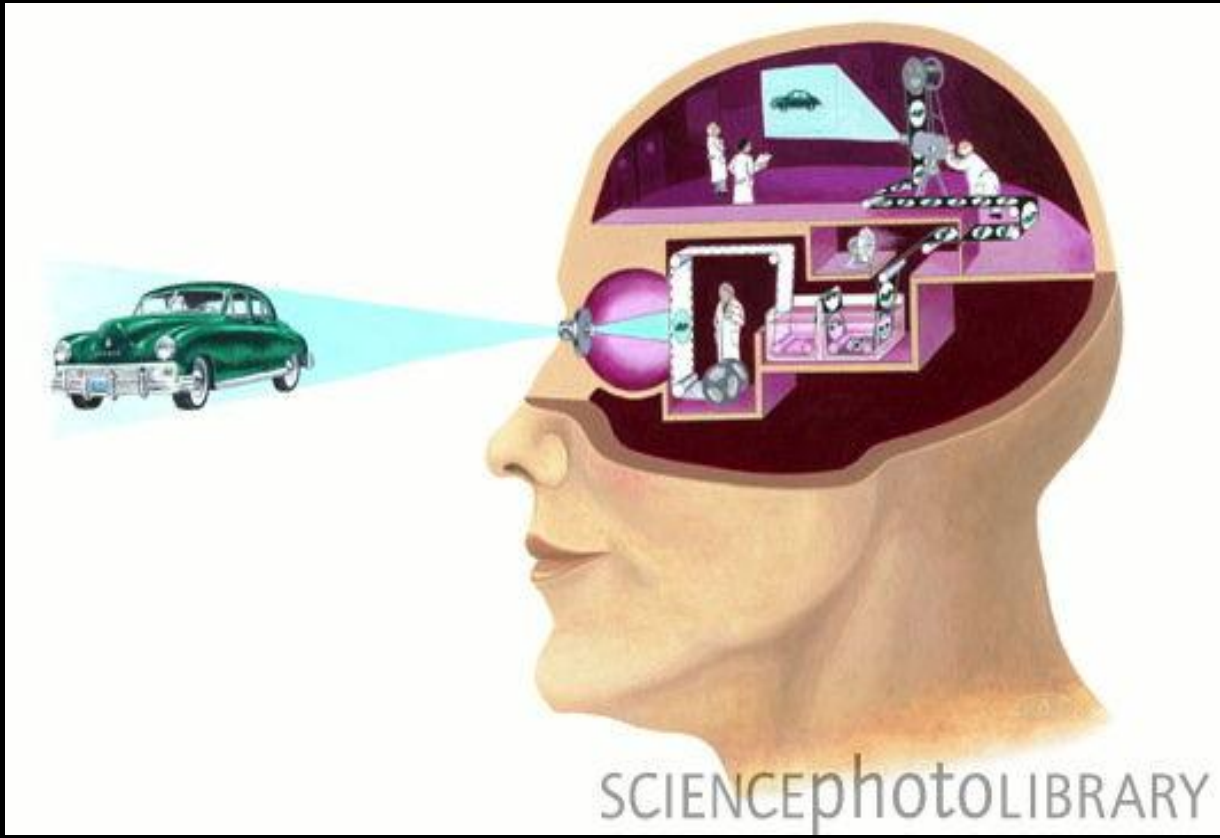
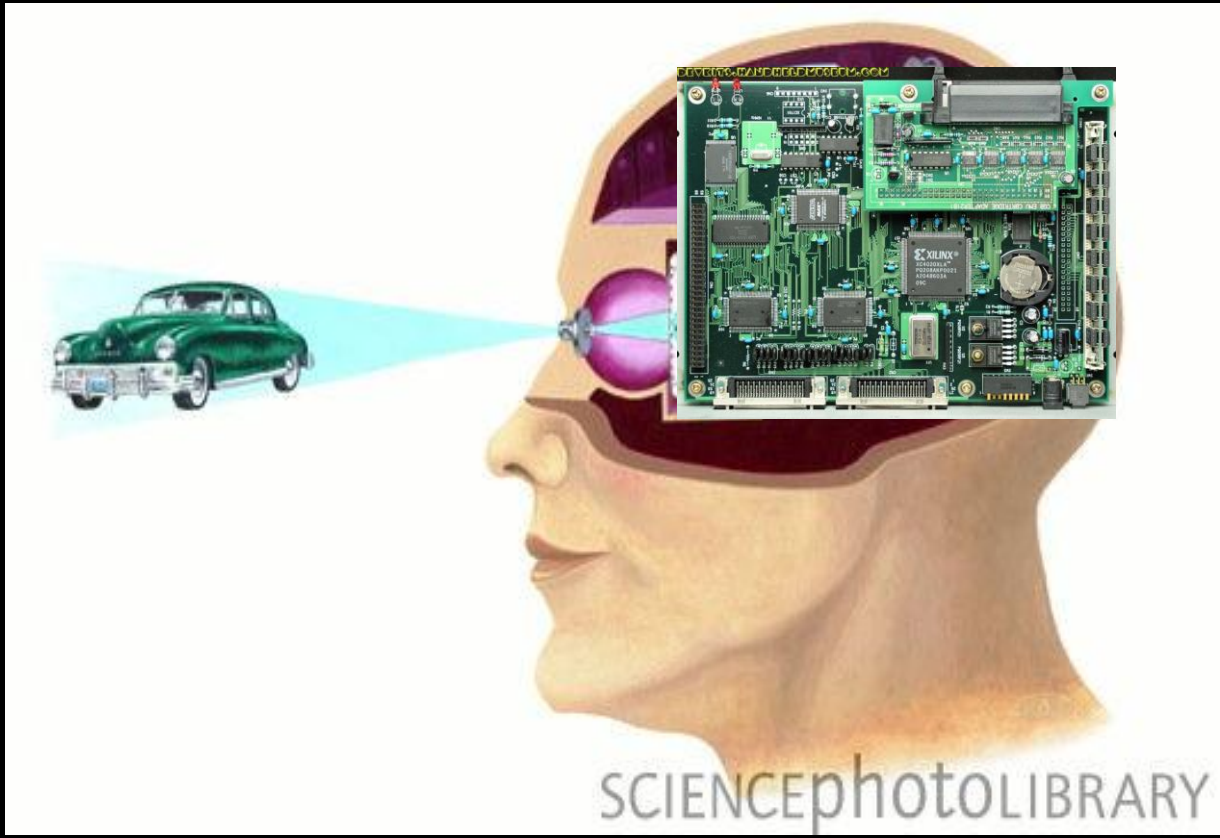
VISÃO

VISÃO



Homunculus Fallacy

VISÃO



Homunculus Fallacy

OLHO : CÂMERA

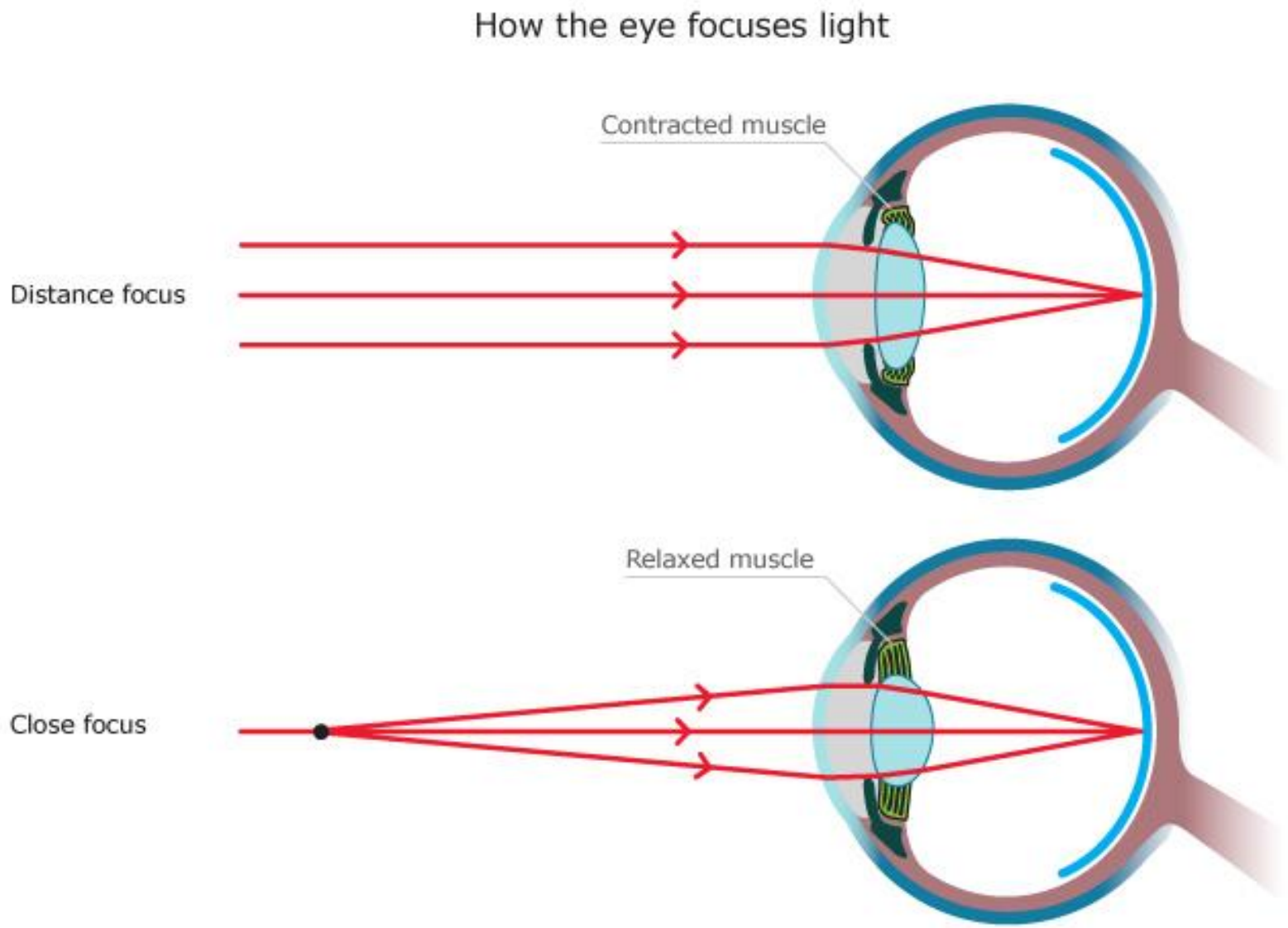
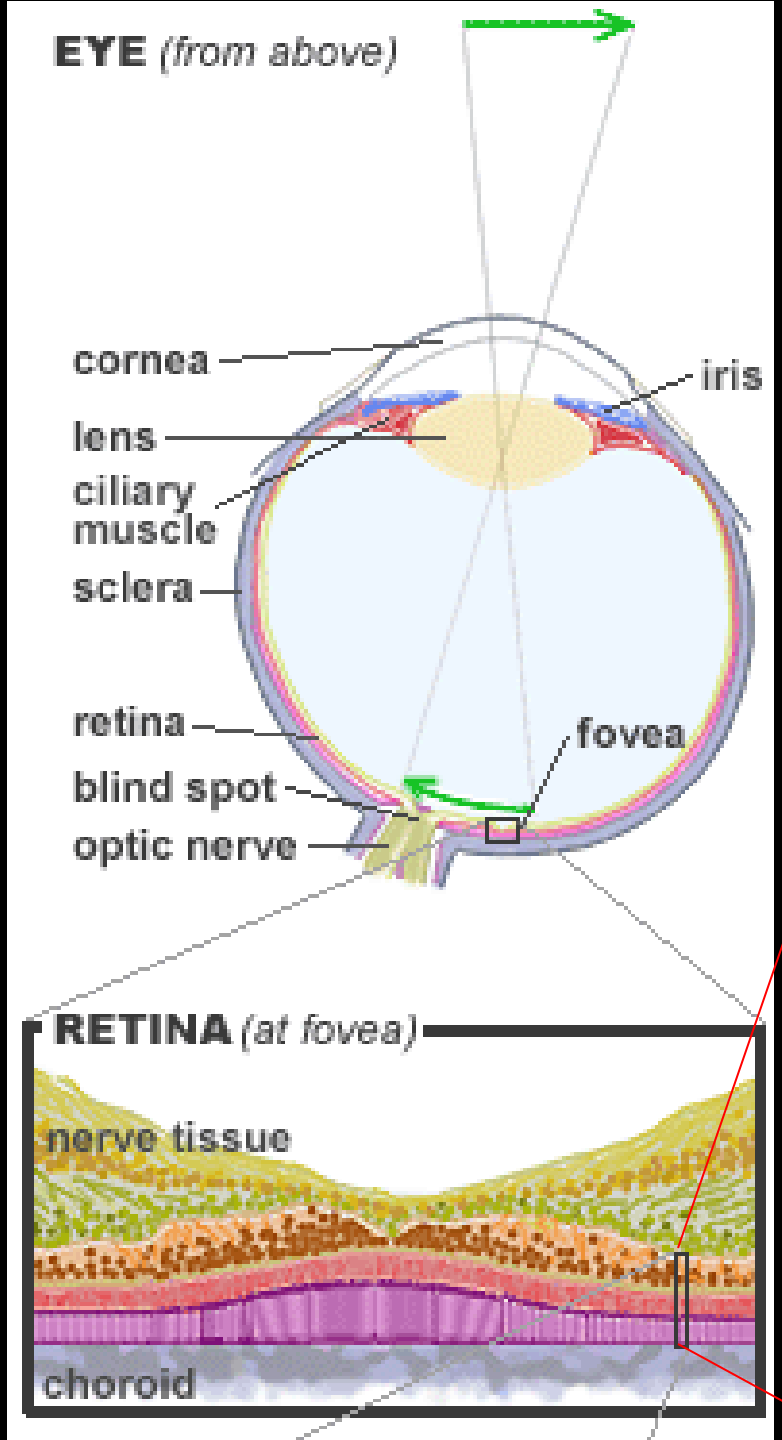


FOTO-SENSORES



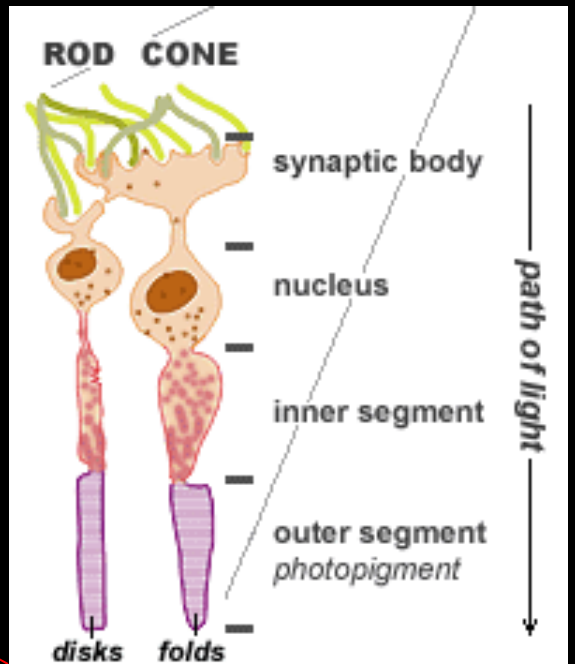


FOTO-SENSORES

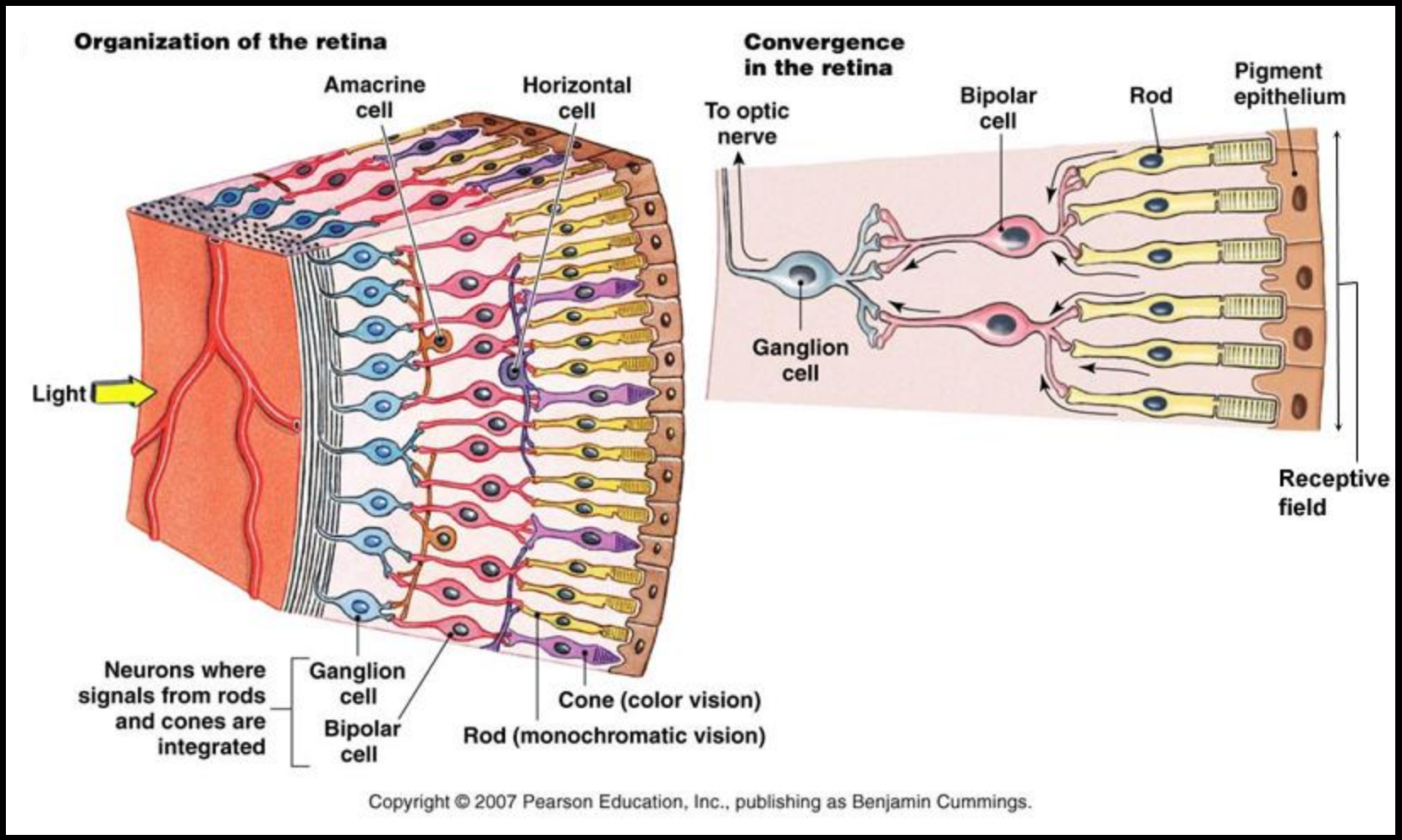
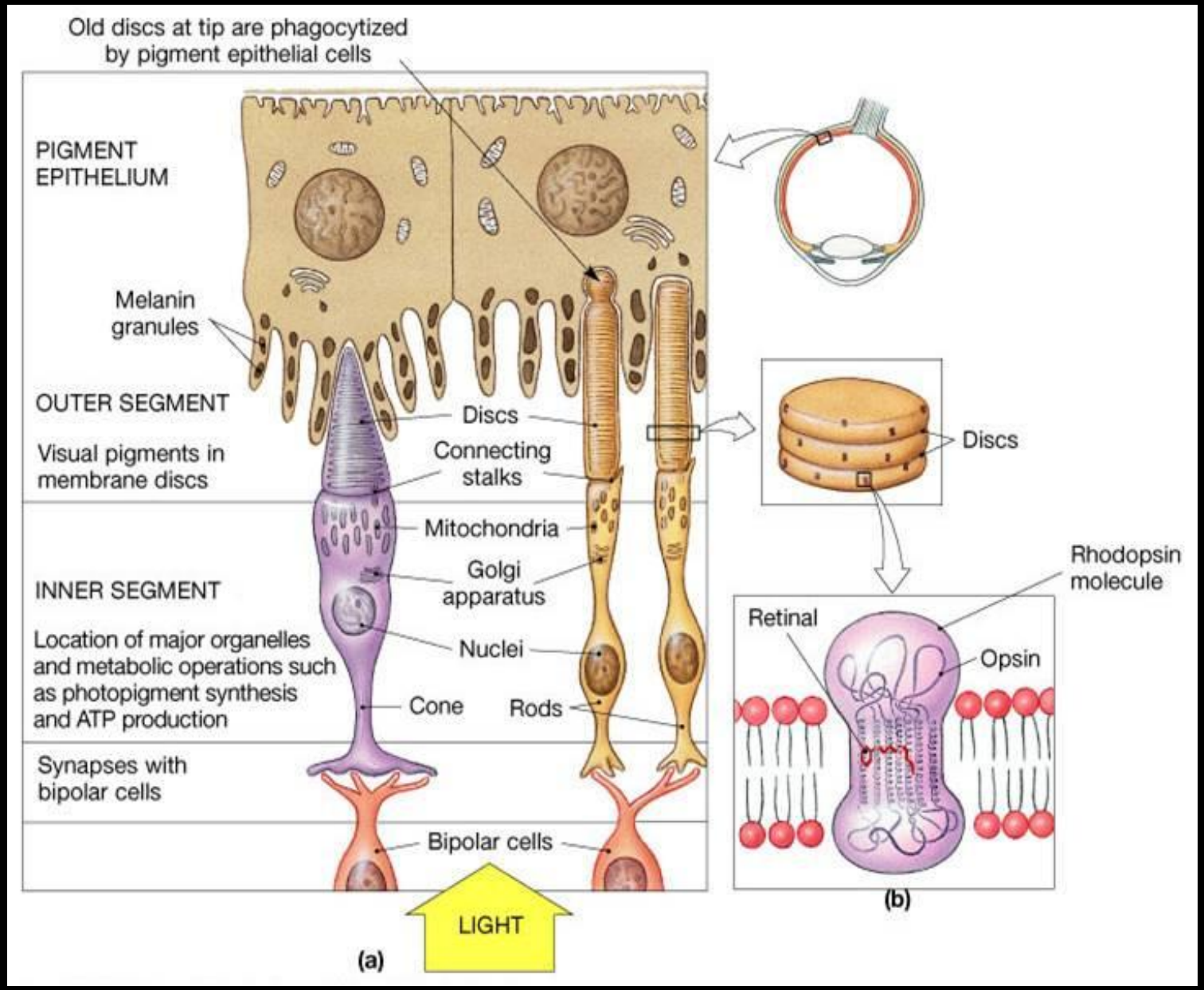


FOTO-SENSORES



CONES

BASTONETES (RODS)

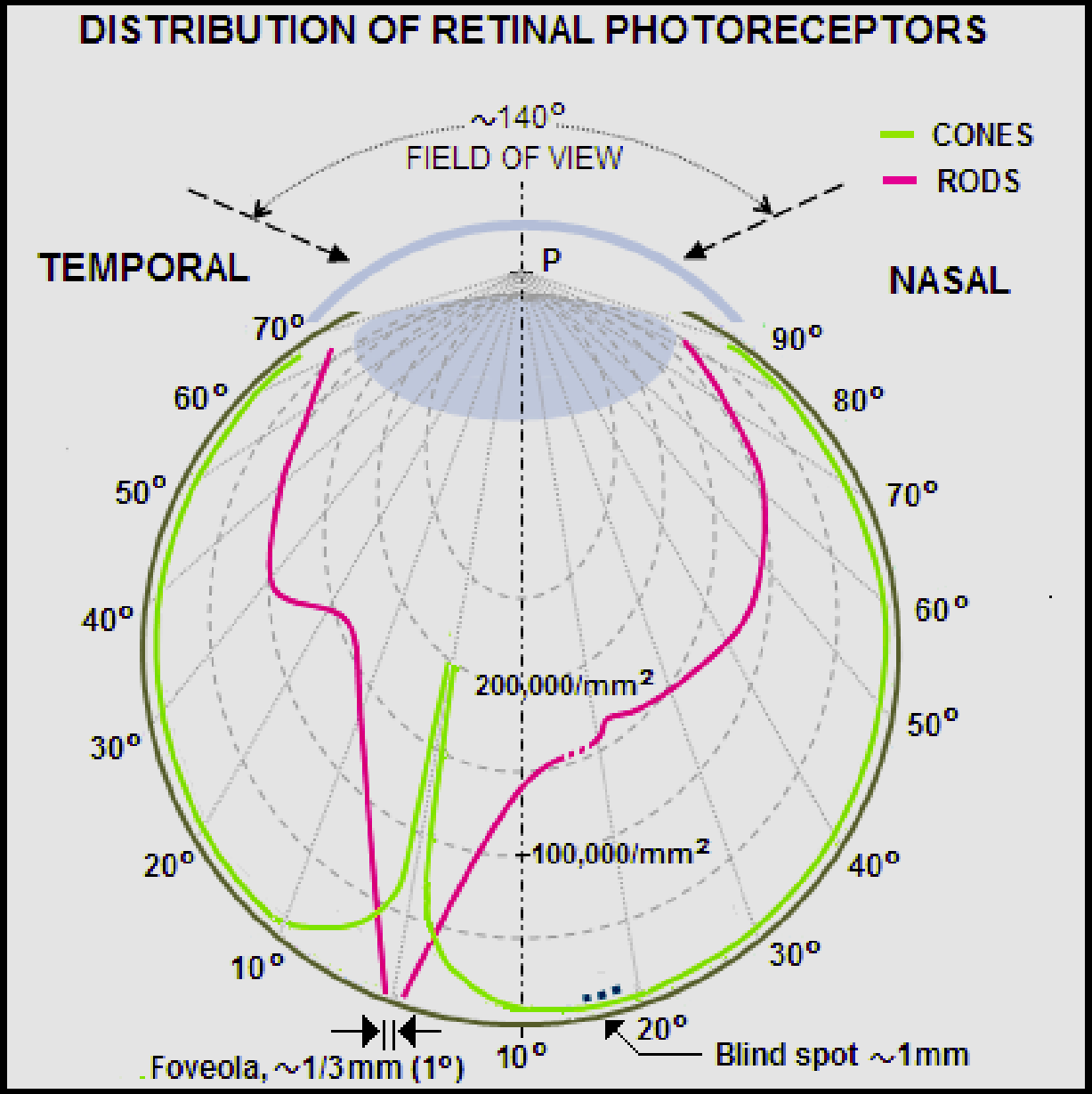


FOTO-SENSORES

CONES

BASTONETES (RODS)

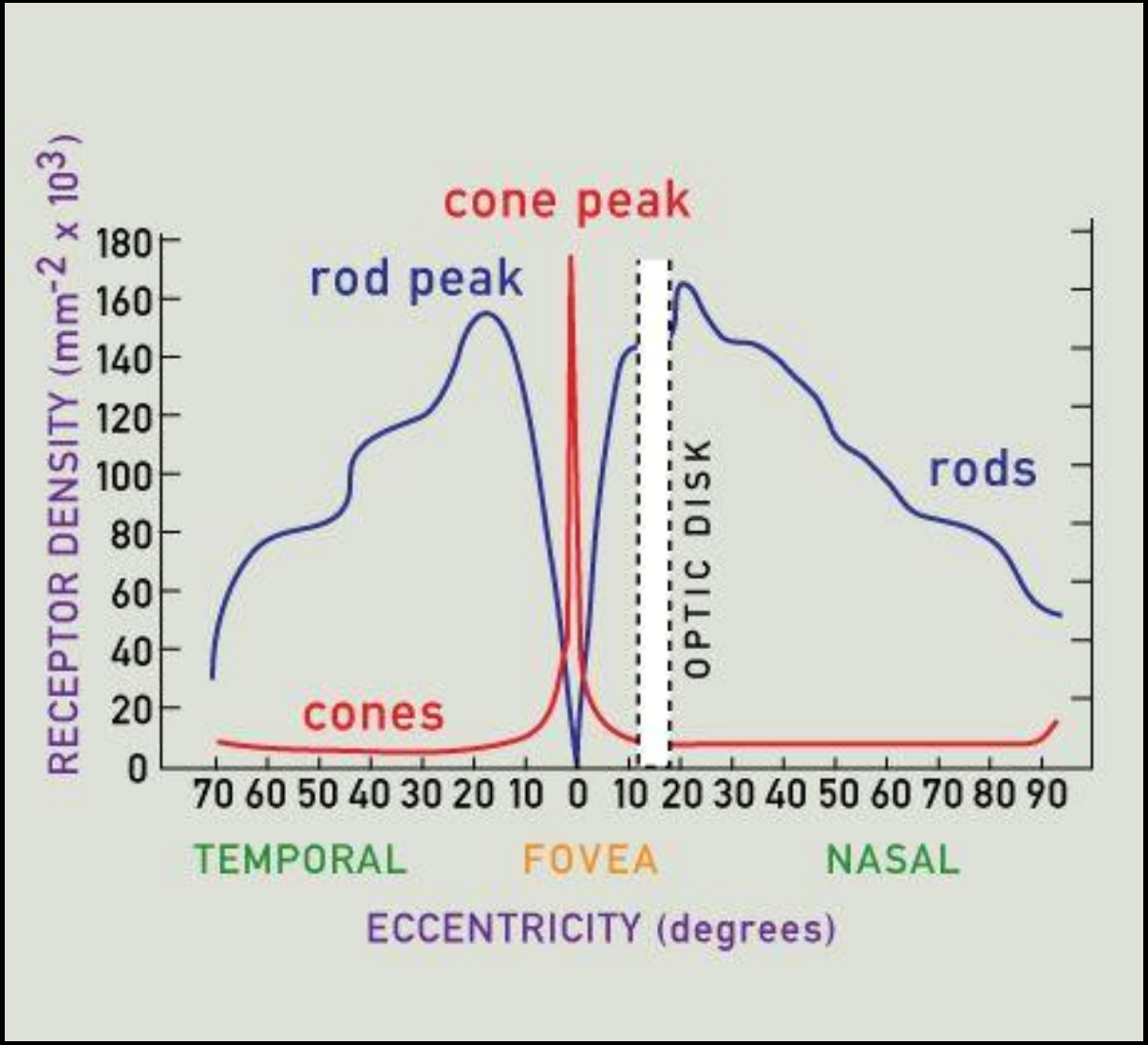
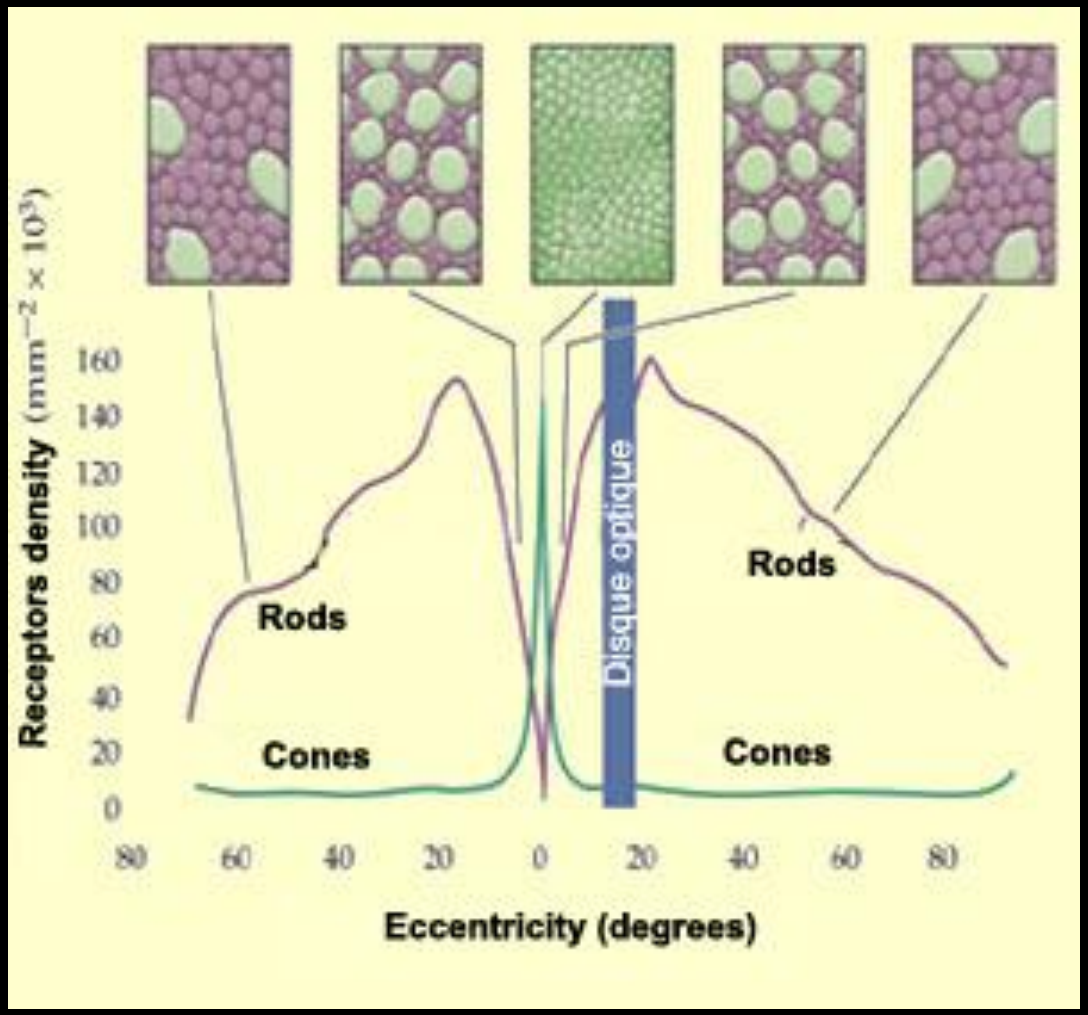
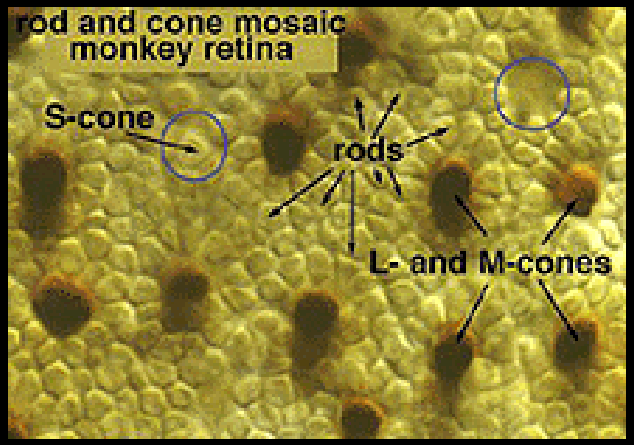
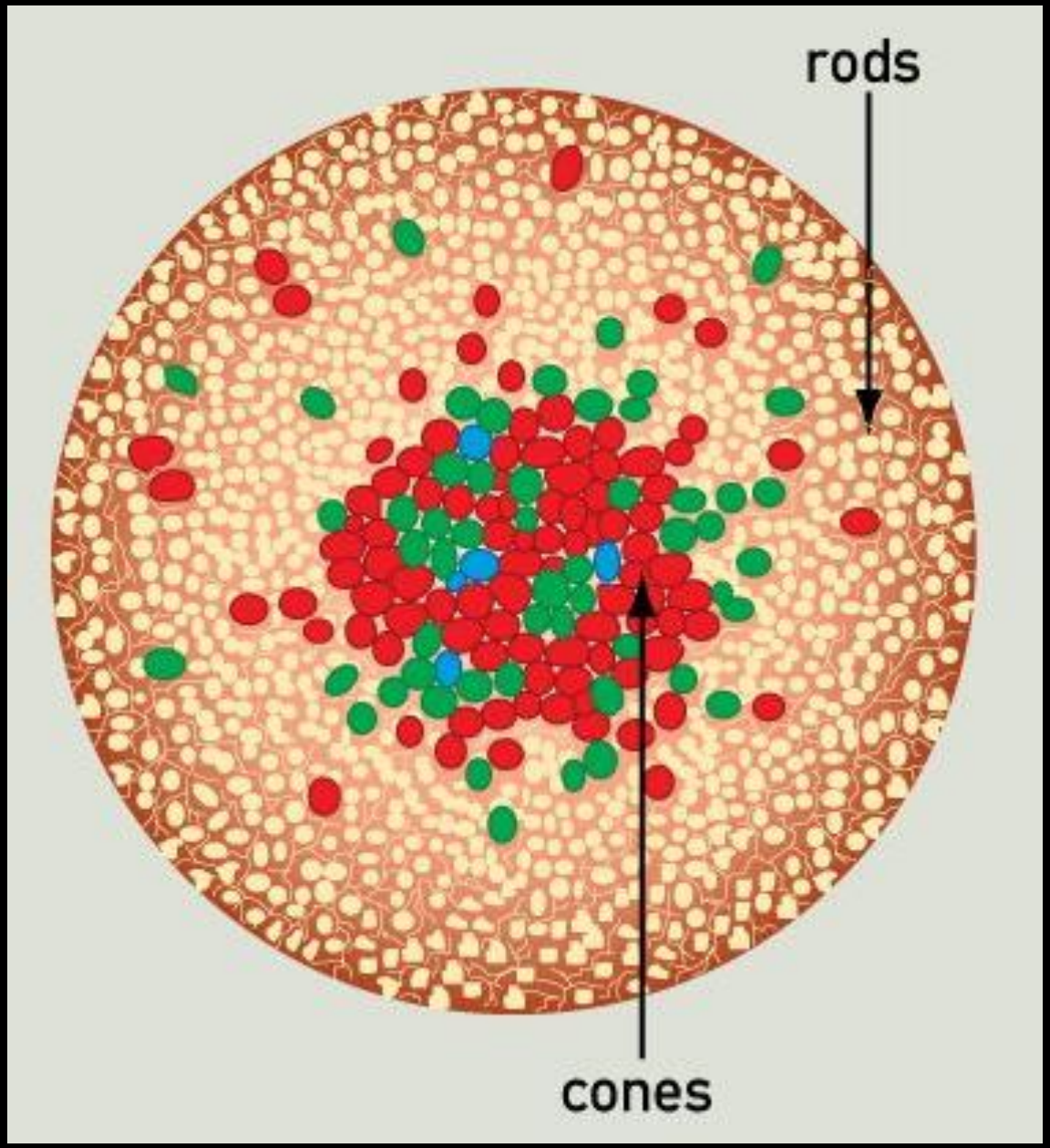


FOTO-SENSORES







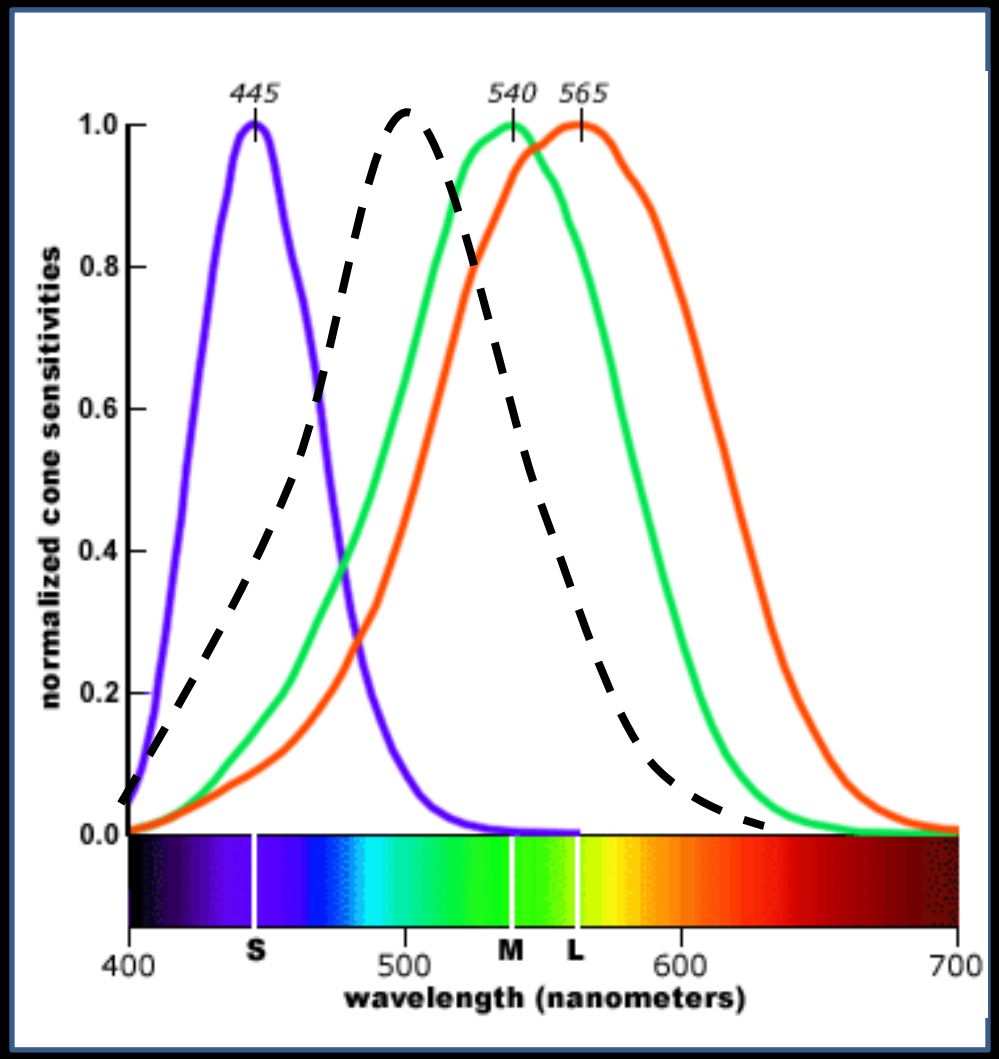
CONES

SHORT 6%

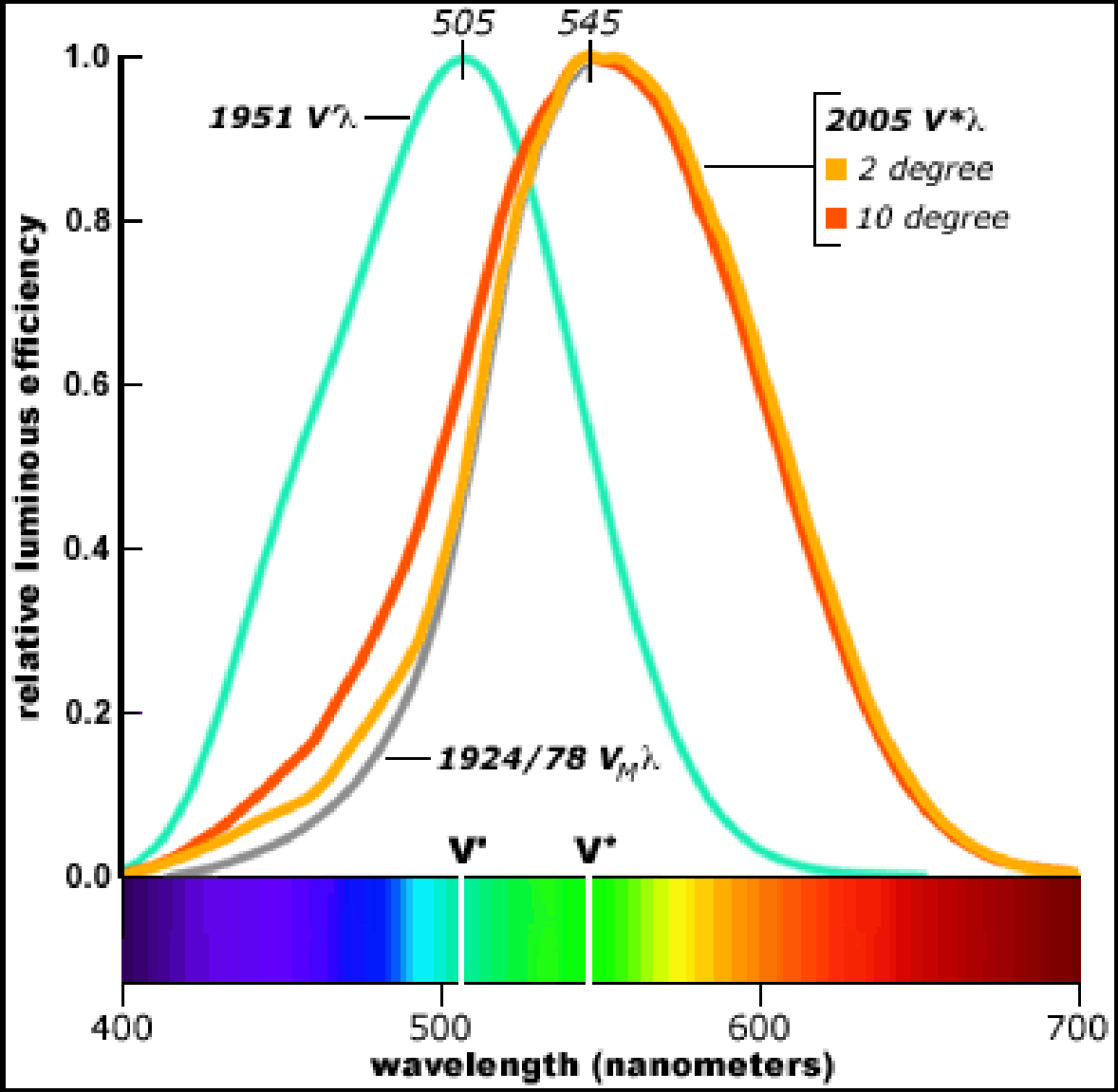
MEDIUM 31%

LONG 63 %

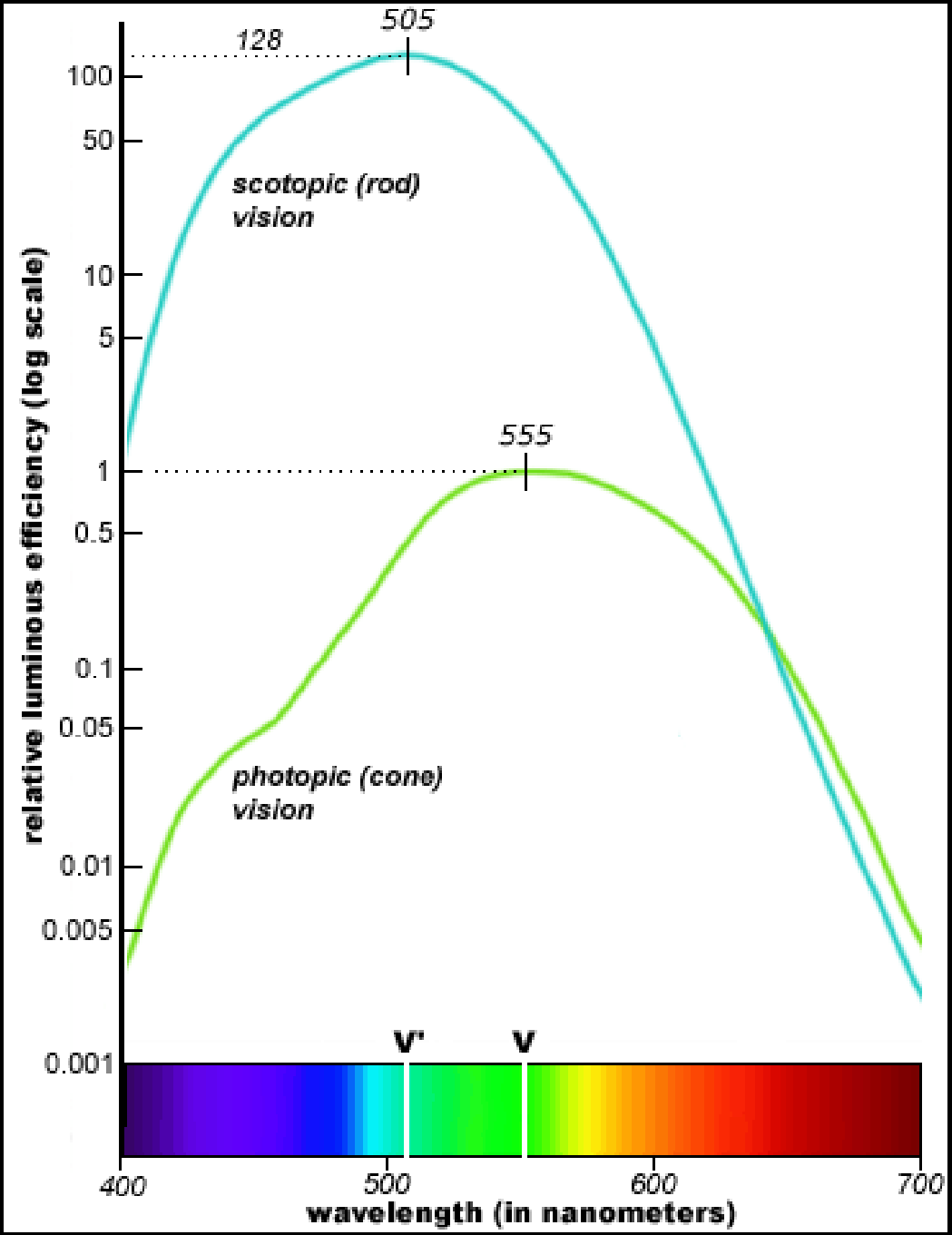
RESPOSTA ESPECTRAL



NOITE vs DIA

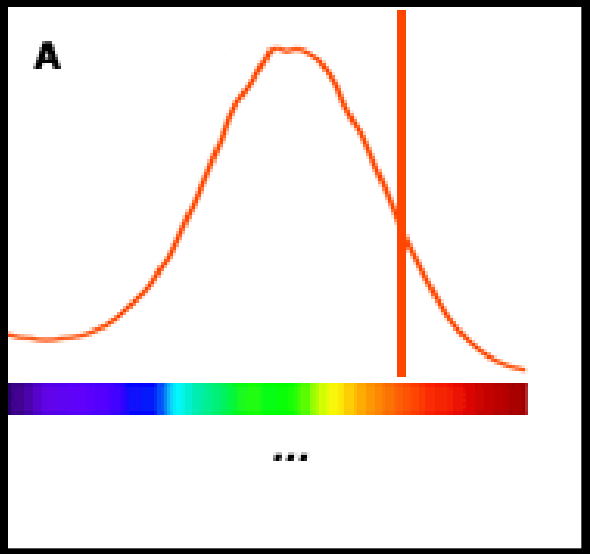

505
545
1.0
0.8
0.6
0.4
0.2
0.0
1951 V'λ
2005 V*λ
2 degree
10 degree
1924/78 VMλ
V'
V*
relative luminous efficiency
400
500
600
700
wavelength (nanometers)

NOITE vs DIA

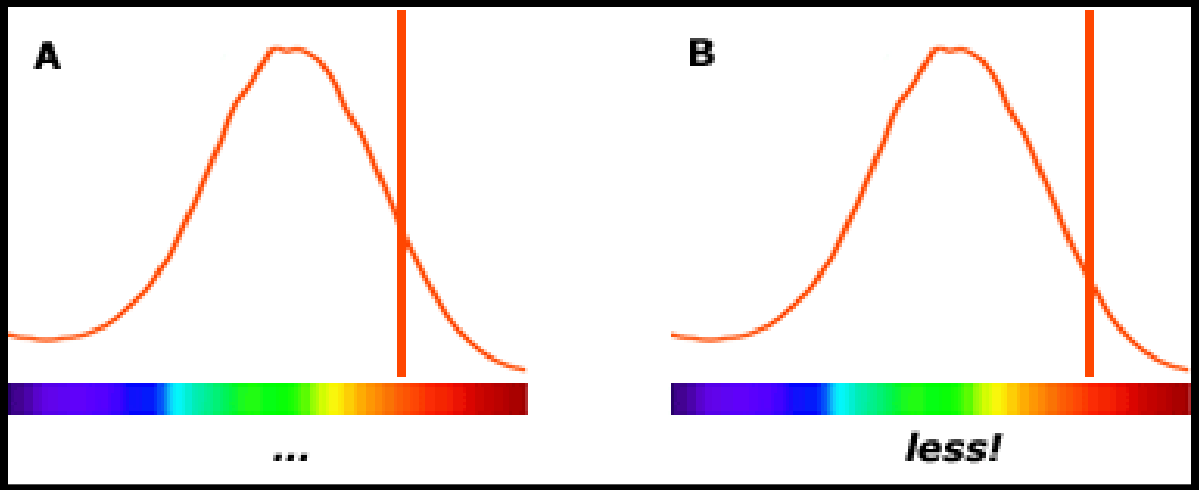

128
505
100
50
10
5
1
0.5
0.1
0.05
0.01
0.005
0.001
555
scotopic (rod) vision
photopic (cone) vision
relative luminous efficiency (log scale)
V'
V
400
500
600
700
wavelength (in nanometers)

DESLOCAMENTO DE PURKINJE

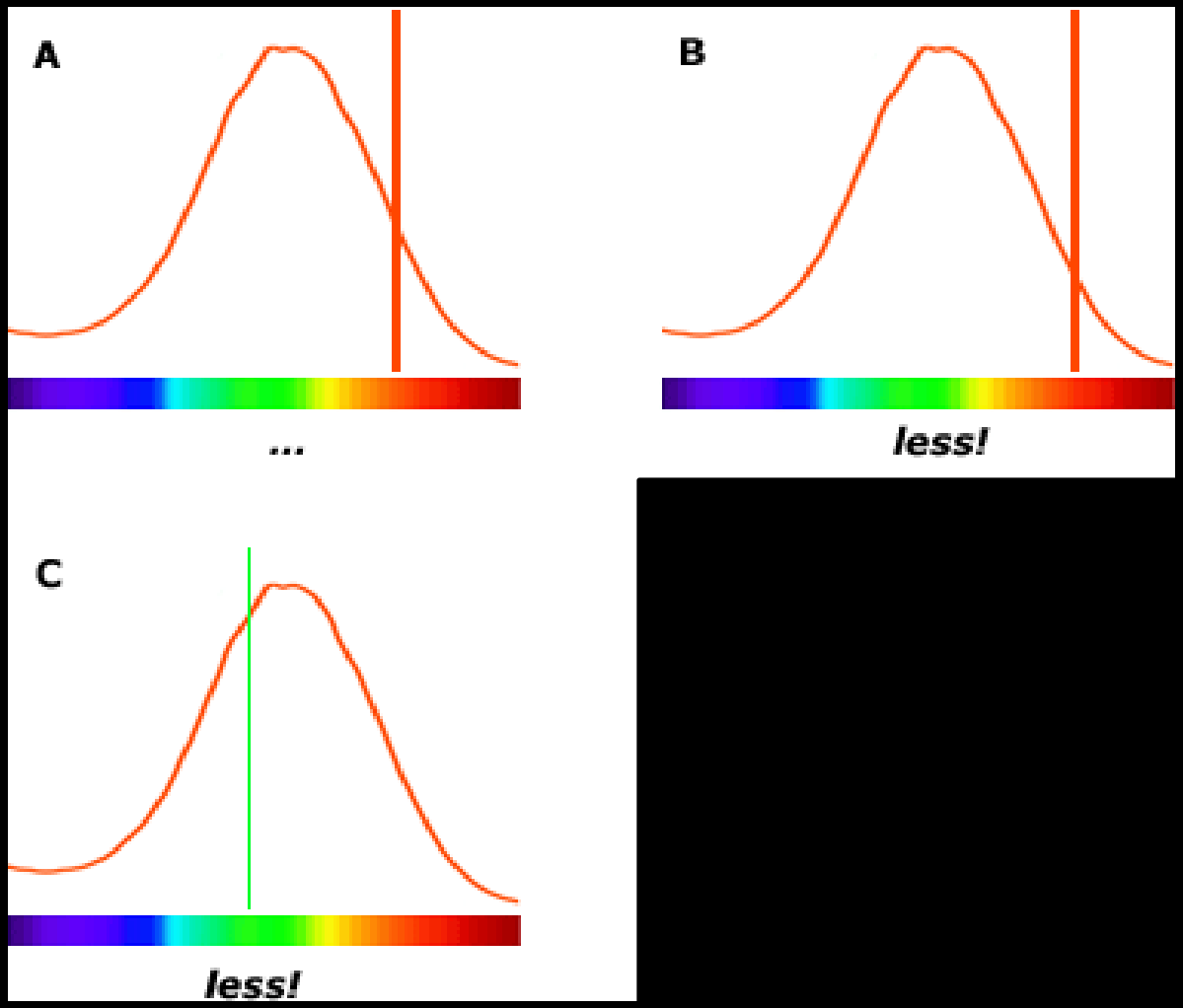
RESPOSTA DE UM FOTO-SENSOR



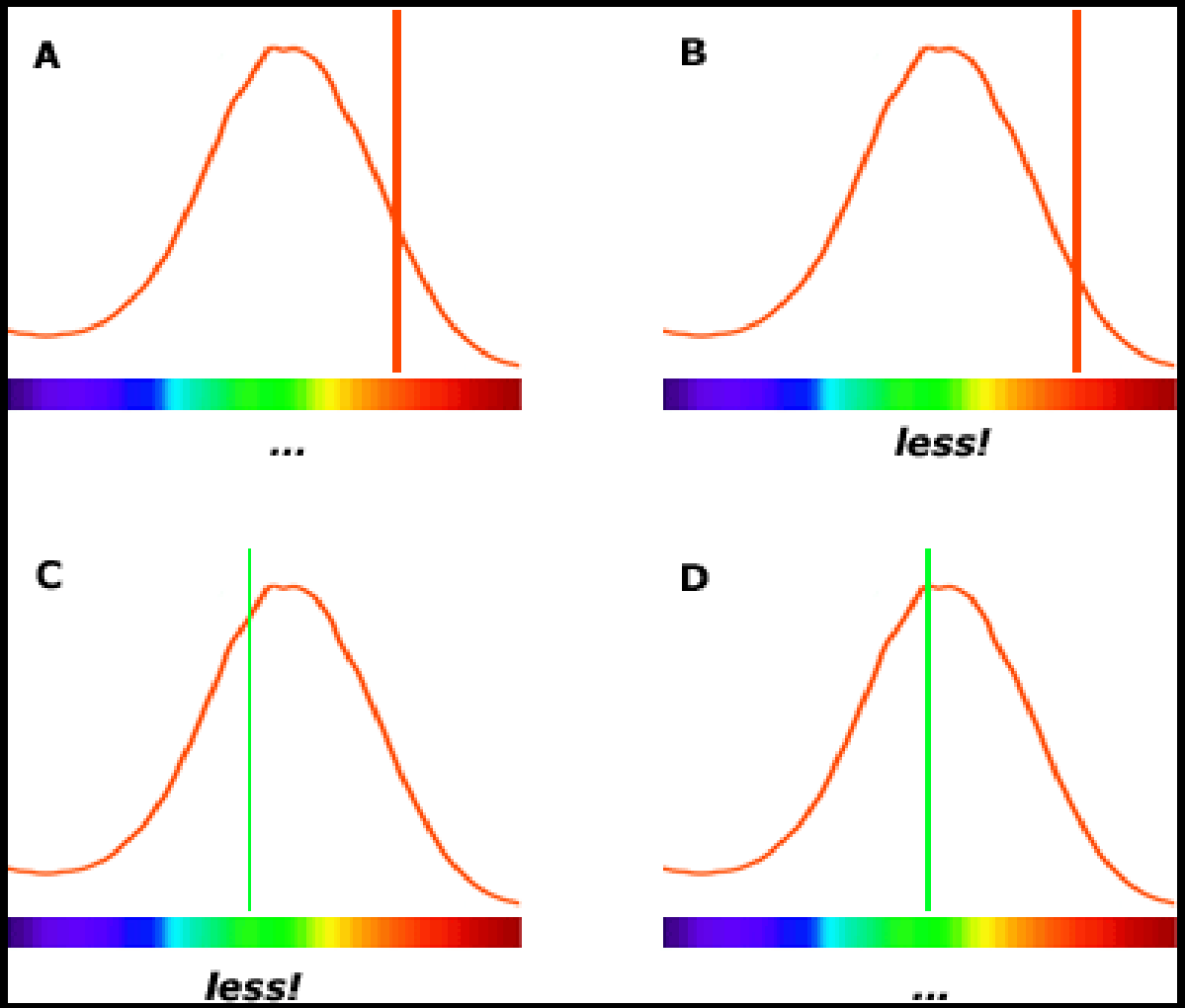
RESPOSTA DE UM FOTO-SENSOR



RESPOSTA DE UM FOTO-SENSOR

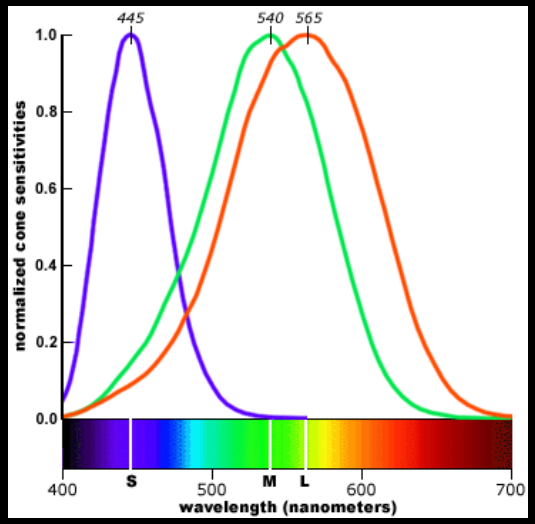


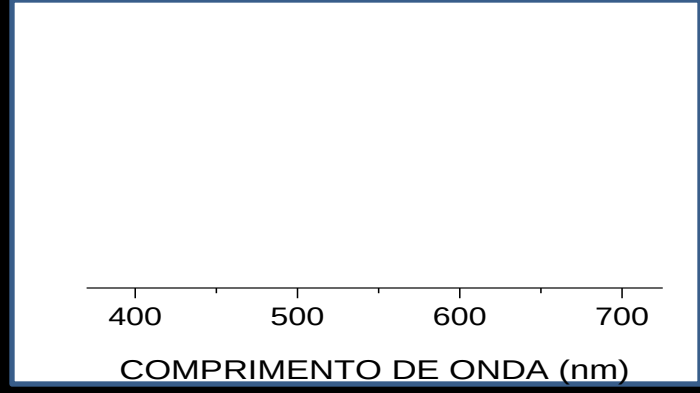
RESPOSTA DE UM FOTO-SENSOR

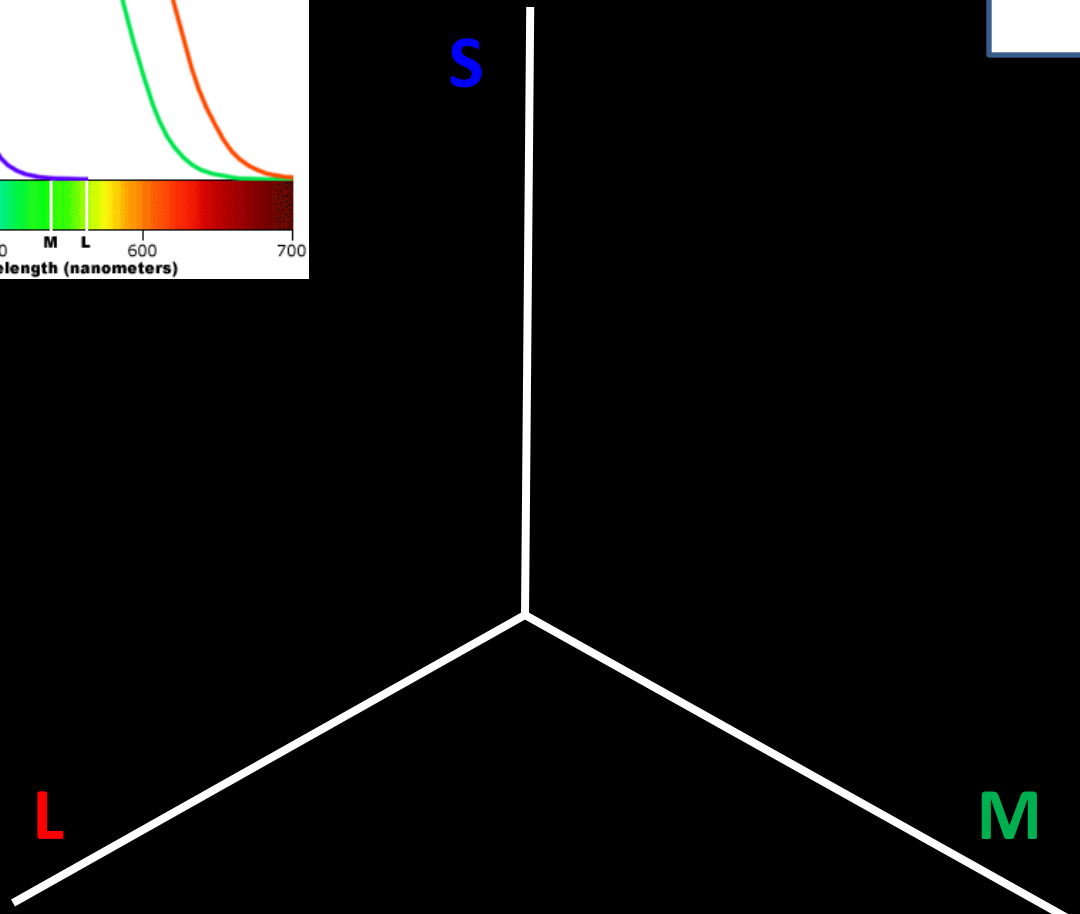


LUZ MONOCROMÁTICA

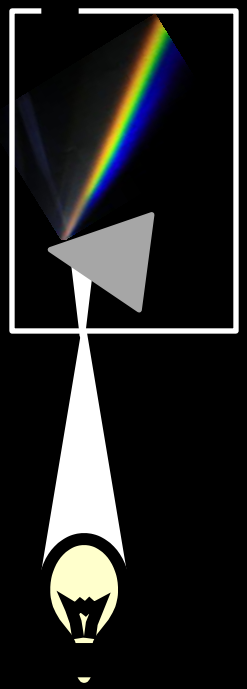
CORES ESPECTRAIS



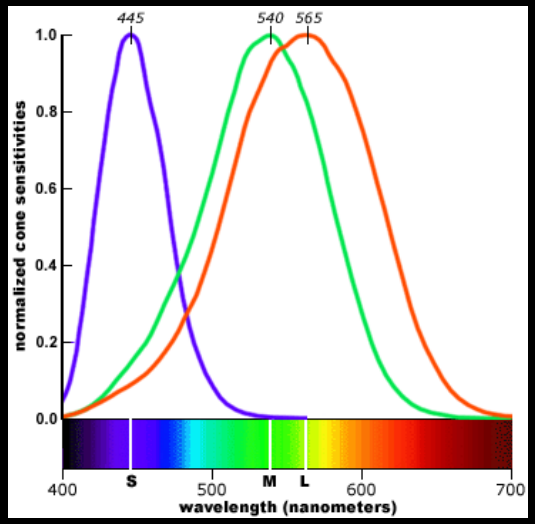


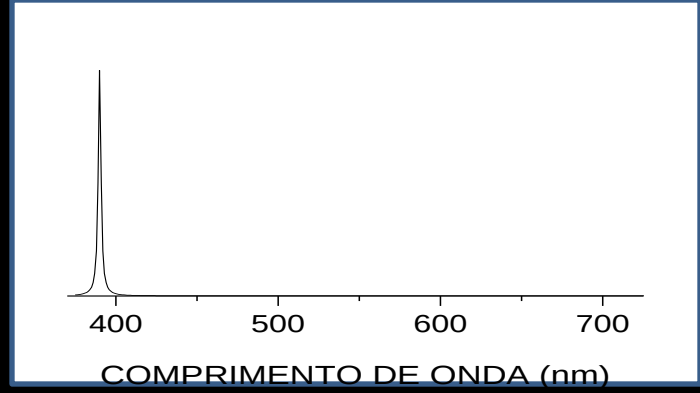


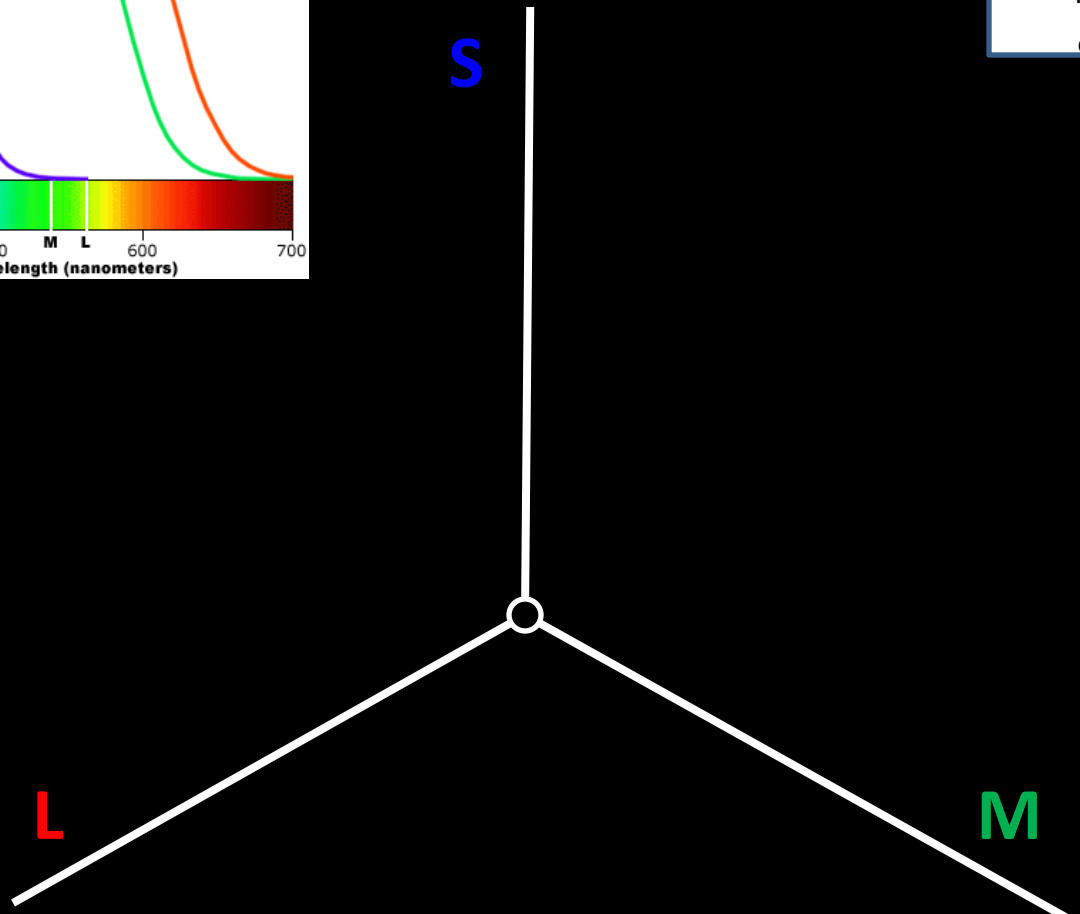
Luz com
$\lambda =$



Fonte de luz

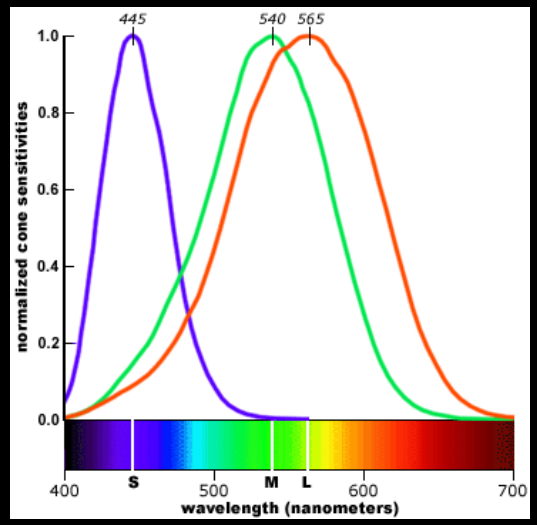


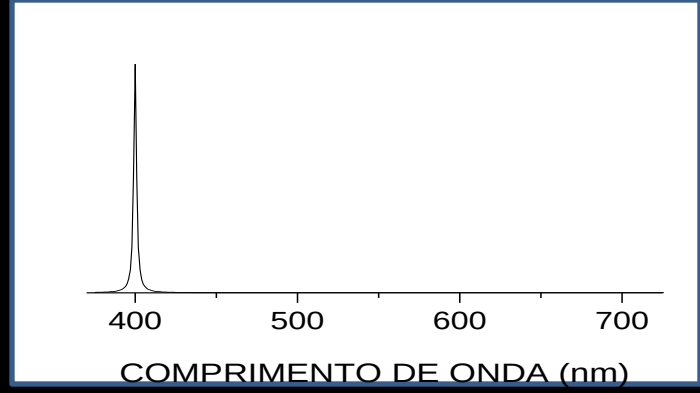


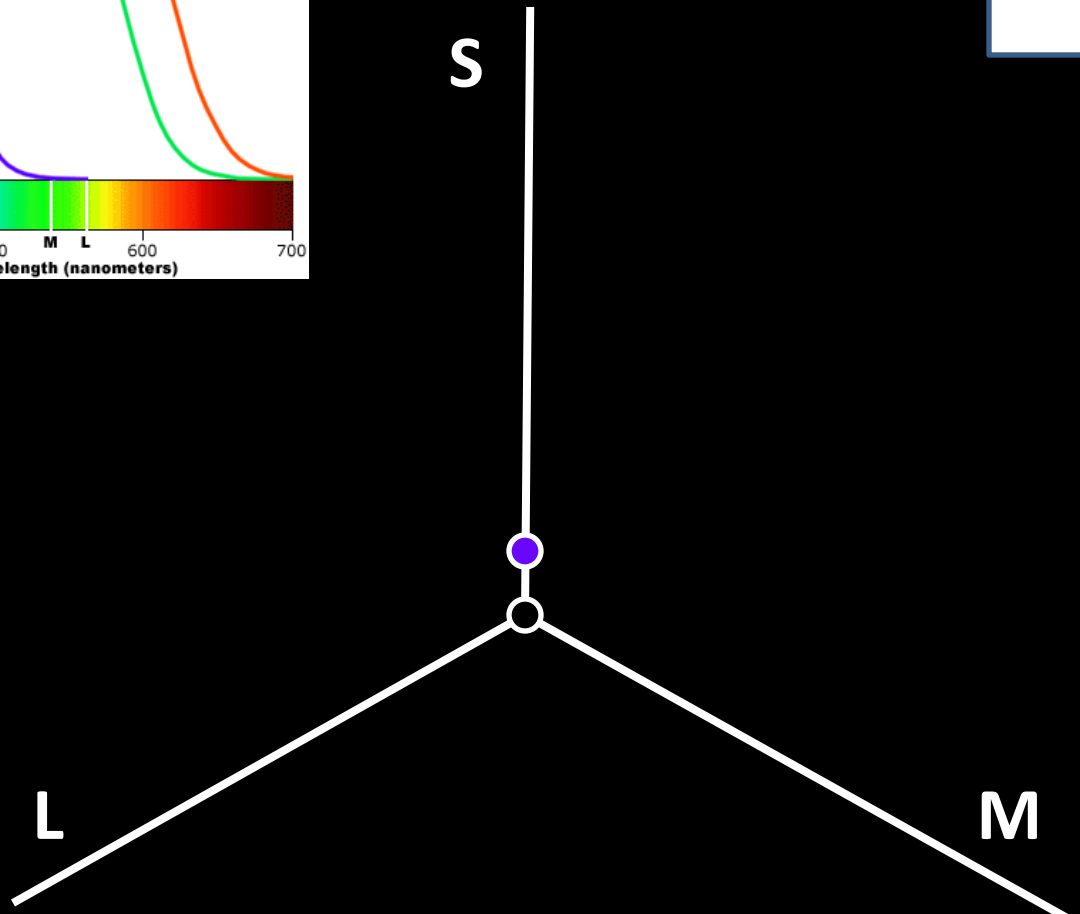


Luz com
λ=380 nm

Fonte de luz

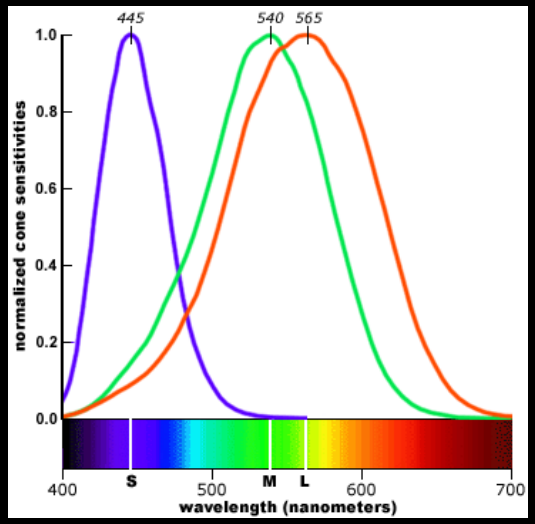


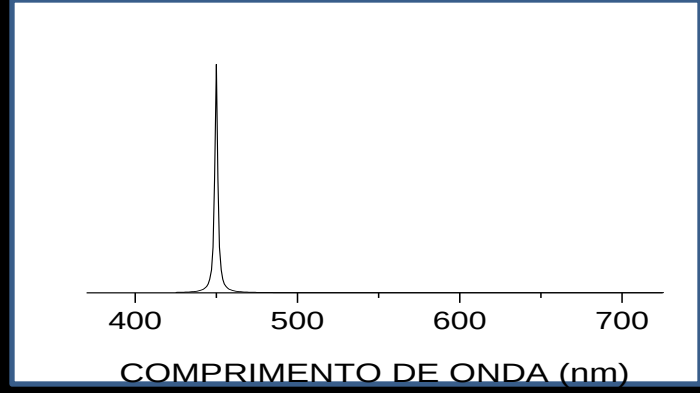


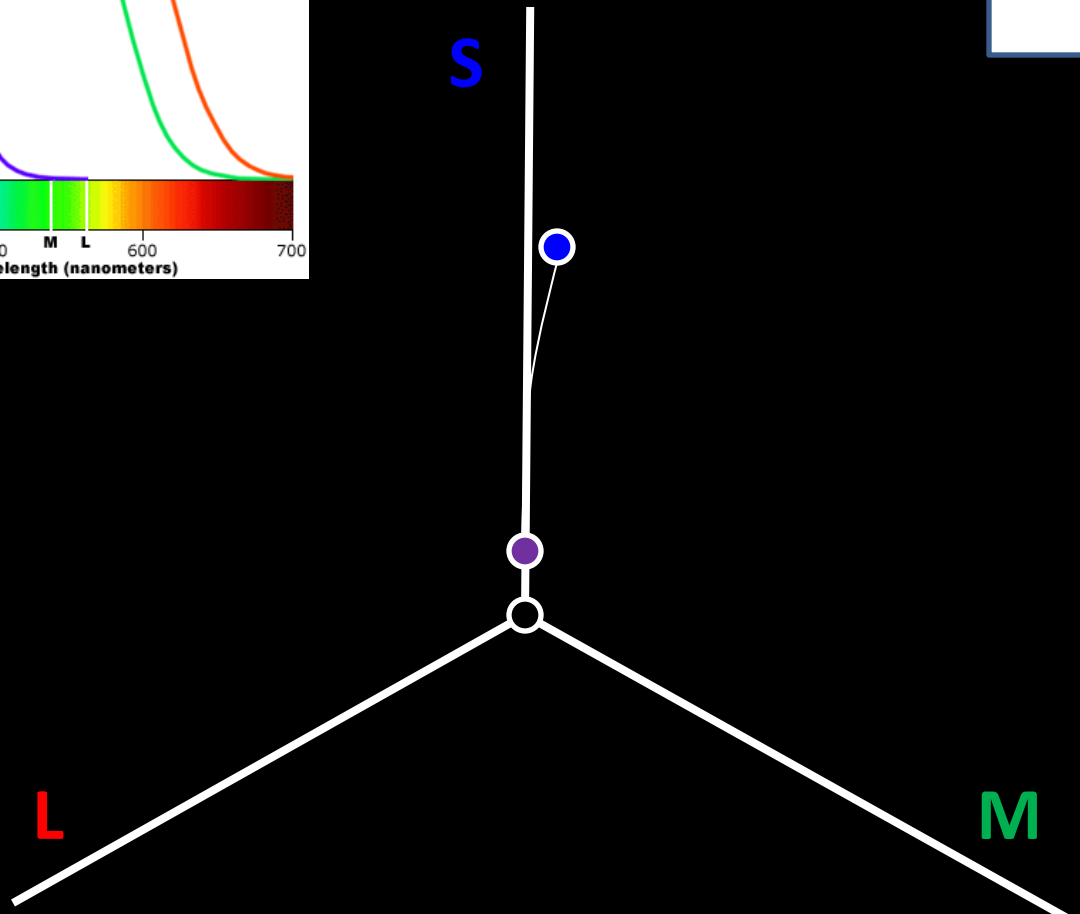


Luz com
$\lambda = 400$ nm

Fonte de luz

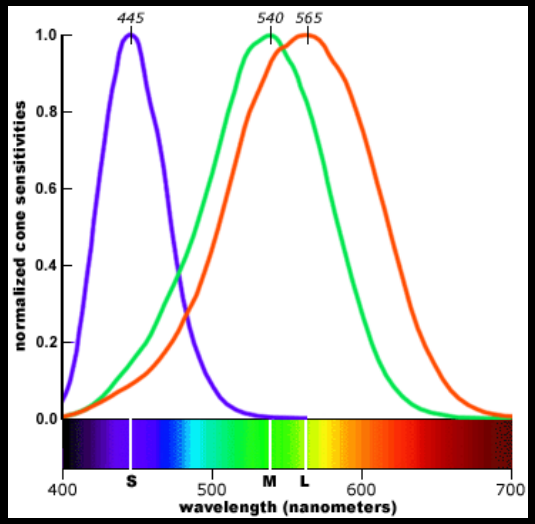


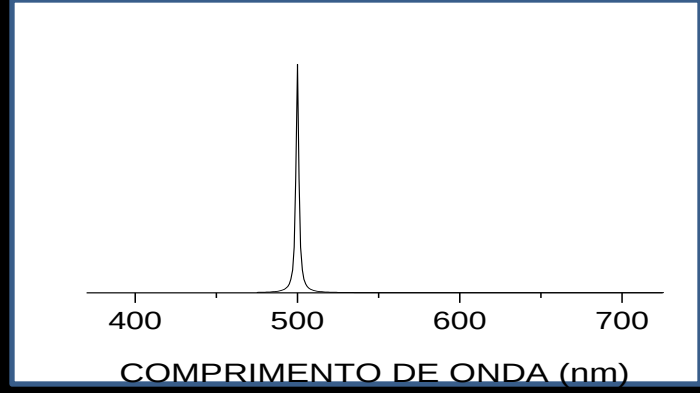


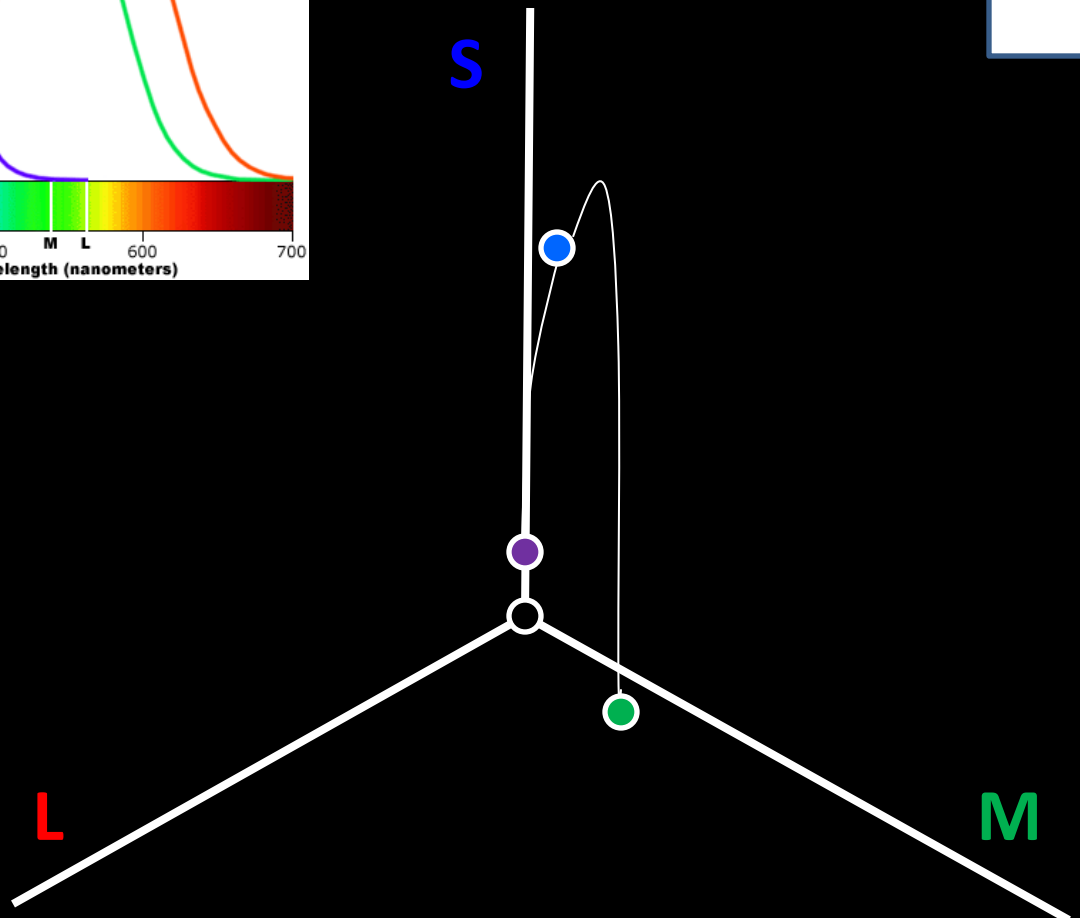


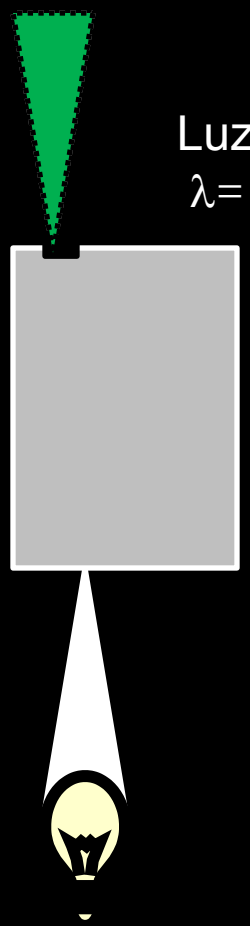
Luz com
$\lambda = 450$ nm

Fonte de luz



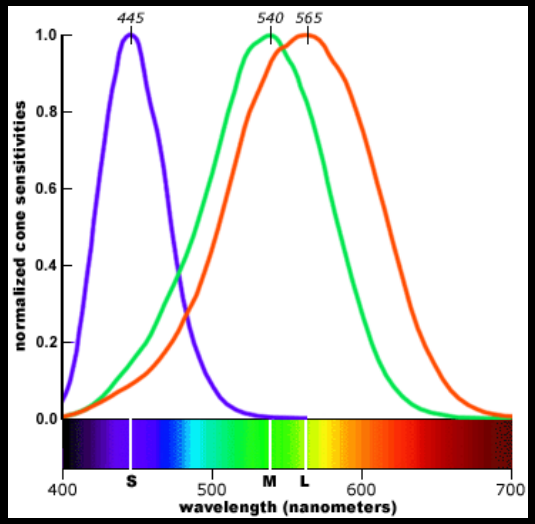


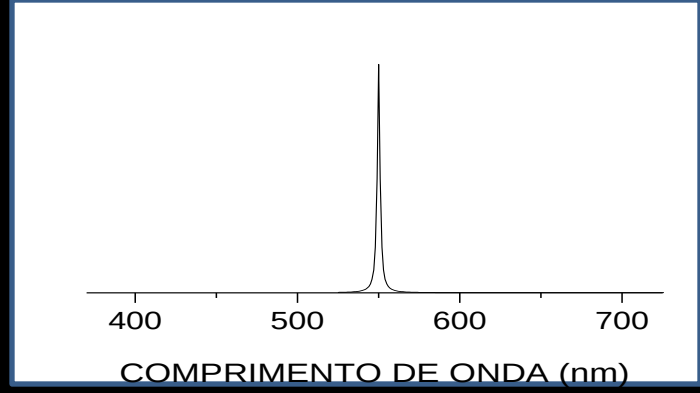


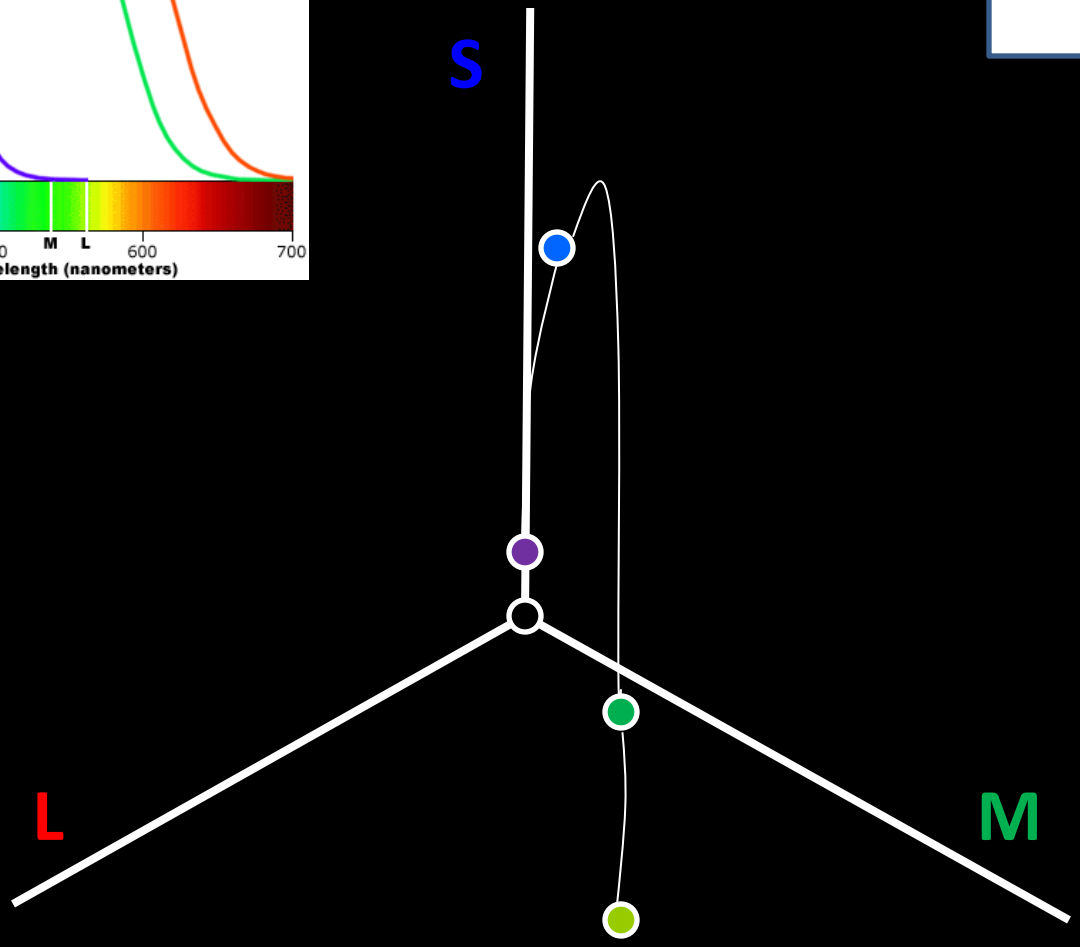


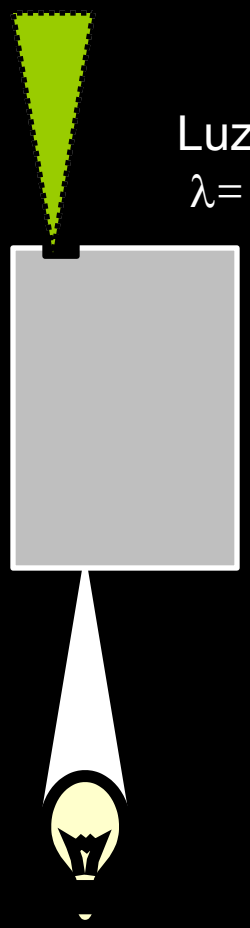
Luz com
$\lambda = 500$ nm

Fonte de luz



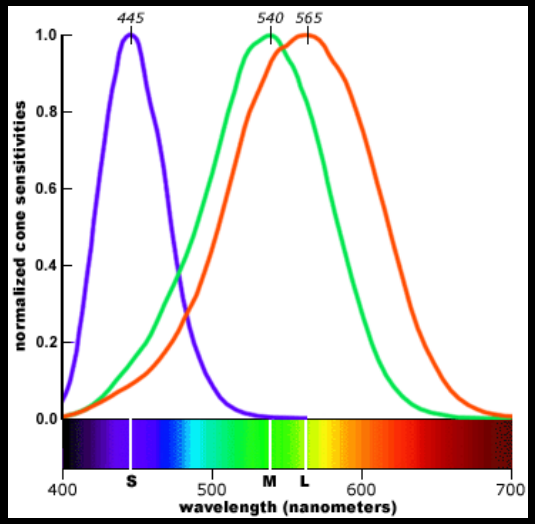


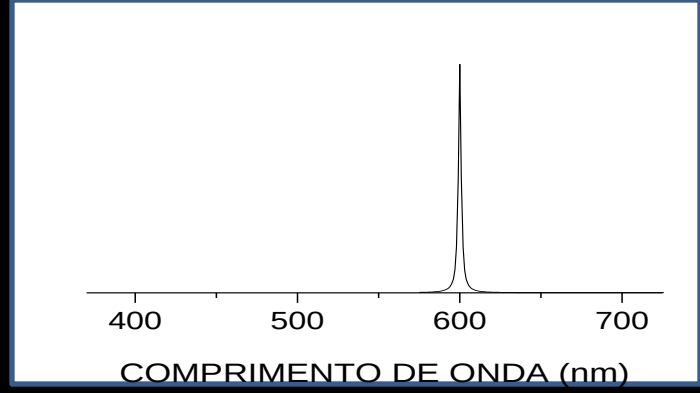


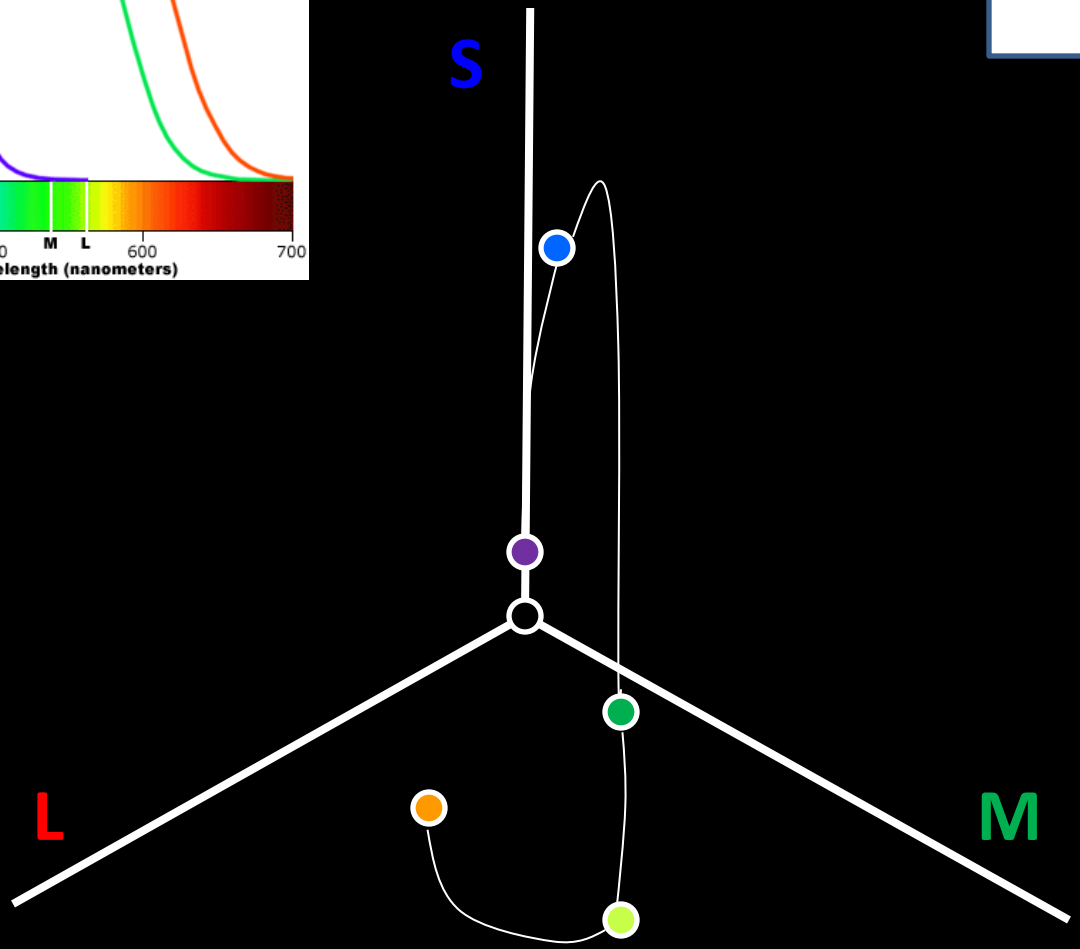


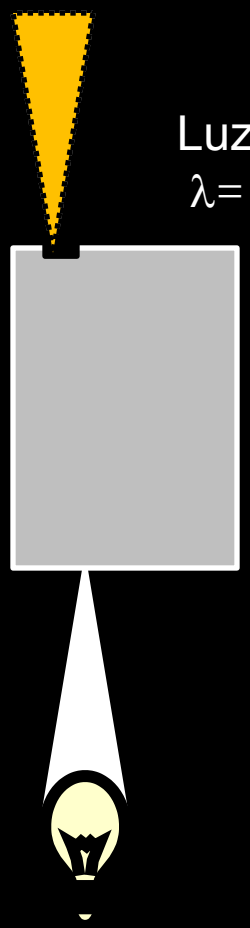
Luz com
$\lambda = 550$ nm

Fonte de luz



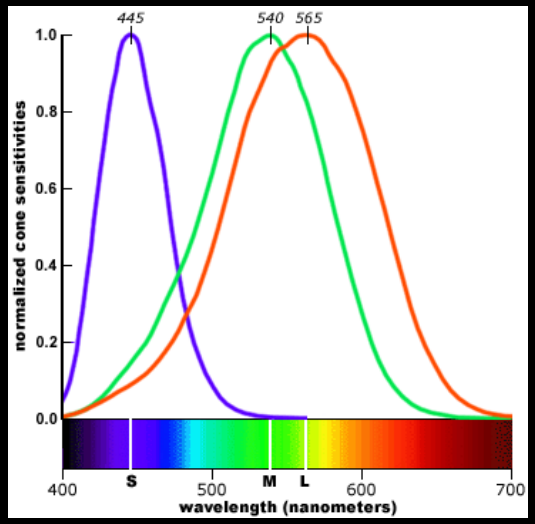


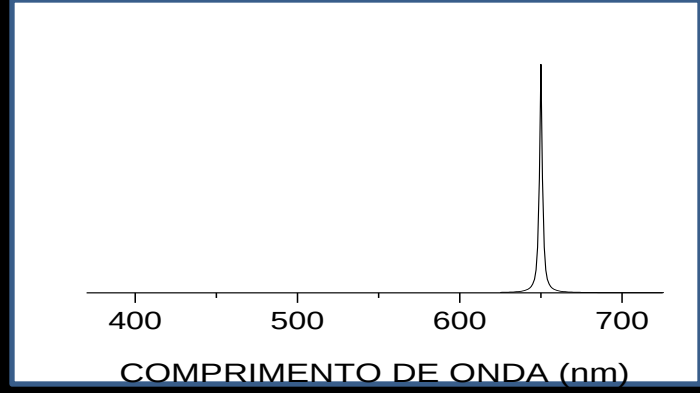


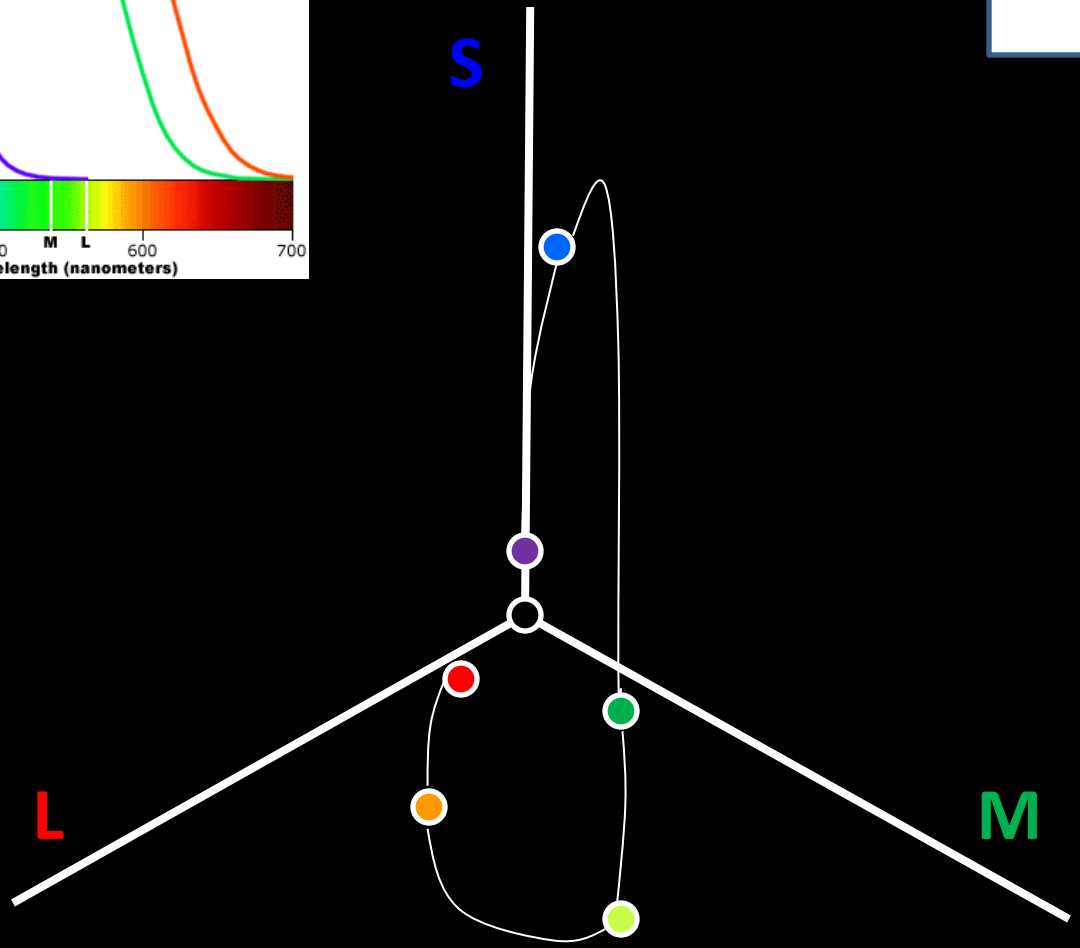


Luz com
$\lambda = 600$ nm

Fonte de luz

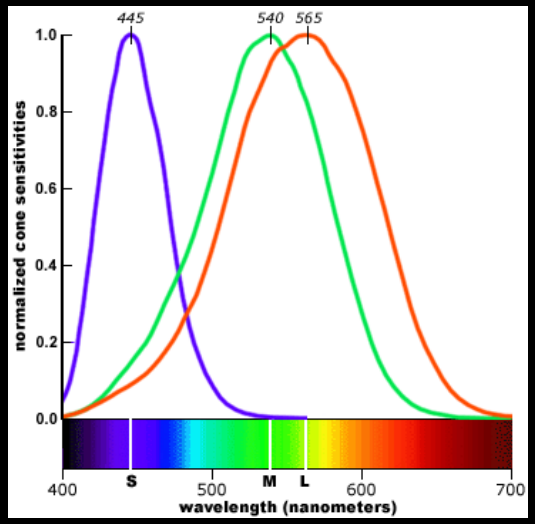


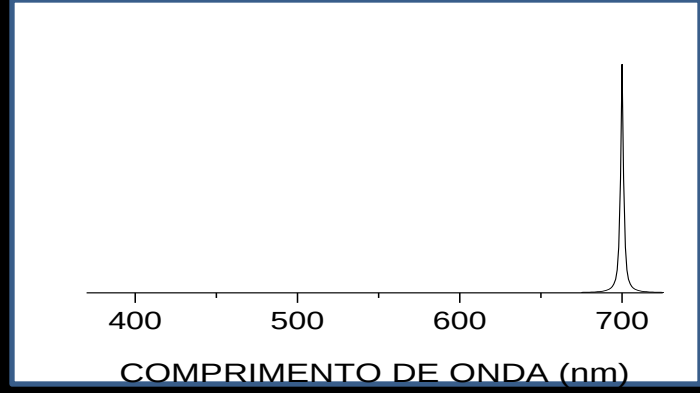


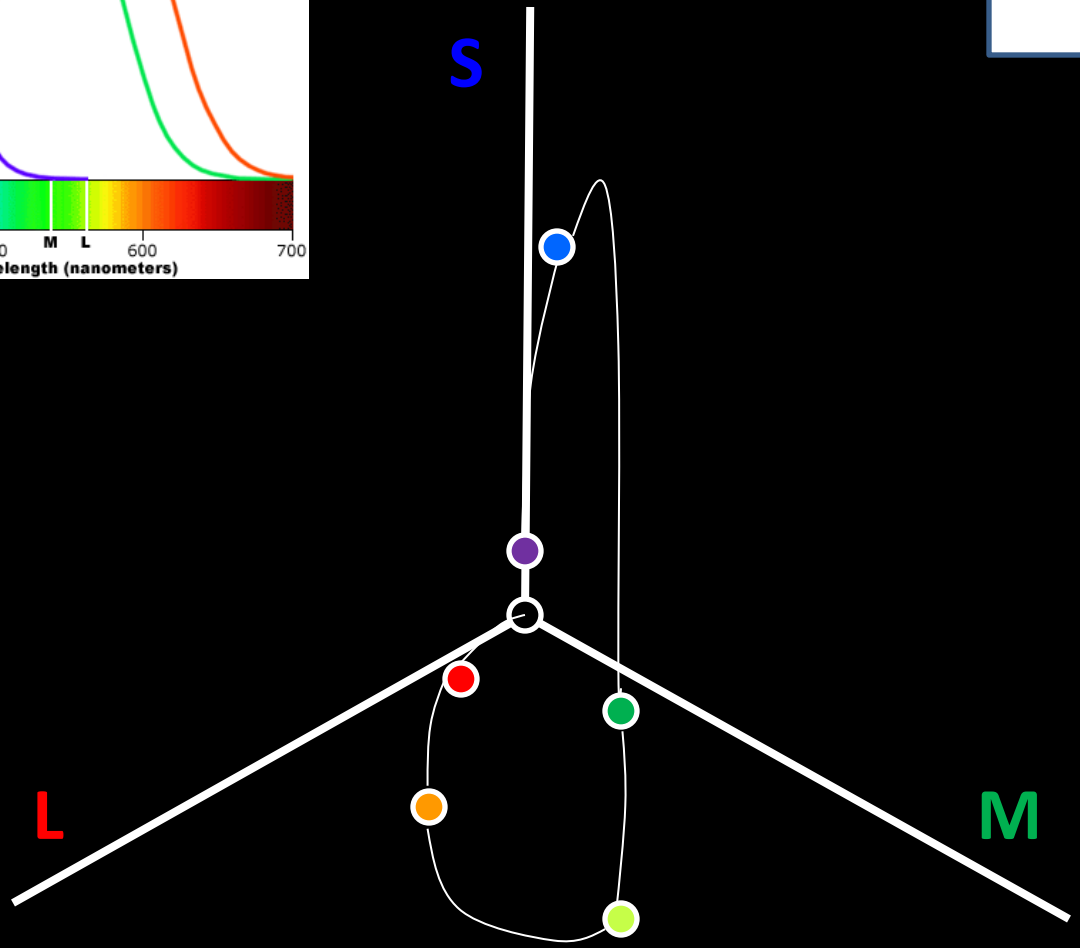


Luz com
$\lambda = 650$ nm

Fonte de luz

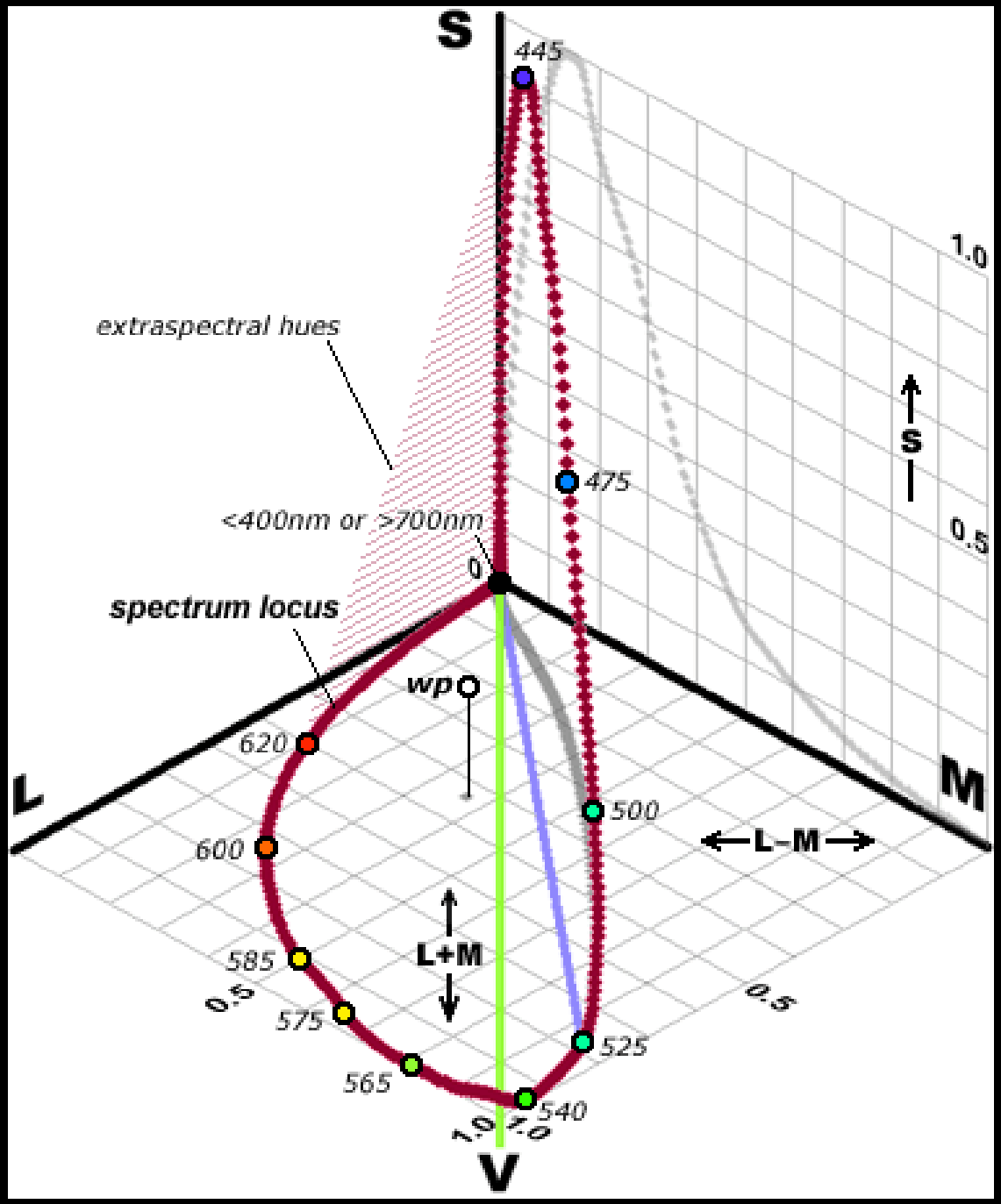






Luz com
$\lambda = 700$ nm

Fonte de luz



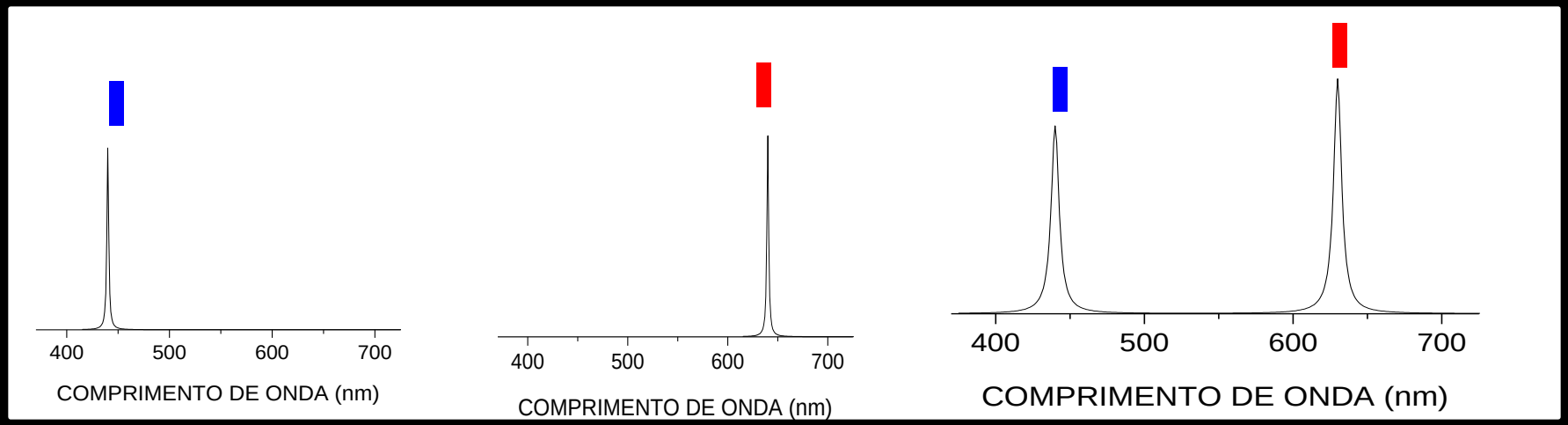
ESPAÇO DAS CORES

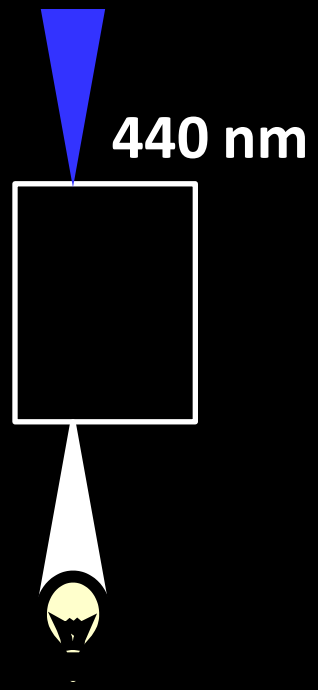
SPECTRUM LOCUS

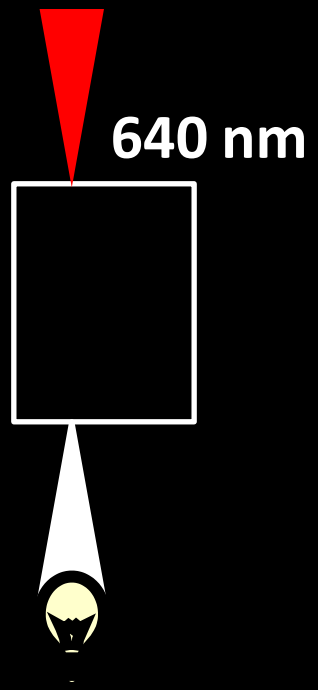
LUZ POLICROMÁTICA

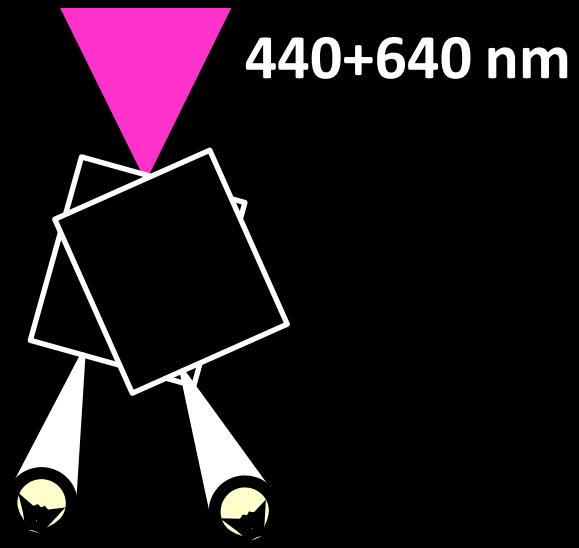
CORES EXTRA-ESPECTRAIS

CORES EXTRA-ESPECTRAIS

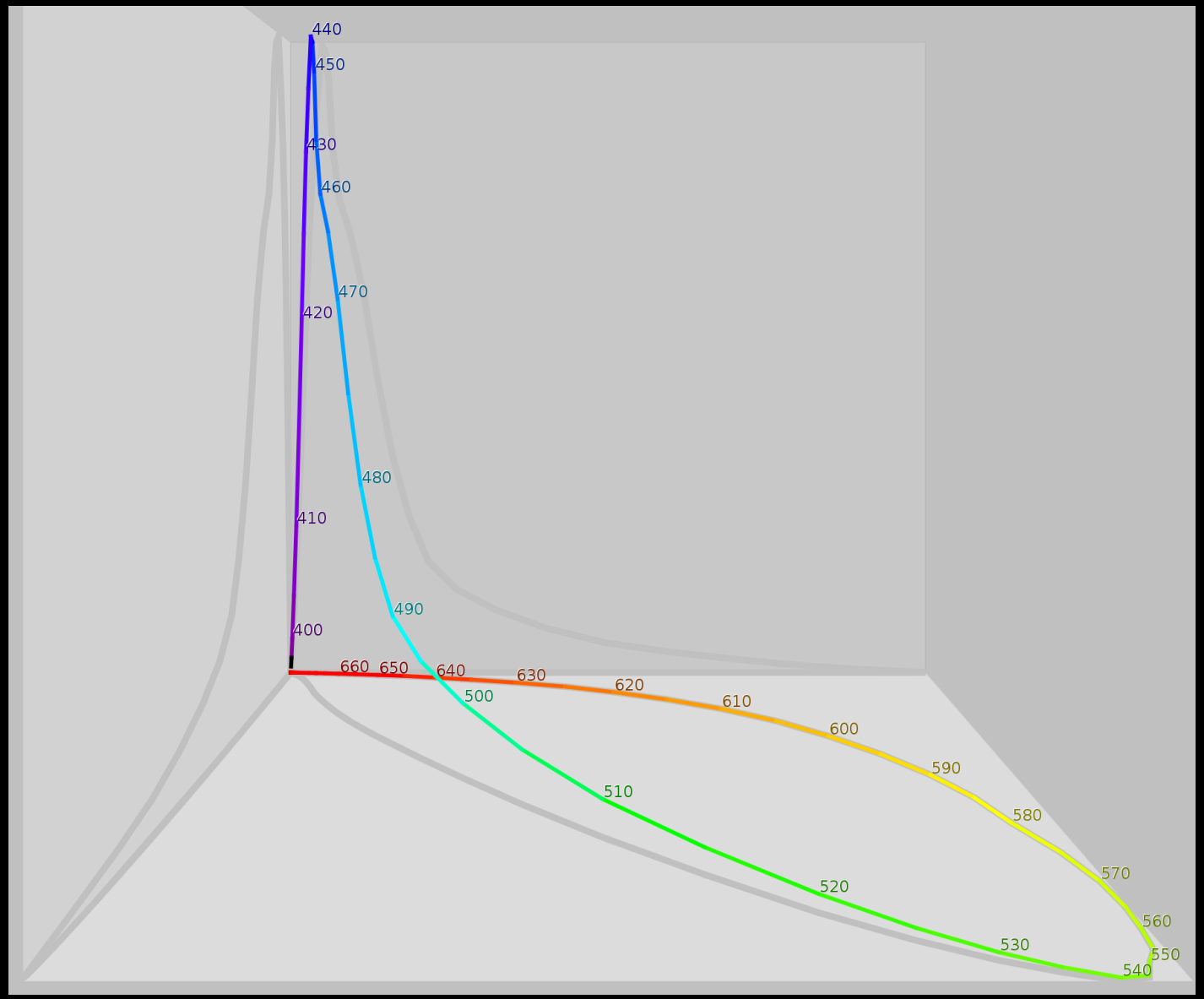






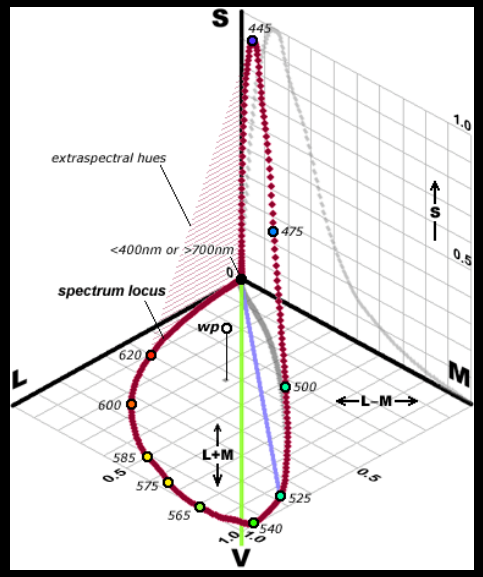


SPECTRUM LOCUS

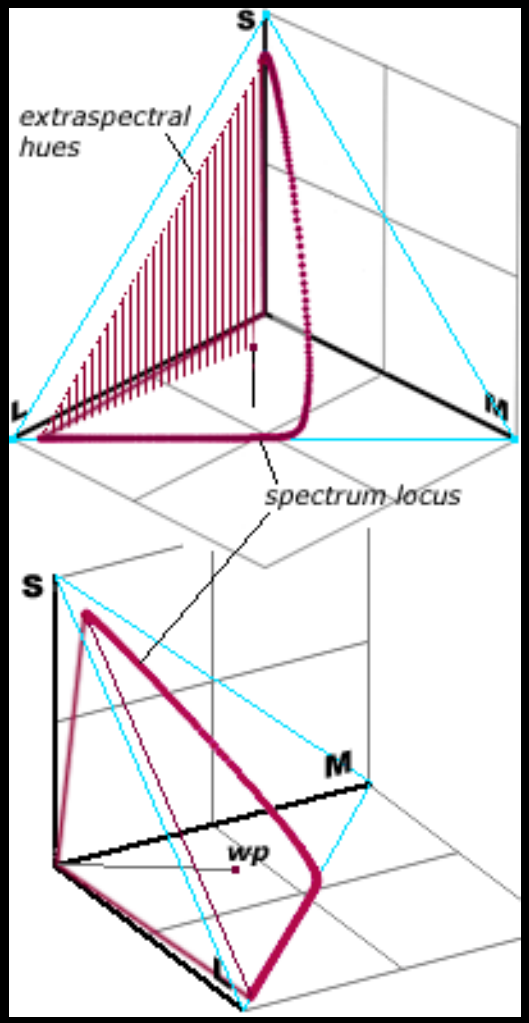


ESPAÇO DAS CORES

S
M
L



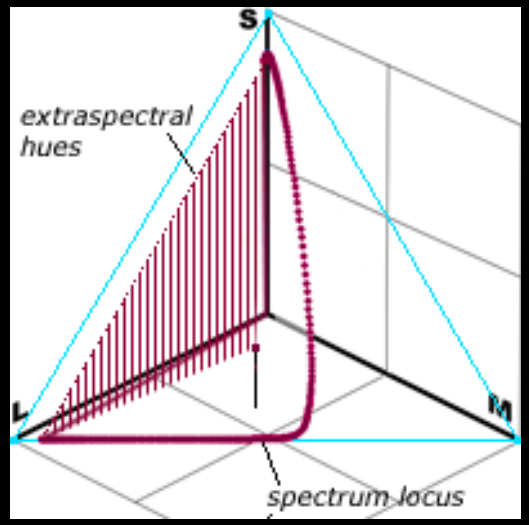
S
M
L



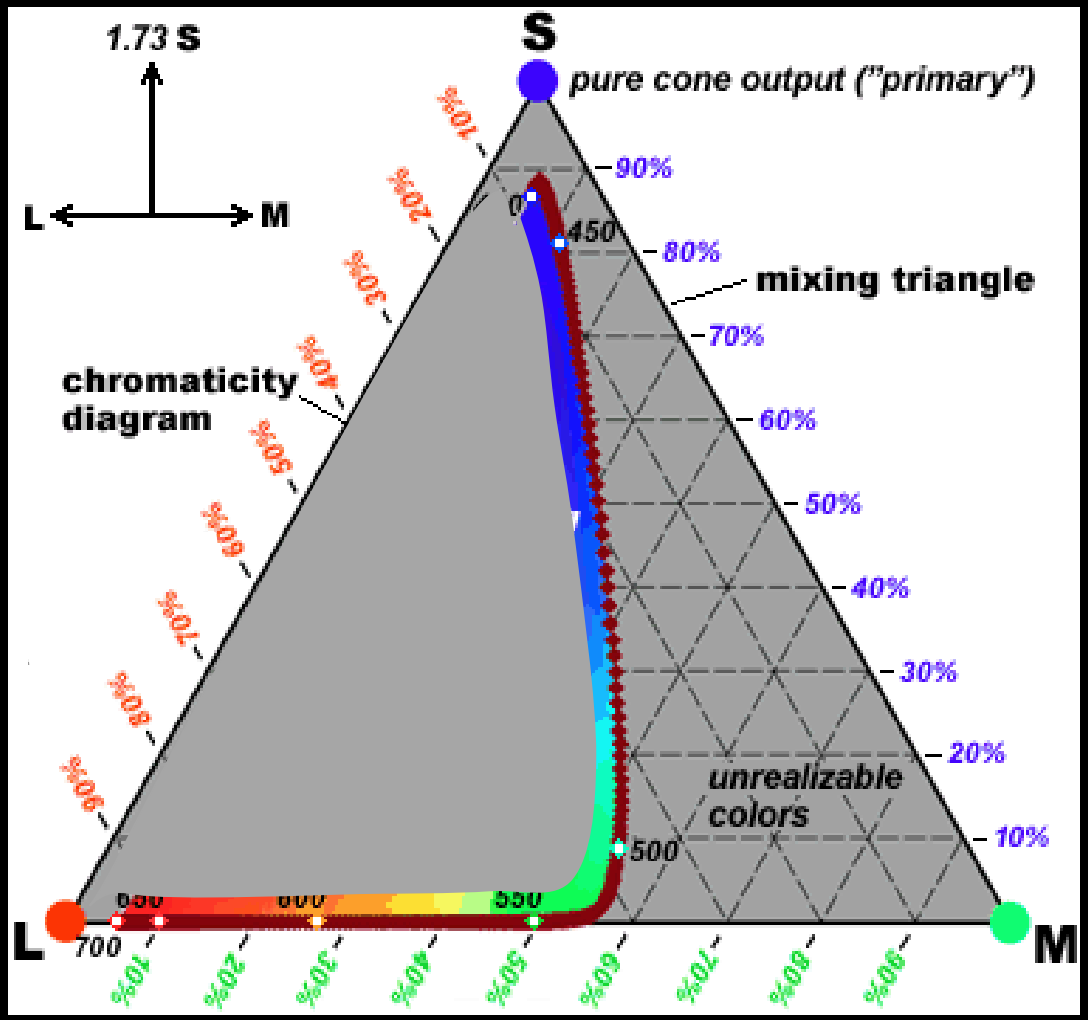
NORMALIZADA

$$S = \frac{S}{S+M+L} \quad M = \frac{M}{S+M+L} \quad L = \frac{L}{S+M+L}$$

ESPAÇO DAS CORES

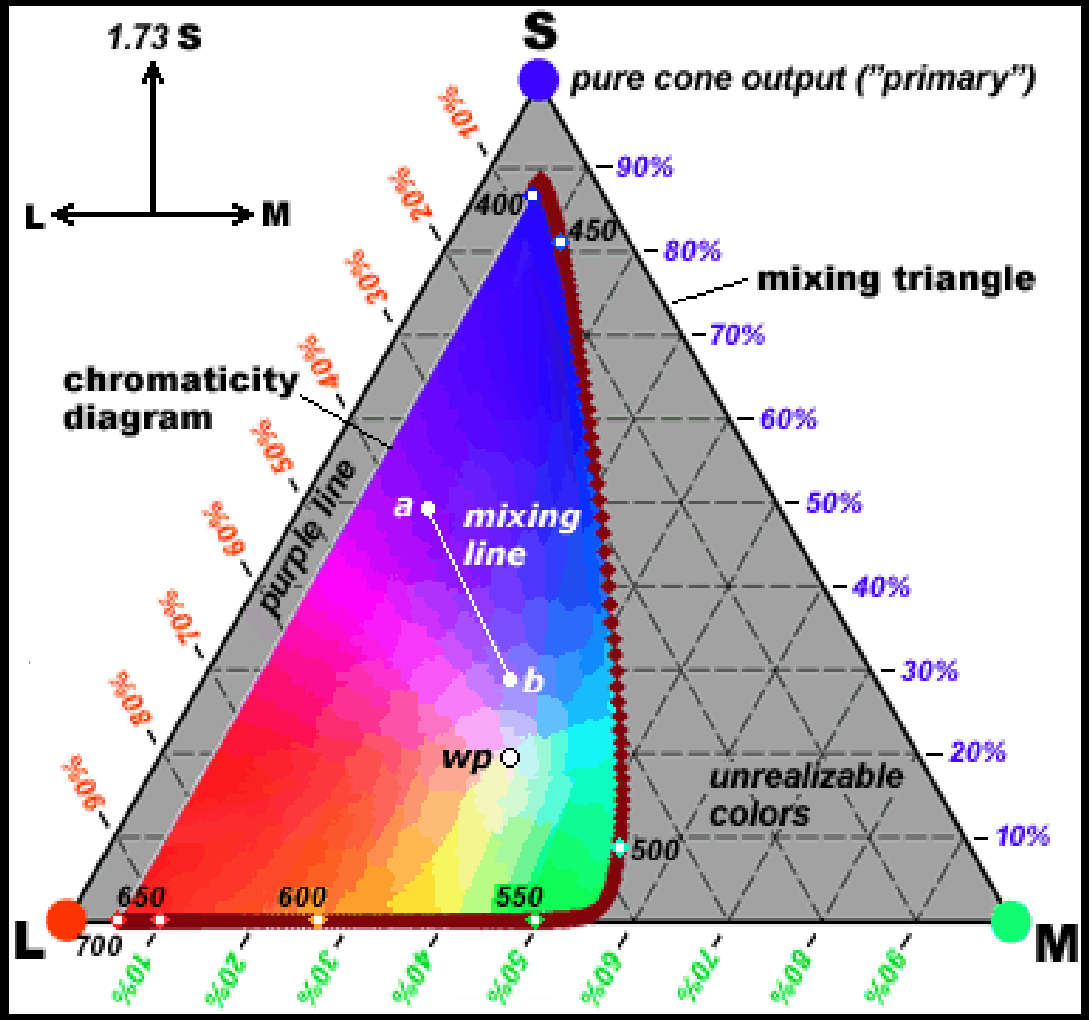


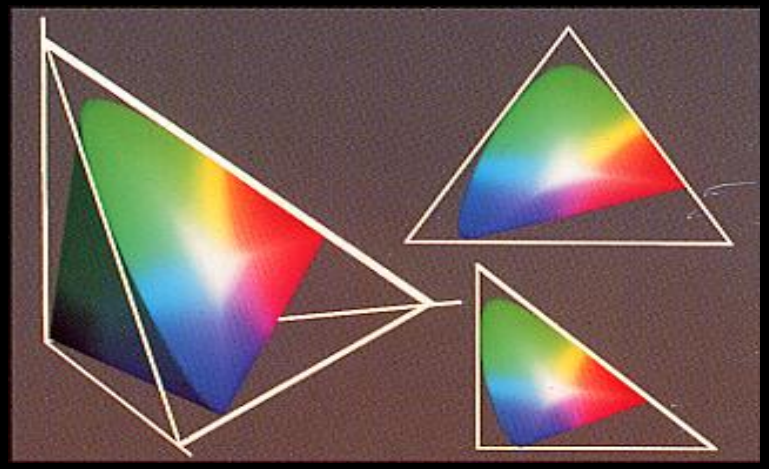
3D



2D + LUMINOSIDADE

ESPAÇO DAS CORES

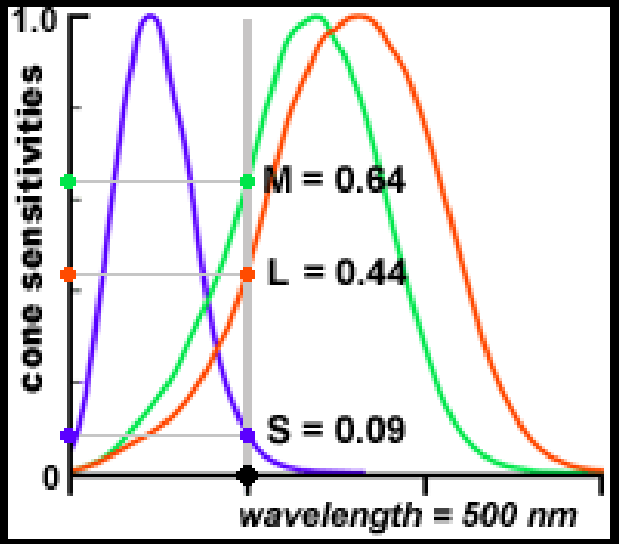




CÓDIGOS DE COR

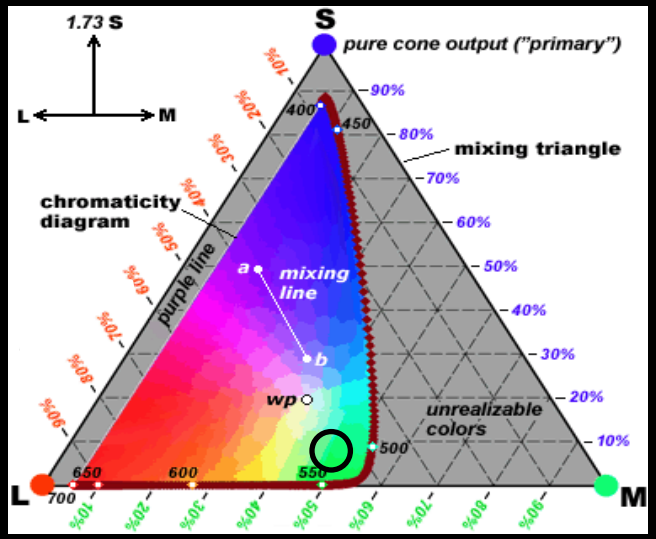
COR = (S=0.09, M=0.44, L=0.44)

COR = (S=7 %, M=38 %, L=55 %)

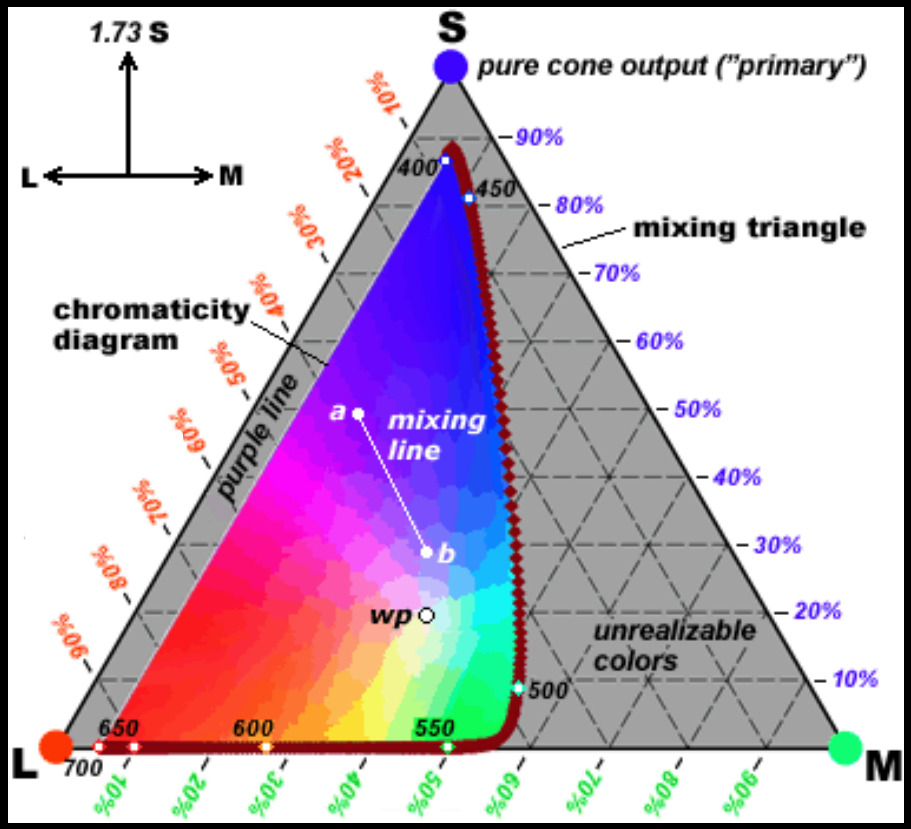


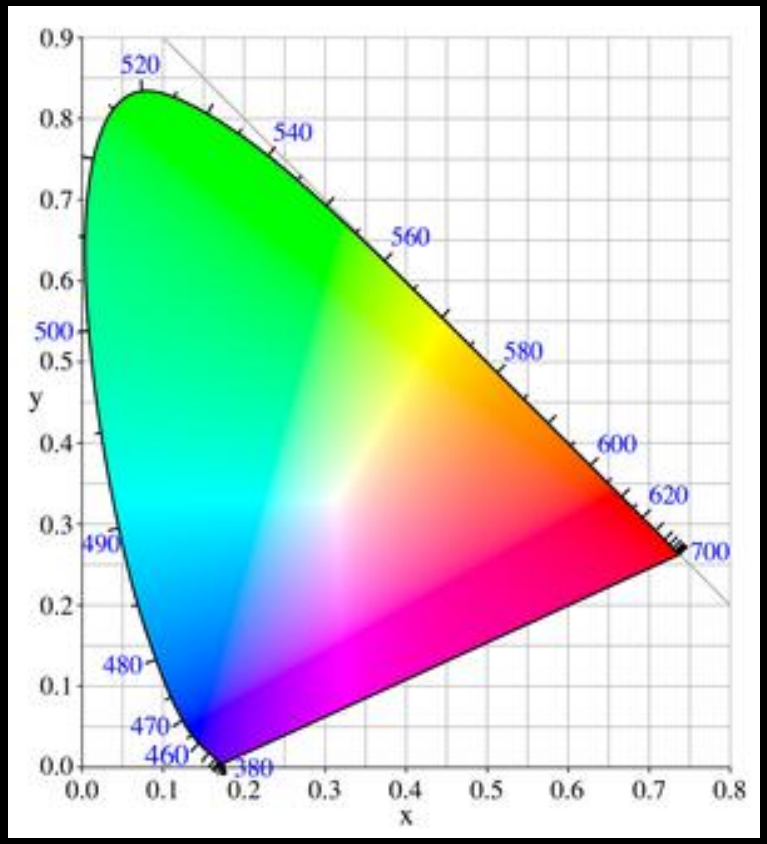
COR = VERDE

COR =



MUDANÇA DE VARIÁVEIS

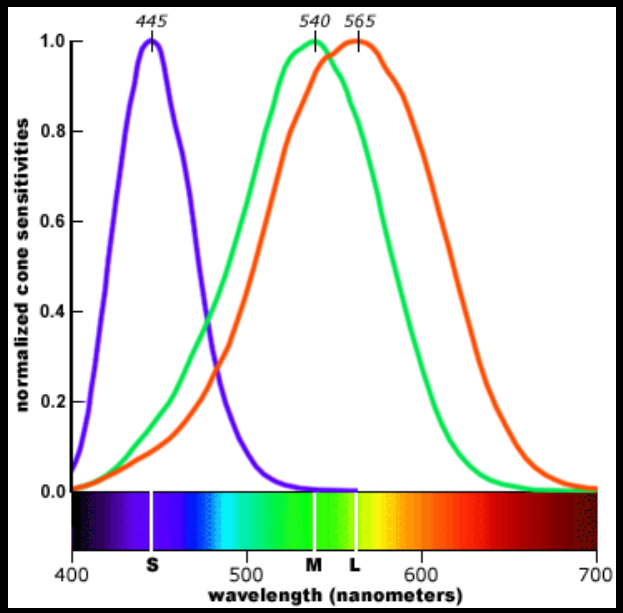


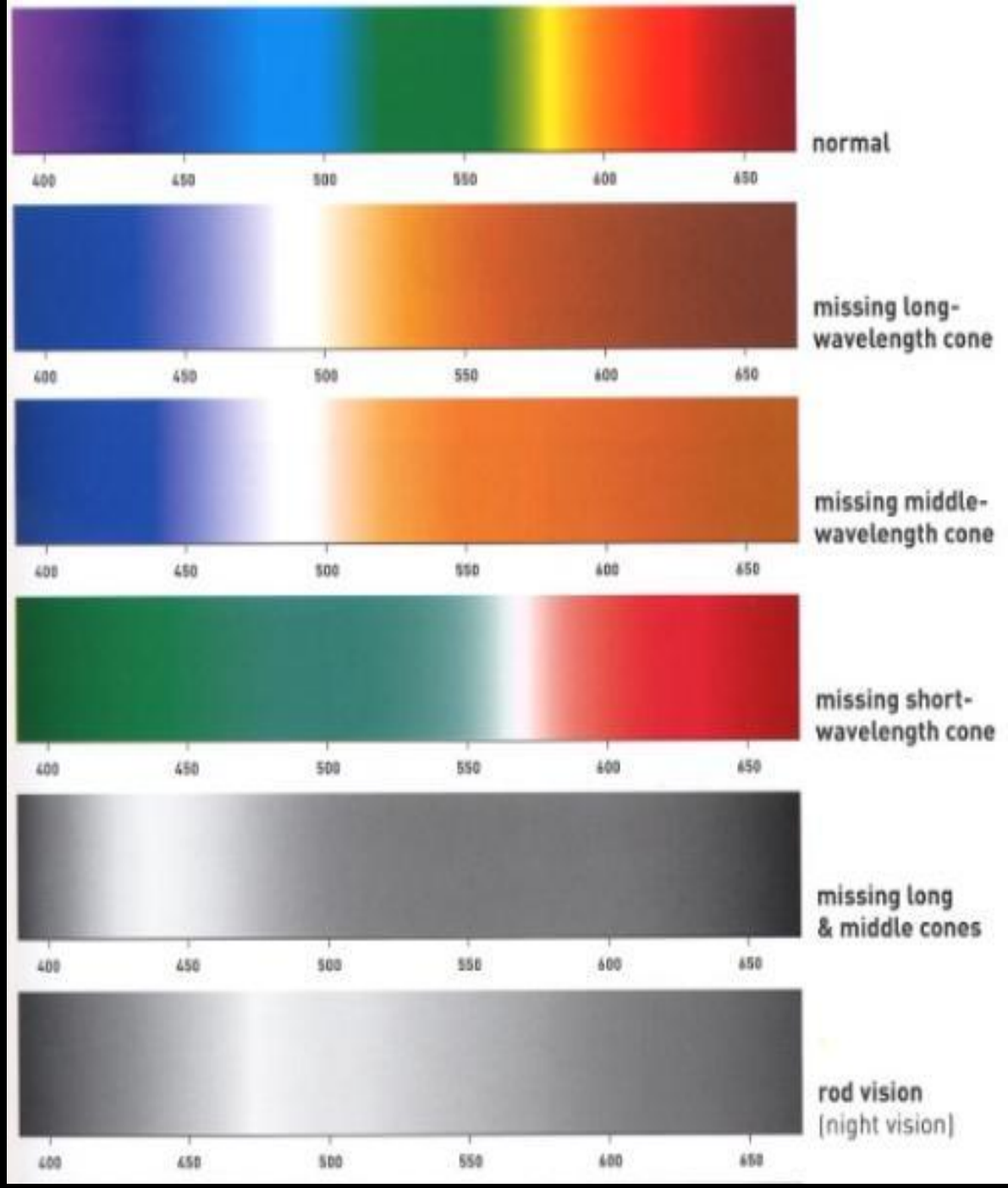


S M L → CIE *xyY* 1931

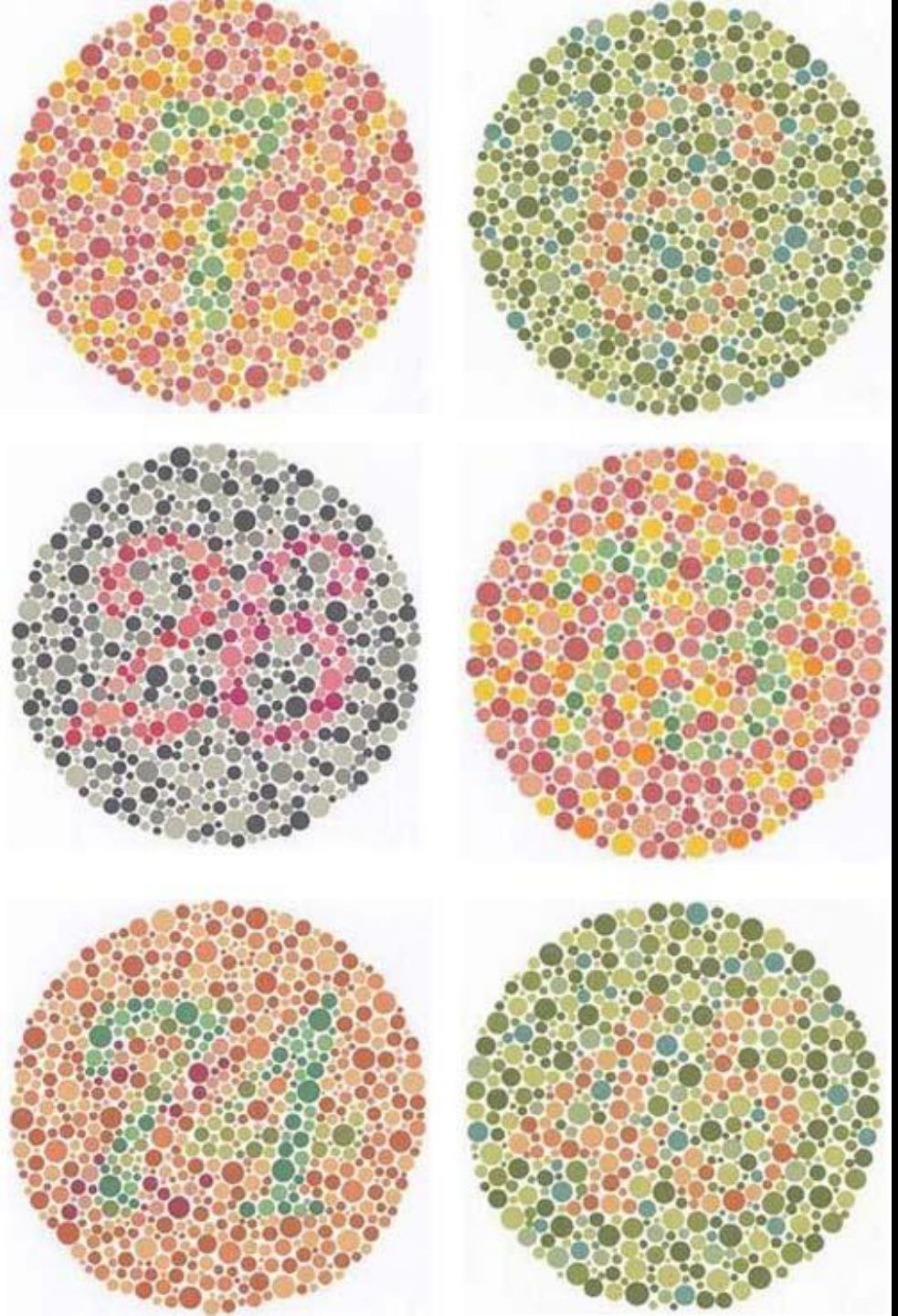
Y : luminosidade

DALTONISMO


445
540
565
1.0
0.8
0.6
0.4
0.2
0.0
normalized cone sensitivities
400
S
500
M
L
600
700
wavelength (nanometers)


normal
missing long-wavelength cone
missing middle-wavelength cone
missing short-wavelength cone
missing long & middle cones
rod vision (night vision)
400
450
500
550
600
650

DALTONISMO

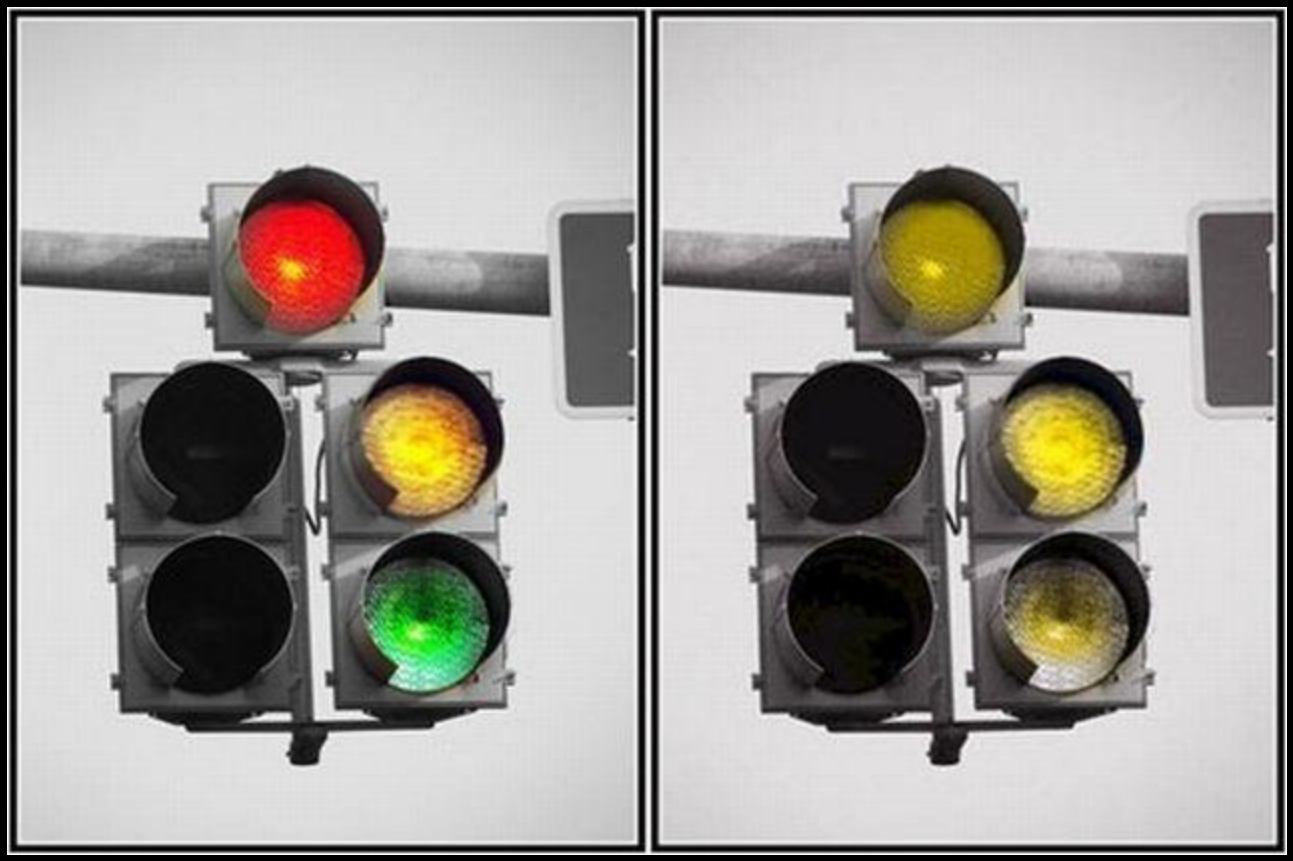


DALTONISMO

ORIGINAL DALTÔNICO

DALTONISMO

ORIGINAL DALTÔNICO



ANIMAIS

1 detector

animais noturnos, peixes de águas profundas

humanos na penumbra

2 detectores

cães, gatos, alguns macacos,..

3 detectores

humanos, alguns macacos,alguns insetos,..

Mais de 3 detectores... ATÉ 12

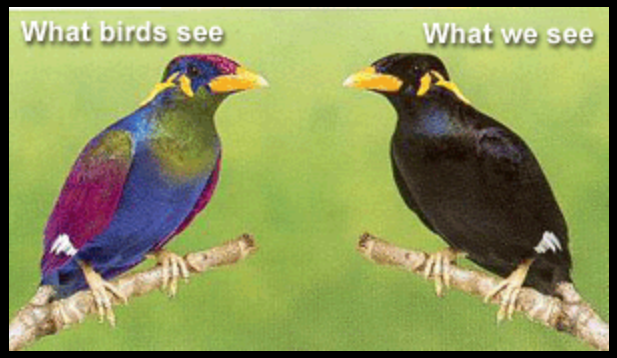
alguns pássaros, peixes, répteis, insetos ..

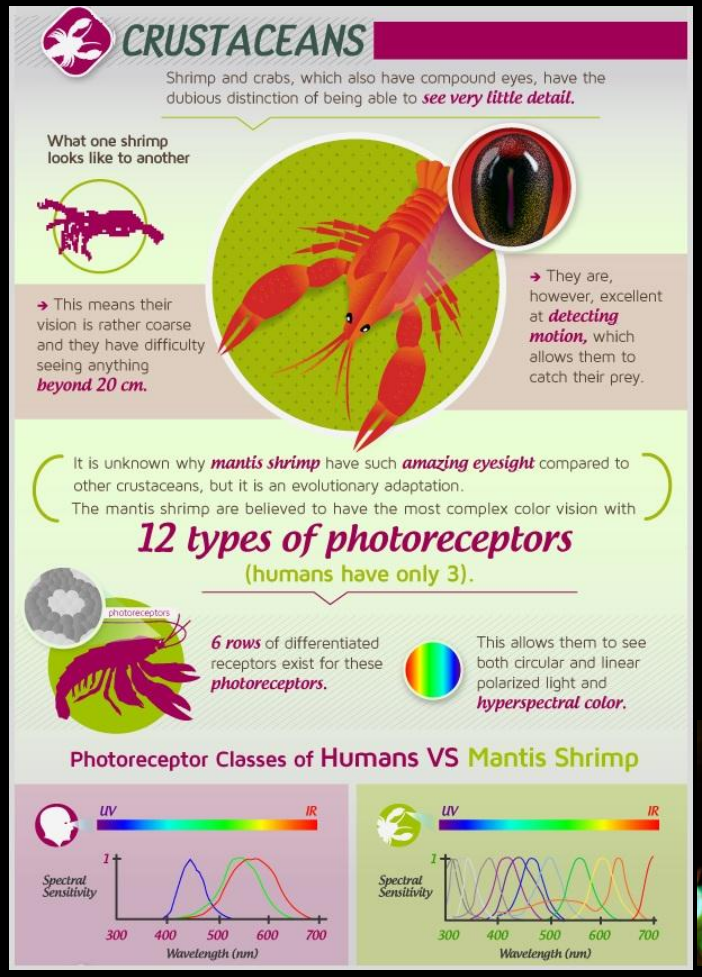
ANIMAIS

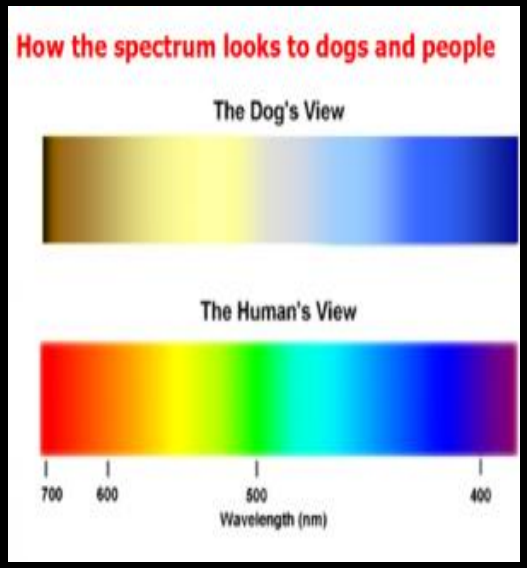
Color vision table

Name of state	Number of cone cells	Approx. number of colors perceived	Porters
Monochromacy	1	100	marine mammals, owl monkey, Australian sea lion, achromat humans
Dichromacy	2	10,000	most terrestrial non-primate mammals, color blind primates
Trichromacy	3	1 million	most primates, especially great apes (such as humans), marsupials, some insects (such ashoneybees)
Tetrachromacy	4	100 million	most reptiles, amphibians, birds and insects, rarely humans
Pentachromacy	5	10 billion	some insects (specific species of butterflies), some birds (pigeons for instance)

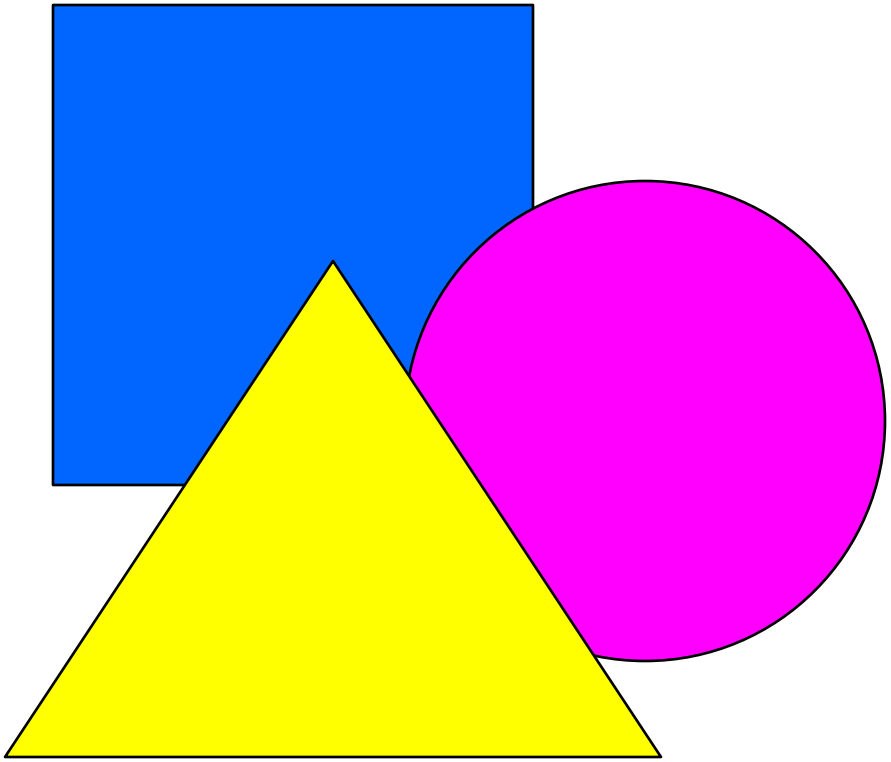
ANIMAIS

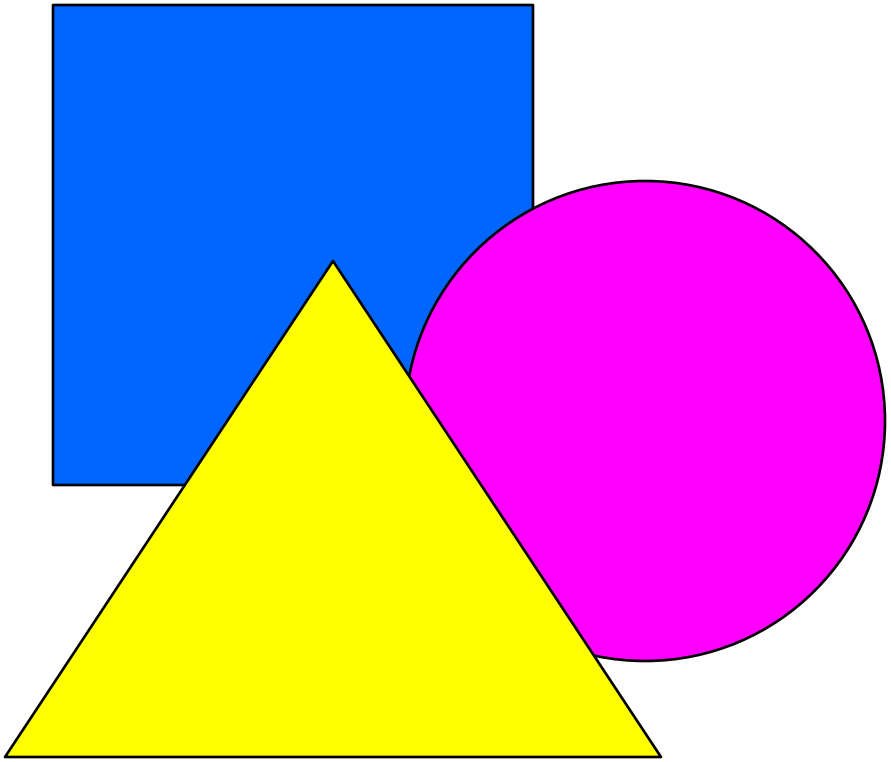

What birds see
What we see

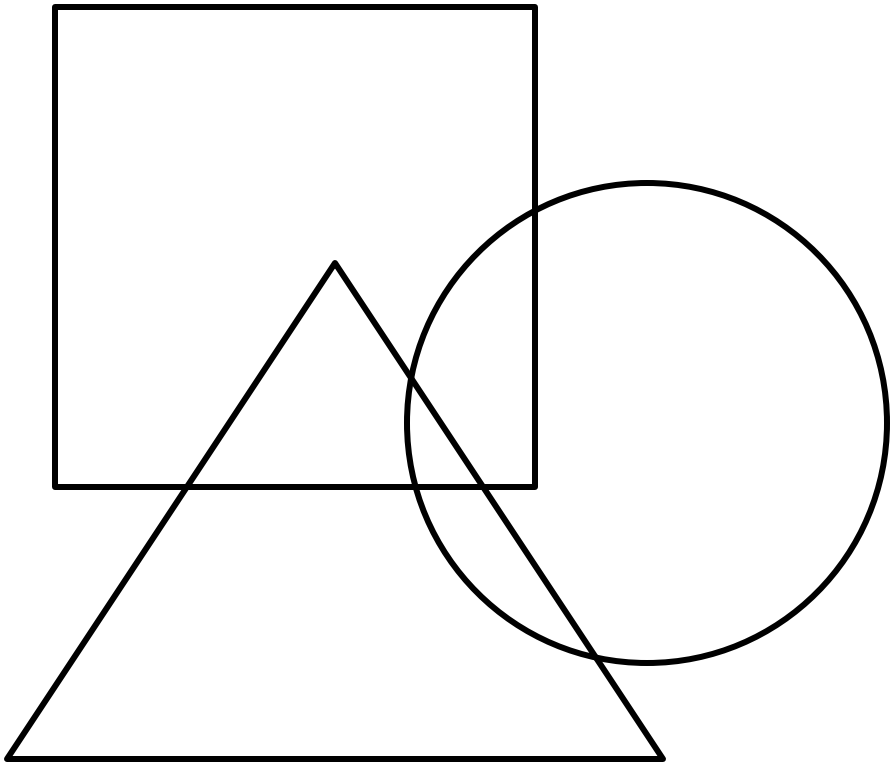

CRUSTACEANS
Shrimp and crabs, which also have compound eyes, have the dubious distinction of being able to see very little detail.
What one shrimp looks like to another
This means their vision is rather coarse and they have difficulty seeing anything beyond 20 cm.
They are, however, excellent at detecting motion, which allows them to catch their prey.
It is unknown why mantis shrimp have such amazing eyesight compared to other crustaceans, but it is an evolutionary adaptation.
The mantis shrimp are believed to have the most complex color vision with
12 types of photoreceptors
(humans have only 3).
photoreceptors
6 rows of differentiated receptors exist for these photoreceptors.
This allows them to see both circular and linear polarized light and hyperspectral color.
Photoreceptor Classes of Humans VS Mantis Shrimp
UV
IR
Spectral Sensitivity
1
300
400
500
600
700
Wavelength (nm)

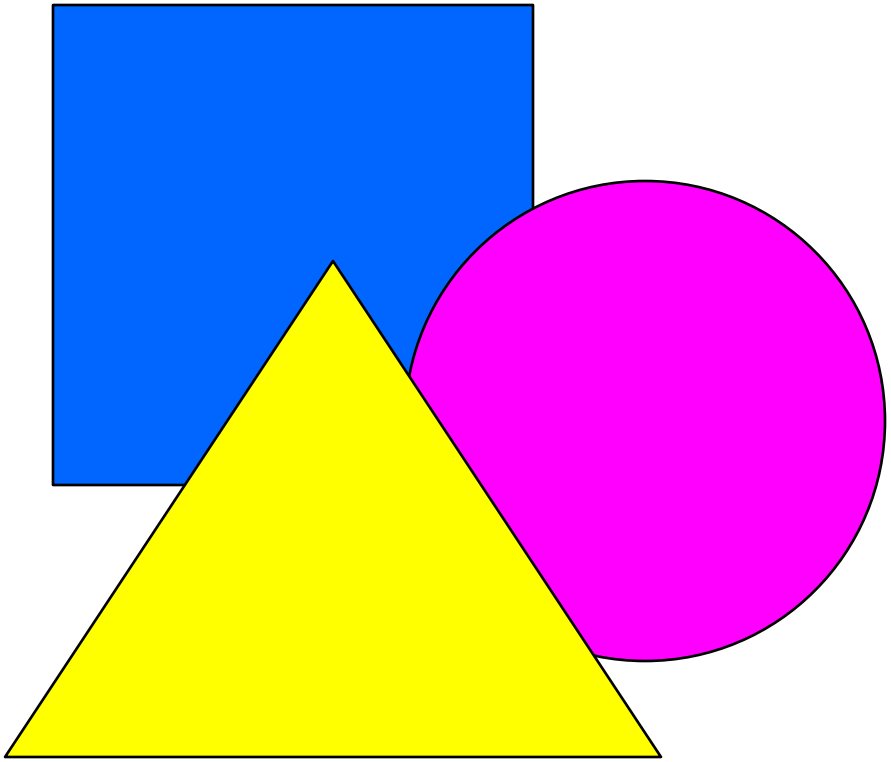

How the spectrum looks to dogs and people
The Dog's View
The Human's View
700
600
500
400
Wavelength (nm)

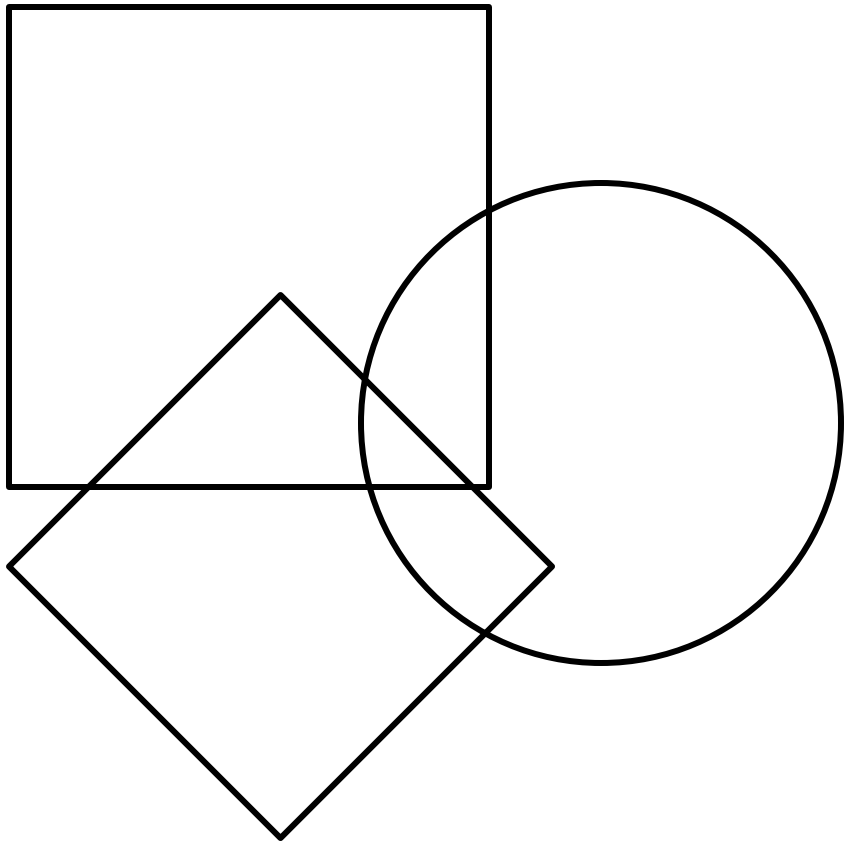
AFTER-IMAGE

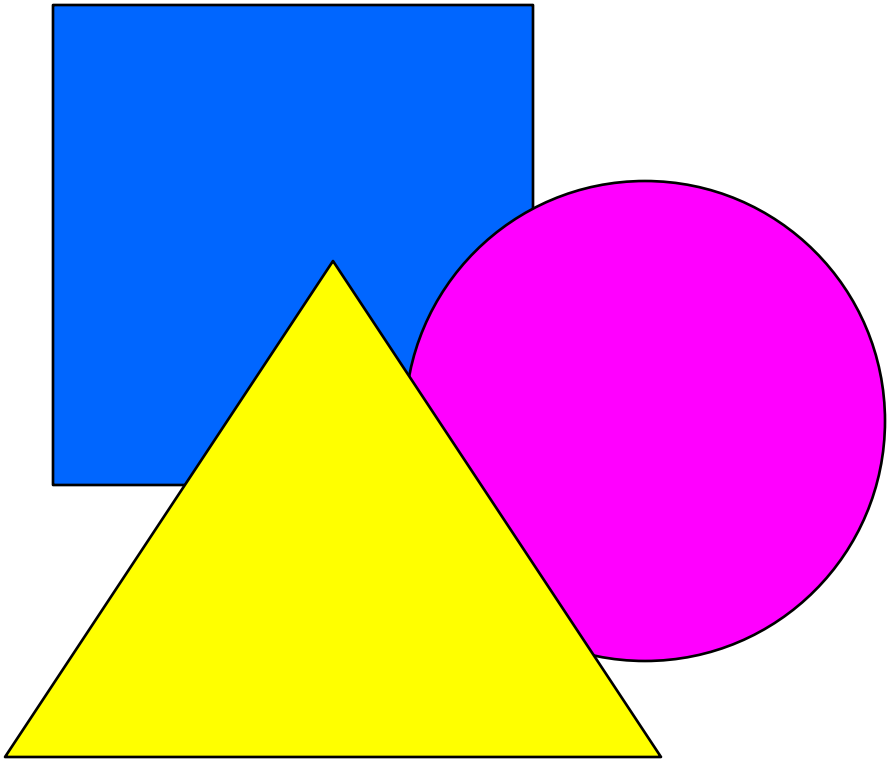


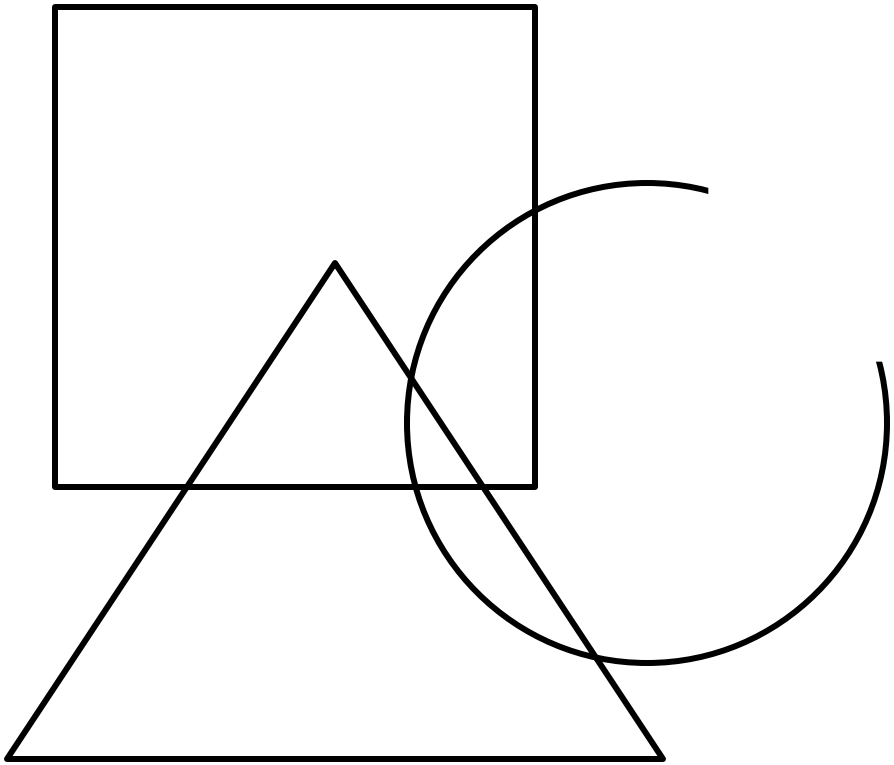






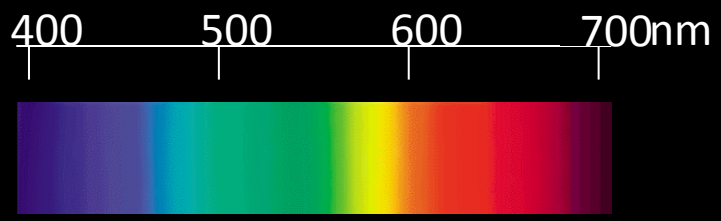






NÚMERO DE BASE

ESPECTRO LINEAR **1**D



3 SENSORES

ESPAÇO **3**D

3 CORES PRIMÁRIAS

2 CORES COMPLEMENTARES

AFTER-IMAGE

TEORIAS DA COR

Issac Newton 1704 ESPECTRAL

Mikhail Lomonosov 1757

George Palmer 1777

TRICROMÁTICAS

Thomas Young 1802

BICROMÁTICAS

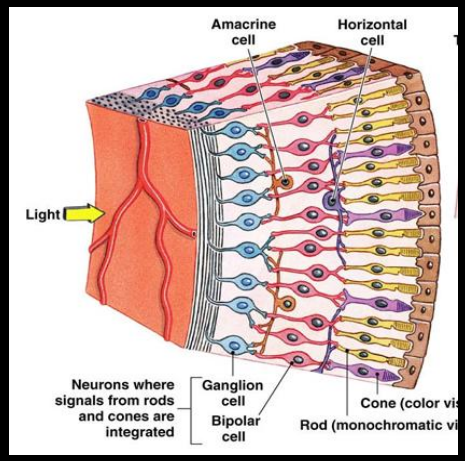
Johanan Goethe 1810

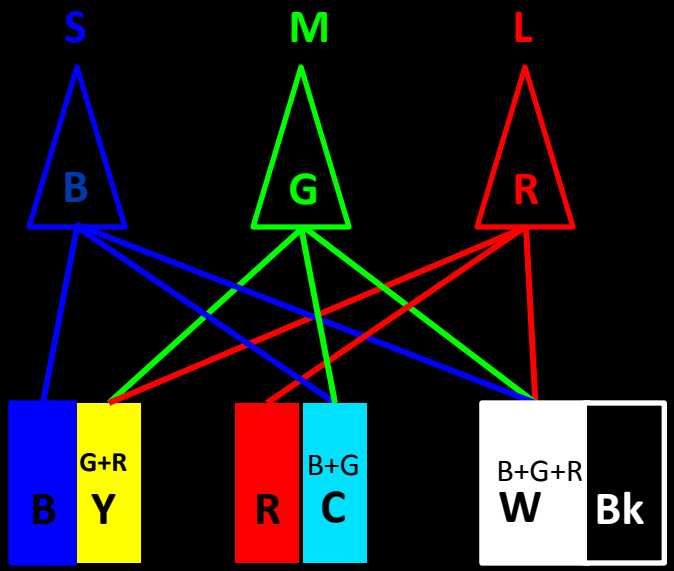
Hermann von Helmholtz 1850

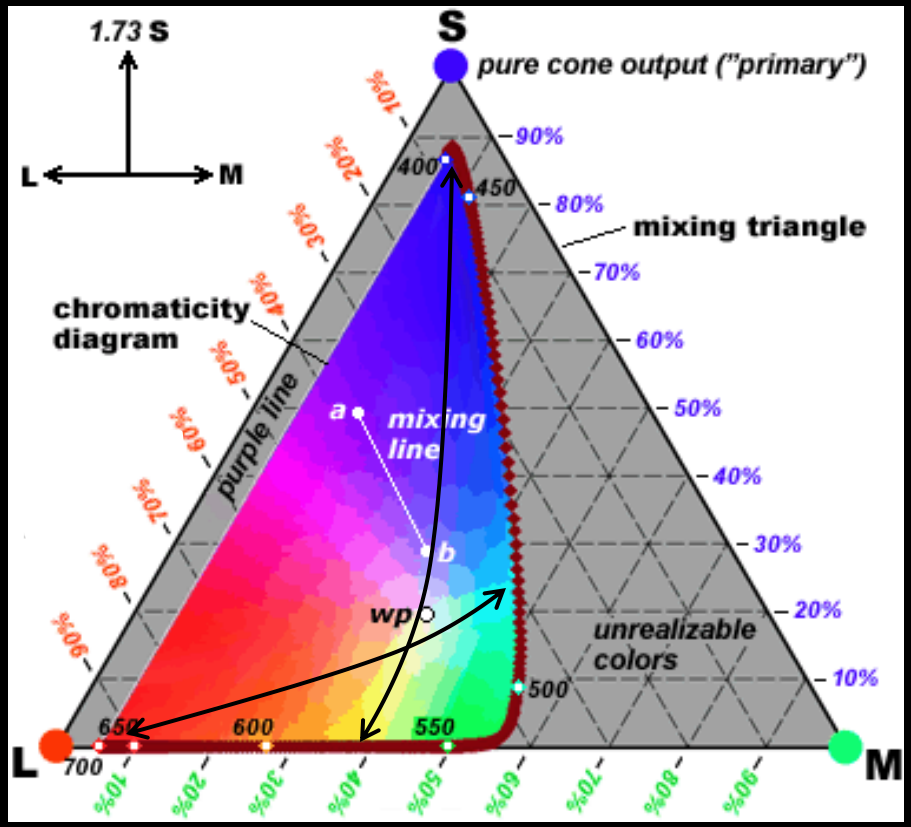
James Clerk Maxwell 1855

Evald Hering 1892

SISTEMA BIOLÓGICO

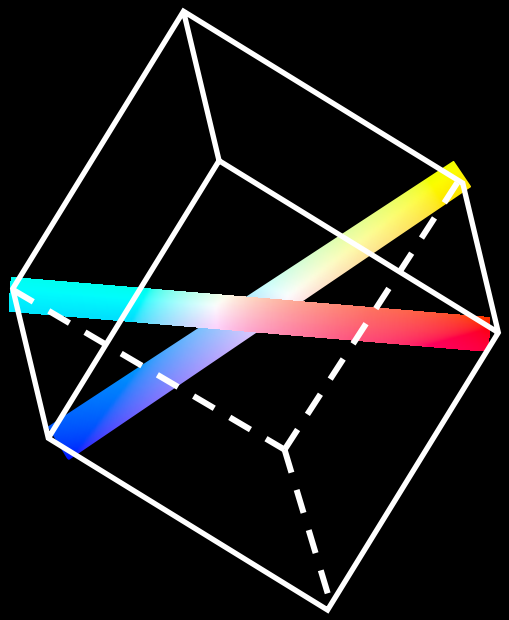


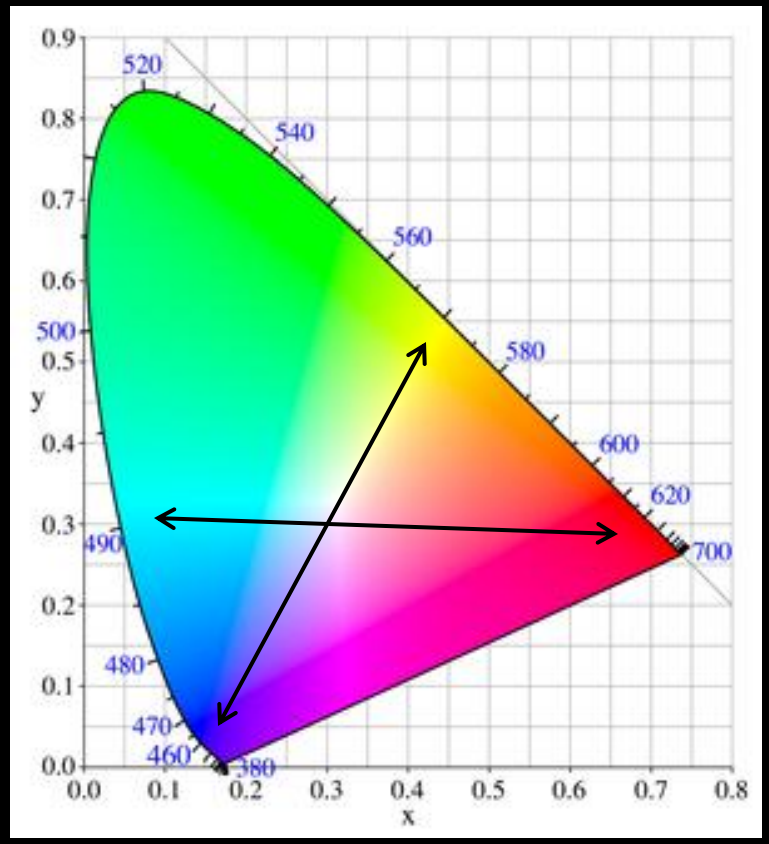




ESPAÇO DAS CORES

Variáveis do sistema humano





EVOLUÇÃO TV *vs* HUMANA

TV ANALÓGICA

Gravação: 3 sinais RGB

Transmissão: luminosidade + 2 sinais diferenciais

HUMANOS

Deteção: 3 sinais dos 3 tipos de cones

Transmissão: luminosidade + 2 sinais diferenciais