Problem# 3

The Purkinje shift

REPORTER

AVA ALEBOUYEH

Online IYNT 2021

Outline

Problem No. 3

As **light** levels decrease, **human eyes** perceive relative **brightness** and **contrast** of various colors differently. Perform experiments in **controlled conditions** to investigate this effect.

Key words

Eye Structure

light level

Color contrast

Introduction

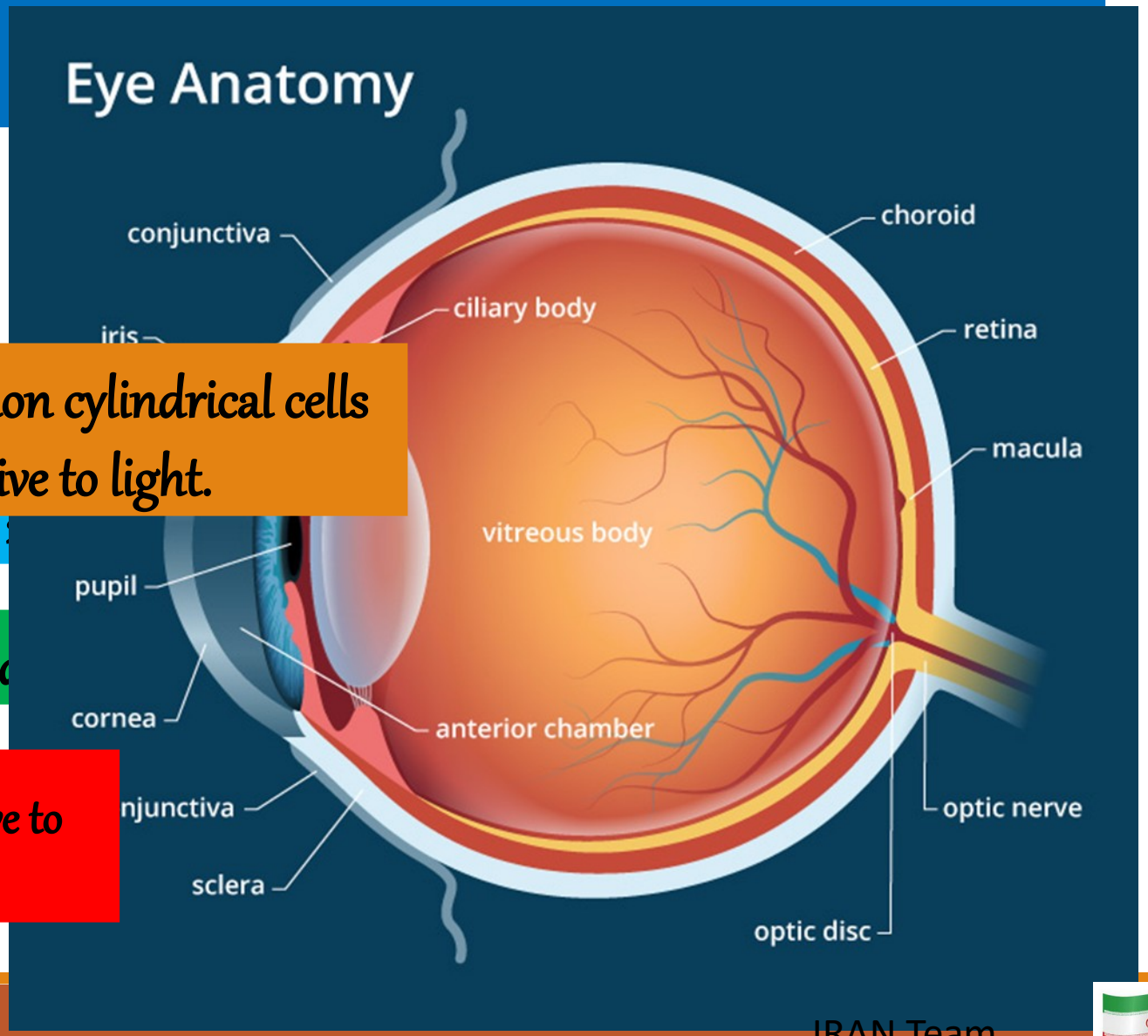
Anatomy of the Eye

Cylindrical cells : There are about 120 million cylindrical cells in the human retina , which are less sensitive to light.

our environment. It is spherical with

the innermost layer of the eye is celle

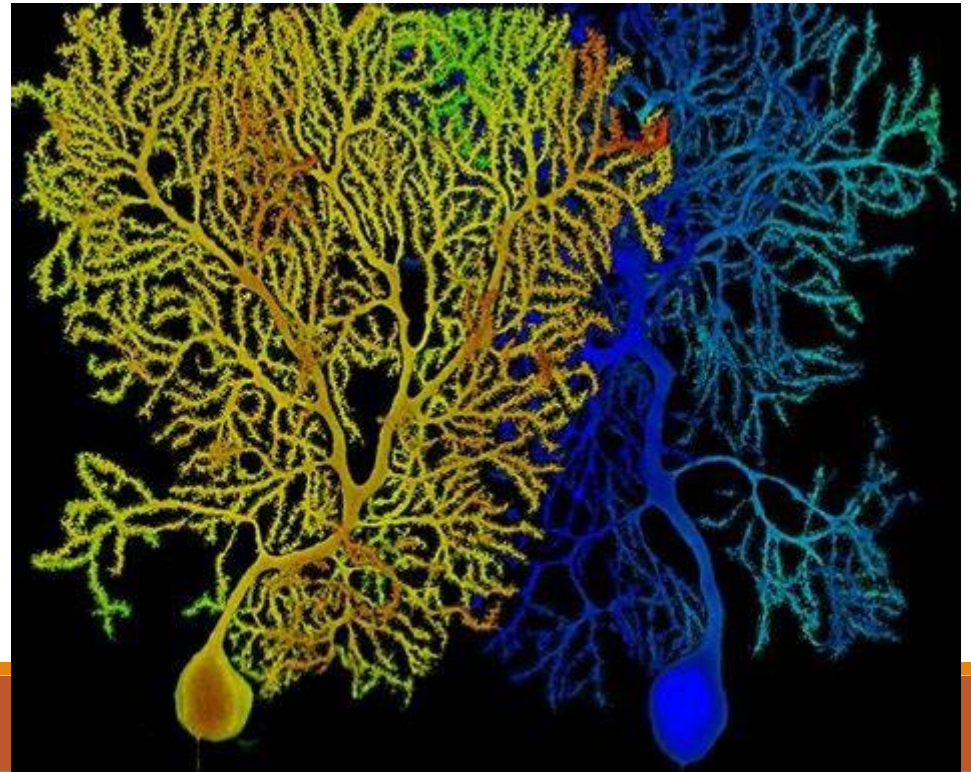
Cone cells : Receives colors and is less sensitive to cylindrical cells in low light.



The difference between conical and cylindrical cells is how they work .

lighting	dim	Darkness
Conical cells	Cylindrical and Conical cells	Cylindrical cells

Purkinje cells are some of the largest neurons in the human brain in the cerebellum and by moving Purkinje cells, which are for information processing we can have different perceptions of different colors, lights, and color contrast in different conditions with relative brightness. Light also affects our vision.



Experiments

e use sunglasses. T
f light that is visible

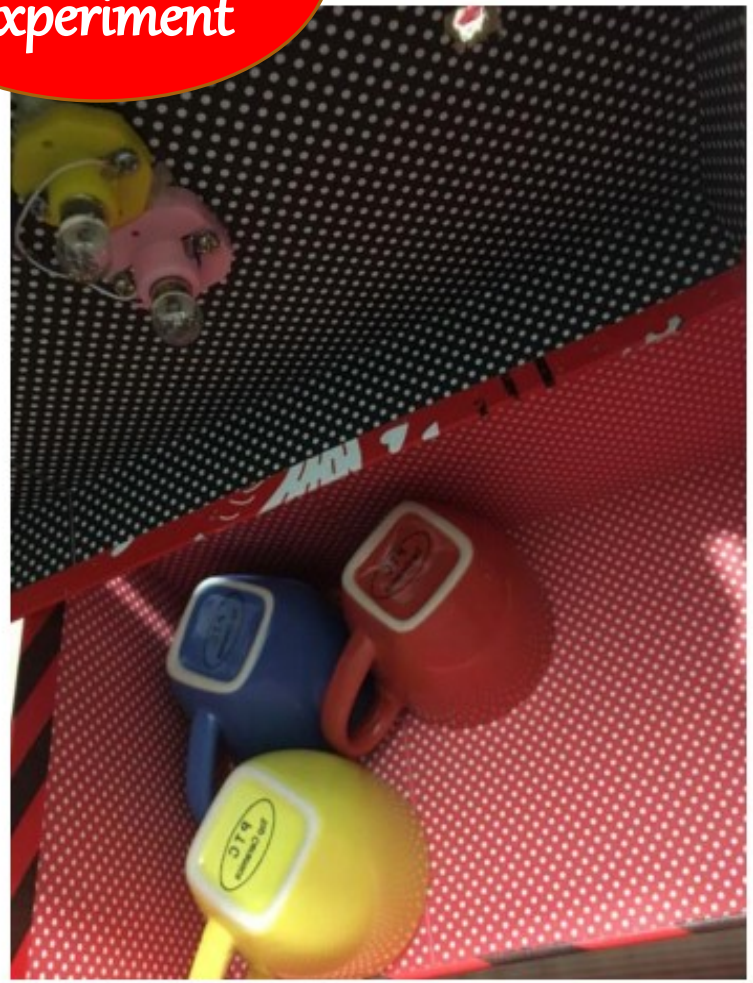
With sunglasses

Photo taken in the afternoon

Photo taken in the morning

2nd Experiment

we u ed



In this experiment, we wanted to investigate the effect of Purkinje cell displacement on relative brightness and understand the contrast of different colors in the human eye .The human brain is involved in the study of contrasts and in different lighting conditions, such as the change in human vision day and night. We moved the Purkinje by moving the head and tested this experiment on several people.

Table 1: The effect of natural light on different age groups

Mobility conditions - age	5 to 11	12 to 20	21 to 29	30 to 39	40 to 50	51 to 60
Fixed colored object and head	Colors appear darker.	Colors appear darker.	The colors are darker than before.	Colors appear darker. And colors with contrast are close to each other.	Colors appear darker.	Colors appear darker.
Moving head	They look much darker.	Colors are brighter and whiter.	Bright colors are seen as white or brighter and brighter.	Colors appear darker.	Colors appear darker.	Colors appear darker.
Moving object	They look much darker.	Dark colors and black are seen.	Colors are darker and contrasts are closer to each other.	Colors appear darker or blacker.	Colors are seen brighter.	Colors appear darker.
Moving head and colored object	They look much darker and more colorful.	Dark colors are seen and close color contrasts are also seen.	Colors are brighter and whiter.	Colors appear darker or blacker.	Colors appear darker or blacker.	Darker colors are seen in black and other colors are darker.

Table 2: The effect of sunlight on different ages

Mobility conditions - age	5 to 11	12 to 20	21 to 29	30 to 39	40 to 50	51 to 60
Fixed colored object and head	Recognizes color correctly.	The colors tend to be more red, but they guess correctly.	Recognizes color correctly.	Recognizes color correctly.	The contrast of red, orange and ... colors are seen in the same color.	Colors are brighter and the color contrast is more red. But they guess correctly.
Moving head	Recognizes color correctly.	Colors are darker or the contrast of red, orange, etc. are seen in the same color.	Colors are darker or the contrast of red, orange, etc. are seen in the same color.	The contrast of red, orange and ... colors are seen in the same color.	The contrast of red, orange and ... colors are seen in the same color.	Colors look brighter. But they guess correctly.
Moving object	Recognizes color correctly.	The colors are more red.	The contrast of red, orange and ... colors are seen in the same color.	The contrast of red, orange and ... colors are seen in the same color.	The contrast of red, orange and ... colors are seen in the same color.	Colors look brighter. But they guess correctly.
Moving head and colored object	Colors appear darker.	The colors are more red and darker.	Colors appear darker or blacker.	Contrast colors are seen close to each other.	The contrast of red, orange and ... colors are seen in the same color.	Colors appear brighter and sometimes darker.

Table 3: The effect of Lamps on different ages

Mobility conditions - age	5 to 11	12 to 20	21 to 29	30 to 39	40 to 50	51 to 60
Fixed colored object and head	Colors appear darker and more colorful.	Recognizes color correctly.	Recognizes color correctly.	Recognizes color correctly.	Recognizes color correctly.	Colors are more opaque. But they guess correctly.
Moving head	Colors are seen more vividly.	Colors are darker or contrasting colors are seen close to each other.	Colors are darker or contrasting colors are seen close to each other.	Recognizes color correctly.	Colors appear darker and more colorful.	Colors are more opaque. But they guess correctly.
Moving object	Colors look much darker.	Contrast of blue-green colors and ... are seen in the same color.	Contrast of blue-green colors and ... are seen in the same color.	Contrast of blue-green colors and ... are seen in the same color.	Colors appear darker and more colorful.	Colors appear duller and sometimes darker.
Moving head and colored object	Colors appear darker and more colorful.	Colors are darker or colors are seen with the contrast of blue-green colors and ... darker.	Colors are darker or colors are seen with the contrast of blue-green colors and ... darker.	Contrast colors are seen close to each other.	It is brighter in places where there is more light.	Colors appear duller and sometimes black.

Results & Conclusions

Although Purkinje is a higher percentage of men than women but in these experiments we found that the gender does not make much difference in processing. One of the reason is , due to the pandemic of coronavirus, we have performed these tests on a limited number of people.

we conclude that the use of sunglasses changes the intensity of the light spectrum and causes the light to change and decrease.

In experiment with case , we realized that in lightless environment and compare with in natural light, sunlight and with lamps , to recognize colors differs in different ages.

References

[1] Konnerth, A., Llano, I. and Armstrong, C.M., 1990. Synaptic currents in cerebellar Purkinje cells. *Proceedings of the National Academy of Sciences*, *87*(7), pp.2662-2665.
[2] Herzfeld, D.J., Kojima, Y., Soetedjo, R. and Shadmehr, R., 2015. Encoding of action by the Purkinje cells of the cerebellum. *Nature*, *526*(7573), pp.439-442.
[3] Barry, J.C., Backes, A., Pongs, U.M., Kirschkamp, T. and Dunne, M.C.M., 1997. Improved computing scheme for measuring eye alignment with Purkinje images I and IV. *Ophthalmic and Physiological Optics*, *17*(5), pp.433-440.
[4] Mullen, R.J., Eicher, E.M. and Sidman, R.L., 1976. Purkinje cell degeneration, a new neurological mutation in the mouse. *Proceedings of the National Academy of Sciences*, *73*(1), pp.208-212.
[5] Tsutsui, K., Ukena, K., Sakamoto, H., Okuyama, S.I. and Haraguchi, S., 2011. Biosynthesis, mode of action, and functional significance of neurosteroids in the purkinje cell. *Frontiers in endocrinology*, *2*, p.61.

Thanks for your attention