORMATION PLATES





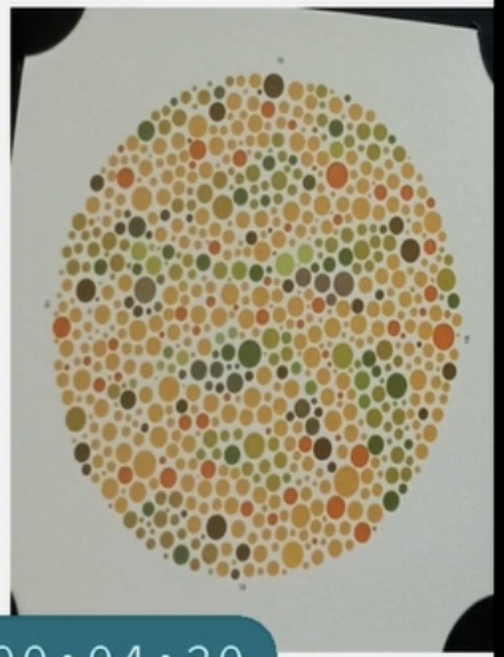
VANISHING PLATES

- Only NORMAL People can recognise these plates
- Plate 10-17

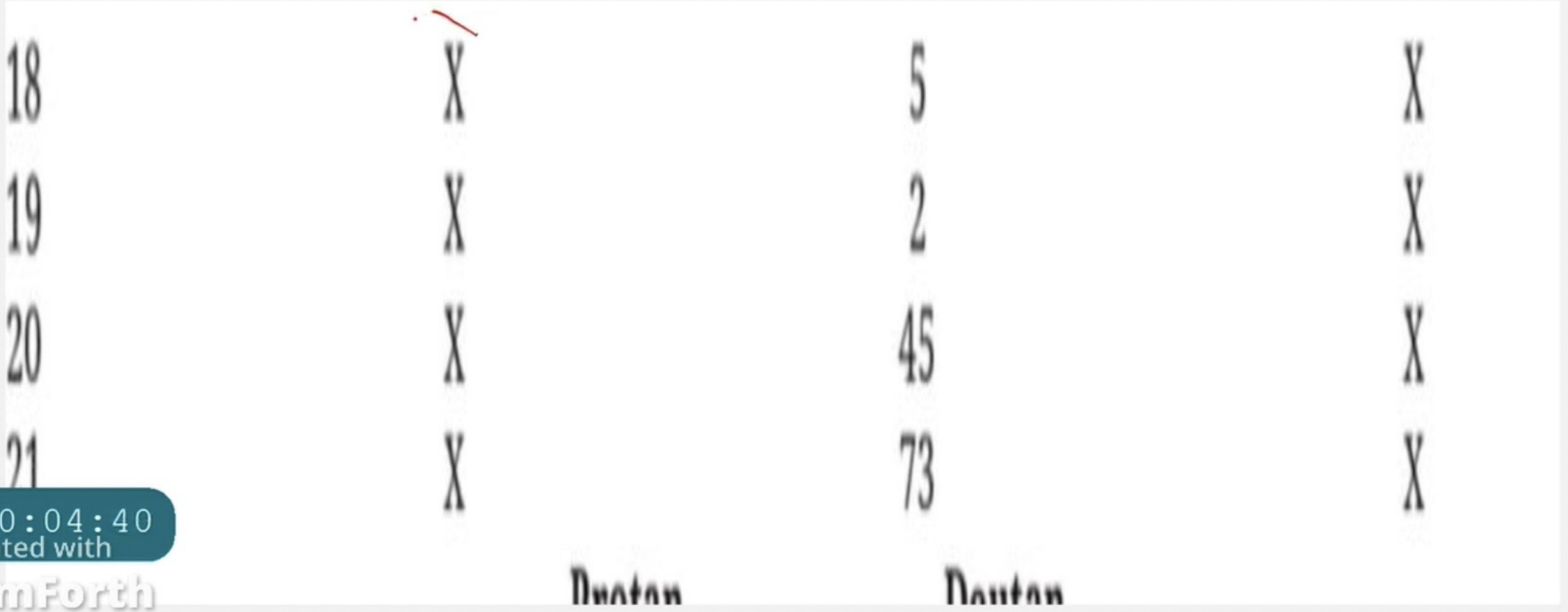


HIDDEN PLATES

HIDDEN PLATES

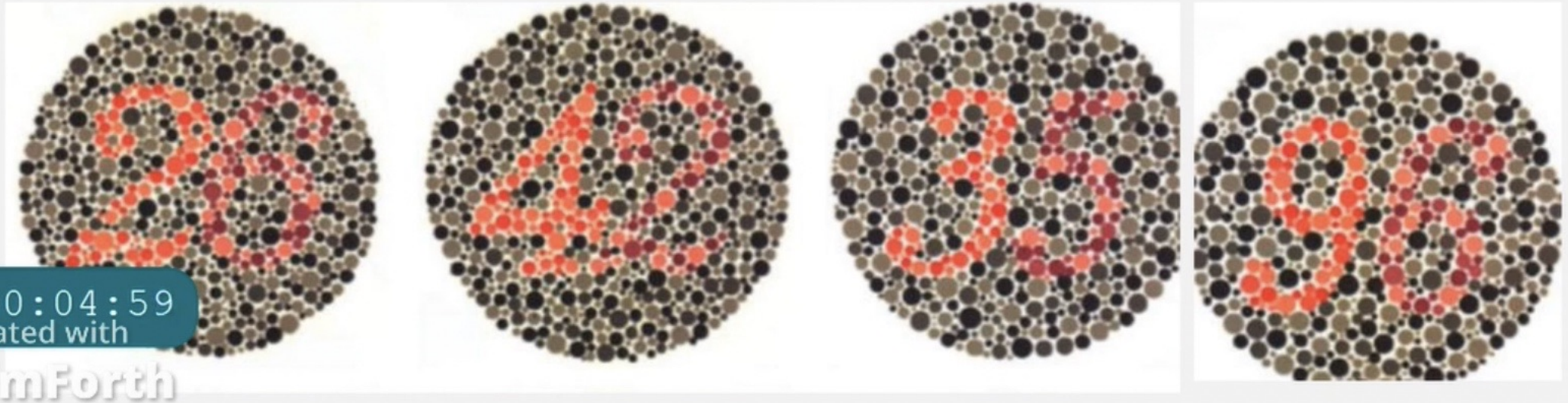


HIDDEN PLATES



DIAGNOSTIC PLATES

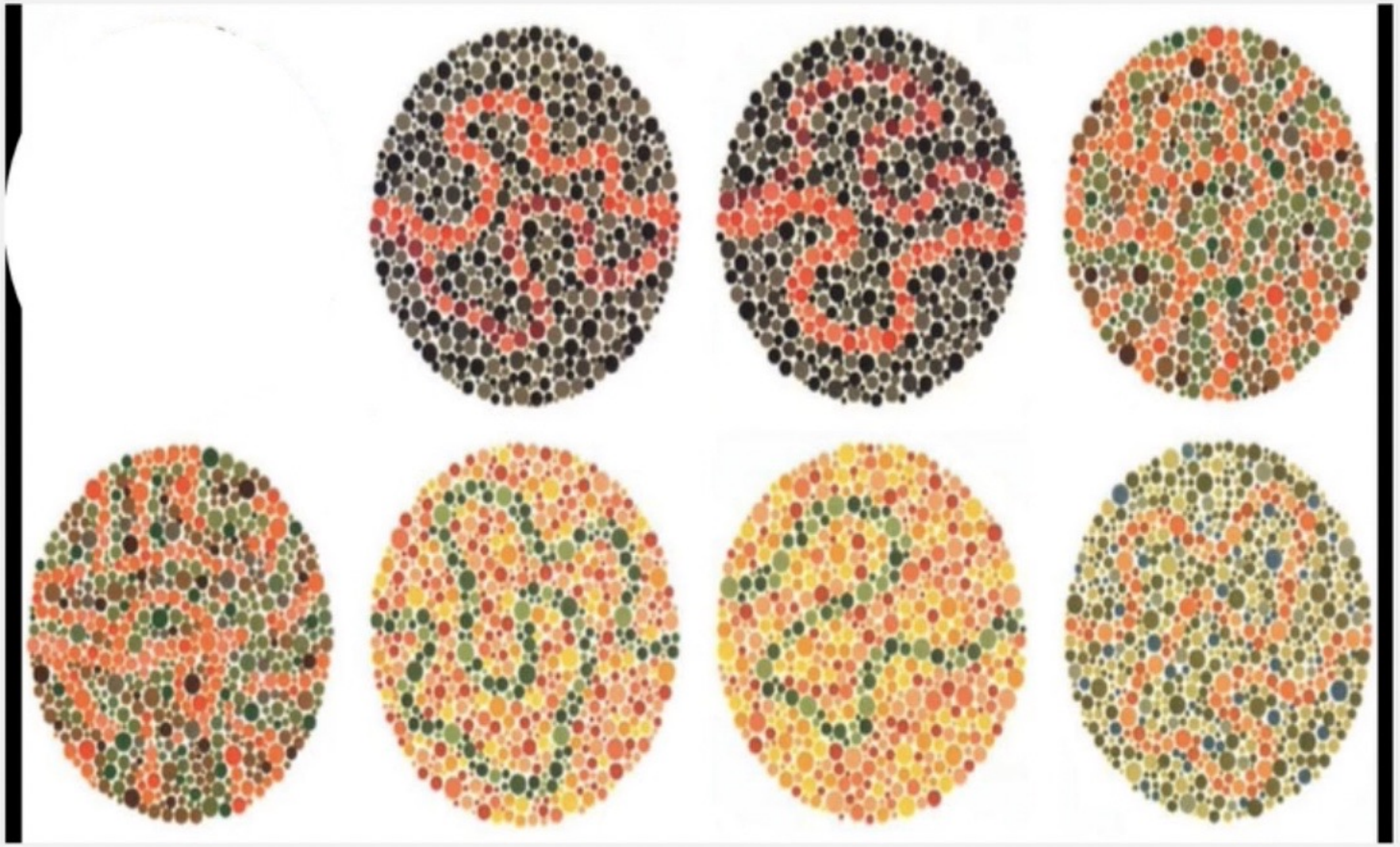
- determine the type of color vision defect (protanopia or deuteranopia) and the severity of it.
- Plate 22, 23,24,25



		Protan		Deutan	
		Strong	Mild	Strong	Mild
22	26	6	(2) 6	2	2 (6)
23	42	2	(4) 2	4	4 (2)
24	35	5	(3) 5	3	3 (5)
25	96	6	(9) 6	9	9 (6)

TRACING PLATES

- **Instead of reading a number, subjects are asked to trace a visible line across the plate.**



INTERPRETATION

- Depends on Institutional policy

US NAVY score is 12/14 is pass score(leaving the first plate)

Plate	Normal Person	Person with Red-Green Deficiencies	Person with Total Color Blindness and Weakness
1	12	12	12
2	8	3	X
3	29	70	X
4	5	2	X
5	3	5	X
6	15	17	X
7	74	21	X
8	6	X	X
9	45	X	X
10	5	X	X
11	7	X	X
12	16	X	X
13	73	X	X
14	X	5	X
15	X	45	X

		Protan		Deutan		
		Strong	Mild	Strong	Mild	
	26	6	(2) 6	2	2 (6)	
	42	2	(4) 2	4	4 (2)	

The mark X shows that the plate cannot be read. Blank spce denotes that the reading is indefinite. Th
numerals in parenthesis show that they can be read but they are comparatively unclear.