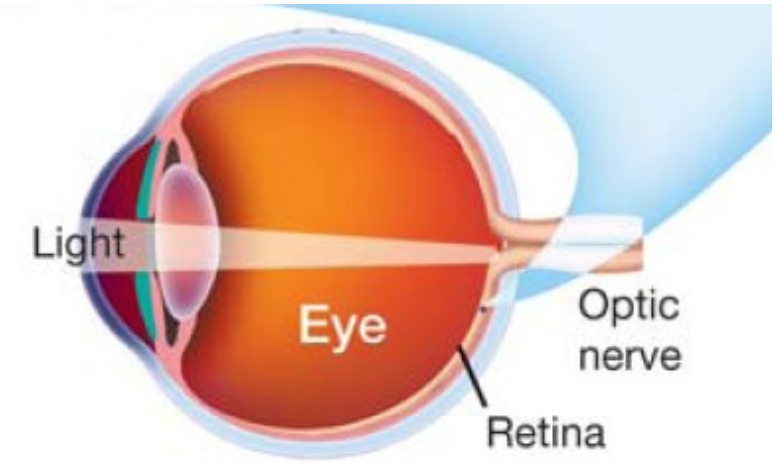
Chapter 14.2 Learning Goals

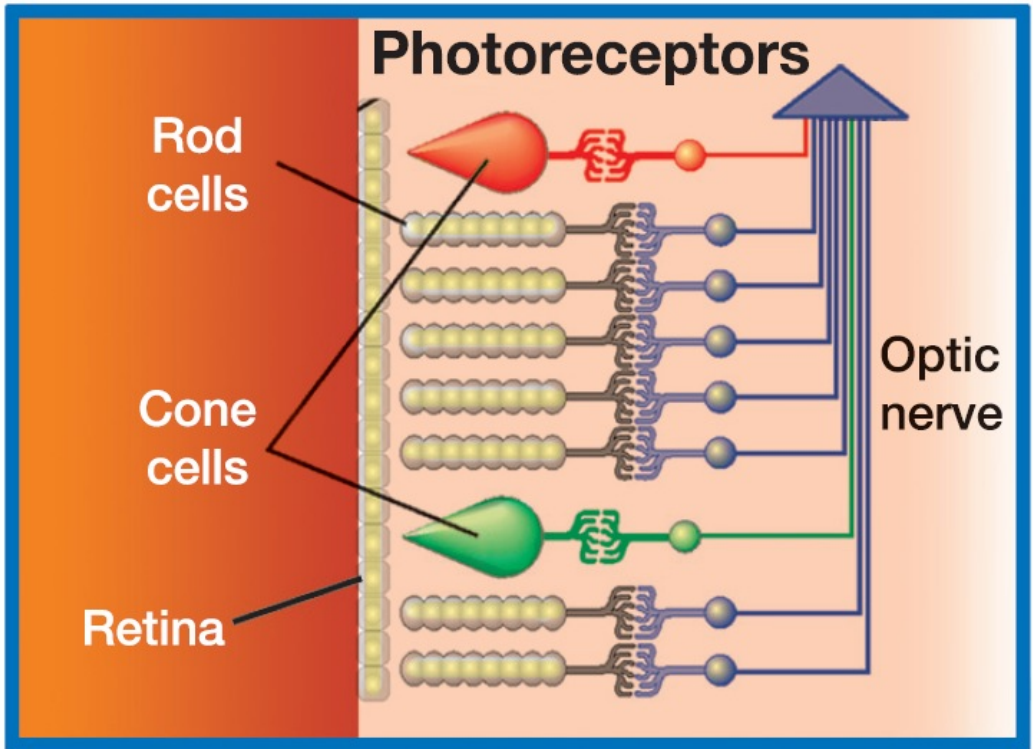
- **Explain how humans see.**

The human eye

- The *eye* is the sensory organ used for vision.
- The retina contains light-sensitive cells called *photoreceptors*.
- Photoreceptors convert light into nerve impulses that travel through the *optic nerve* to the visual cortex of the brain.



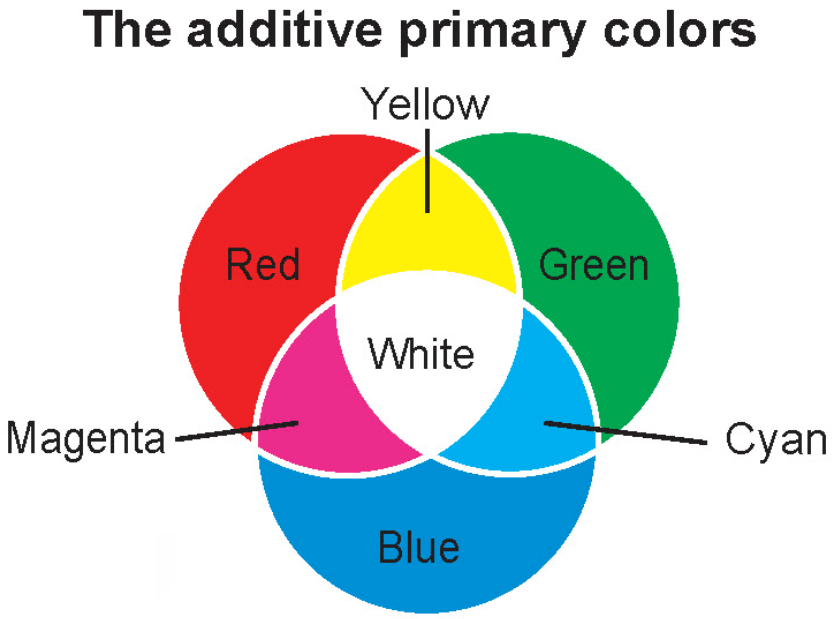
Photoreceptors



- The human eye has two types of photoreceptors—*cones* and *rods*.
- Cones respond to <u>color</u> and rods respond to the <u>intensity</u> of light.
- Rod cells "see" black, white, and shades of gray.

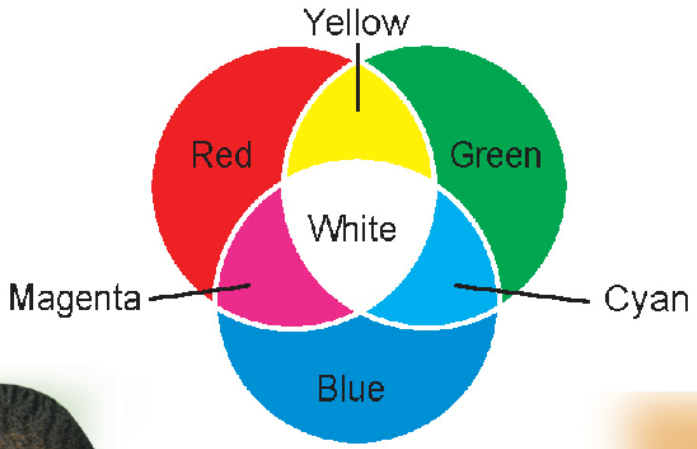
How we see colors

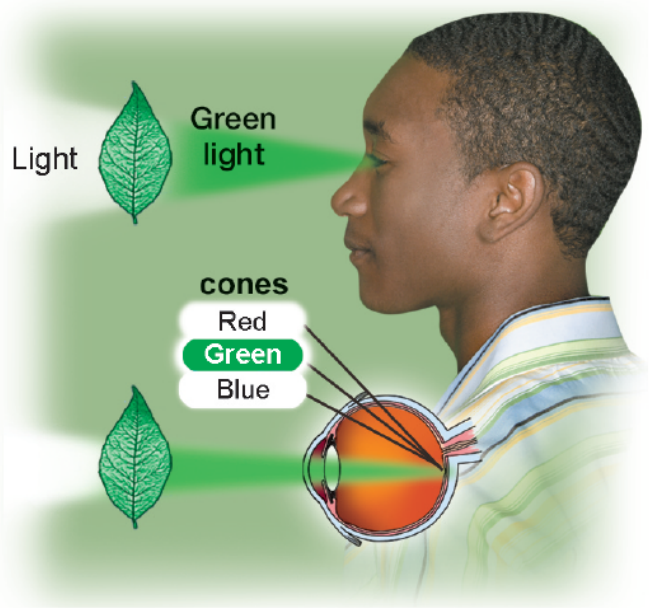
- **Our eyes work according to an *additive color process* — 3 photoreceptors (red, green, and blue) in the eye operate together so that we see millions of different colors.**

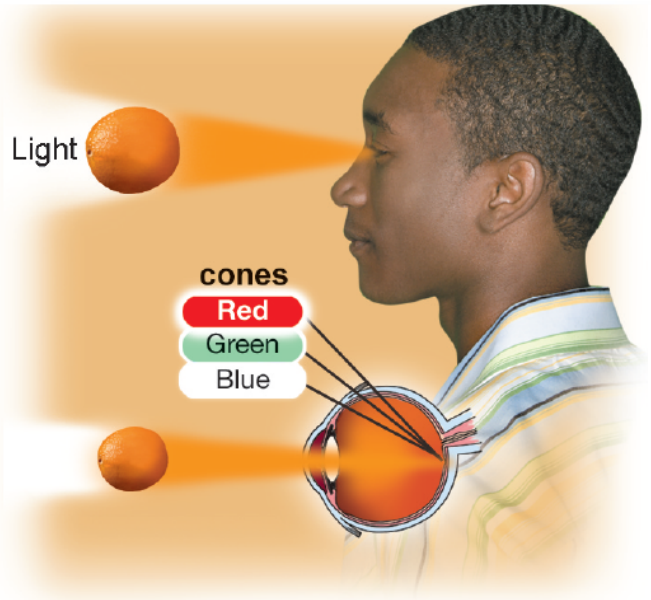


Perceiving Color

The additive primary colors







Making an RGB color image

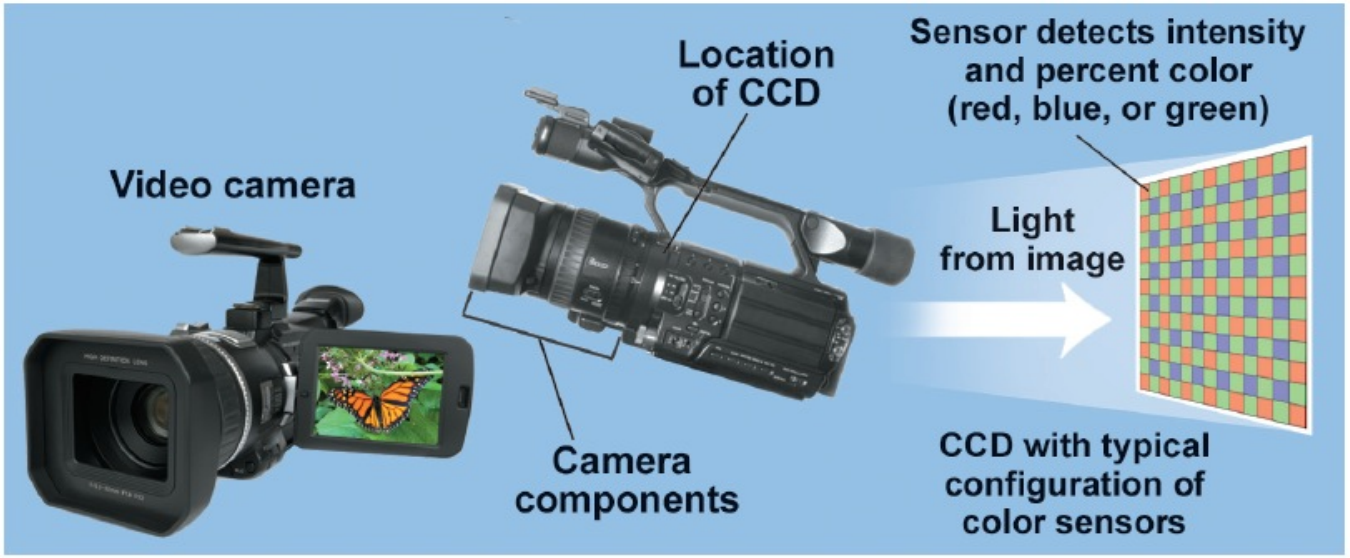
- A television makes different colors by lighting red, green, and blue *pixels* in different proportions.
- Color images in TVs and computers are based on the *RGB color model*.

The RGB Color Process

Dot color on TV monitor	The color you see on the TV monitor					
	Black	White	Red	Yellow	Green	Blue
Red	off	on	on	on	off	off
Green	off	on	off	on	on	off
Blue	off	on	off	off	off	on

Making an RGB color image

- Like the rods and cones in your retina, a video camcorder has tiny light sensors on a small chip called a CCD.
- There are three sensors for each pixel of the recorded image: red, green, and blue.

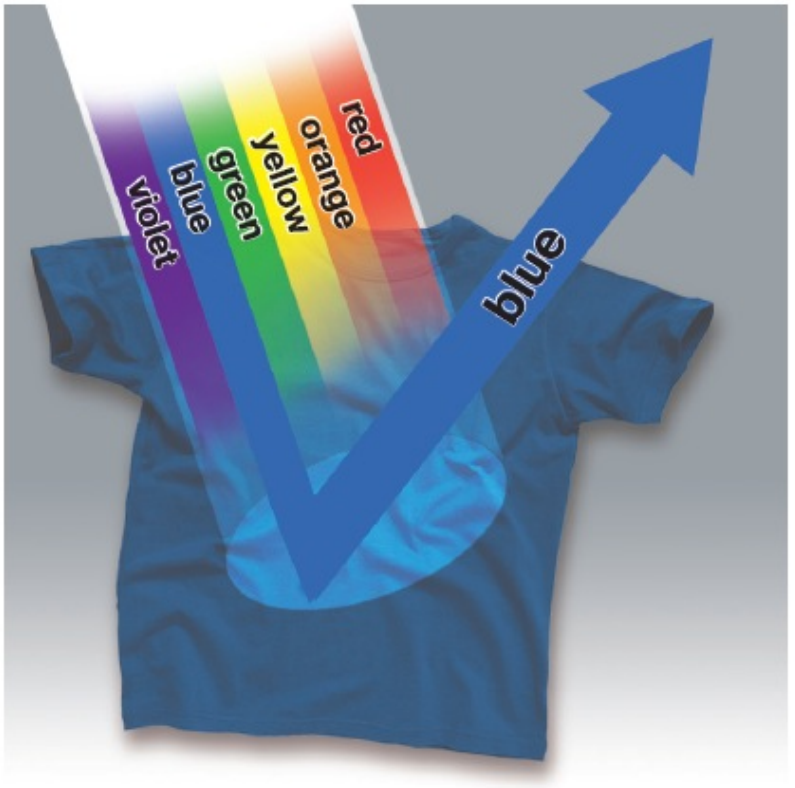


How objects appear to be different colors

- Your eye creates a sense of color by responding to red, green, and blue light.
- You don't see objects in their own light, you see them in reflected light!

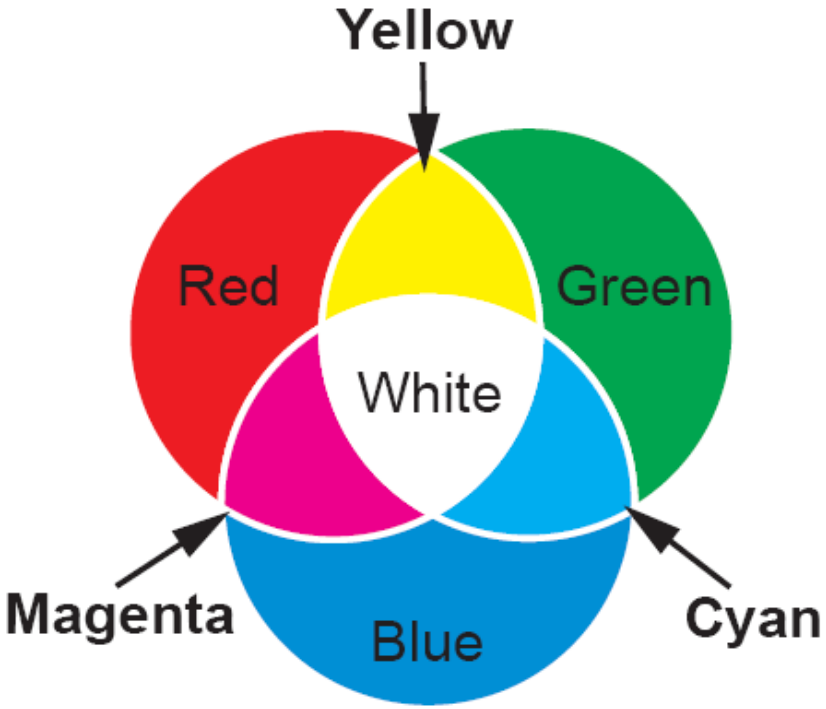
Subtractive color process

- A blue shirt looks blue because it reflects blue light into your eyes.
- Chemicals known as *pigments* in the dyes and paints absorb some colors and reflect other colors.



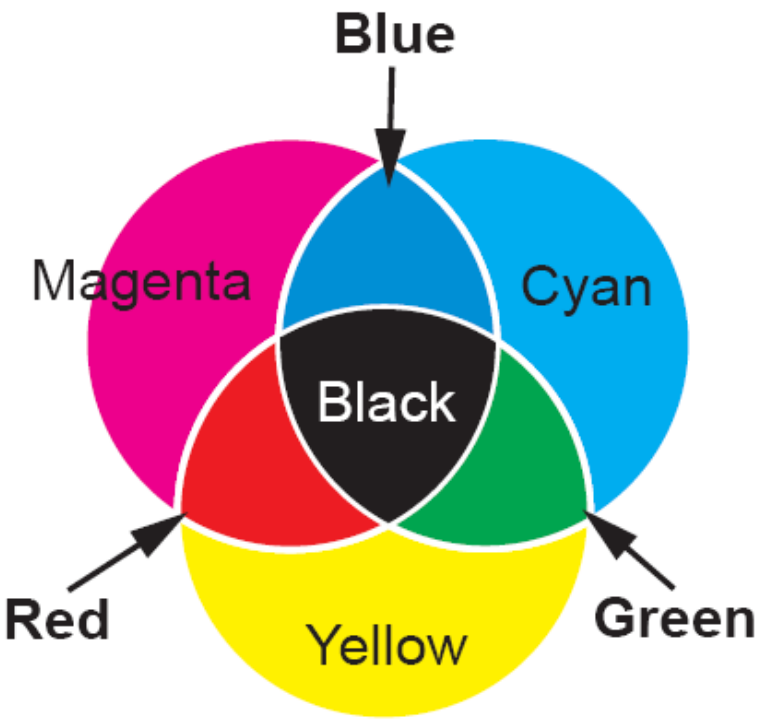
Additive and Subtractive Primary Colors

The additive primary colors



White = red + green + blue
Yellow = red + green
Magenta = red + blue
Cyan = blue + green

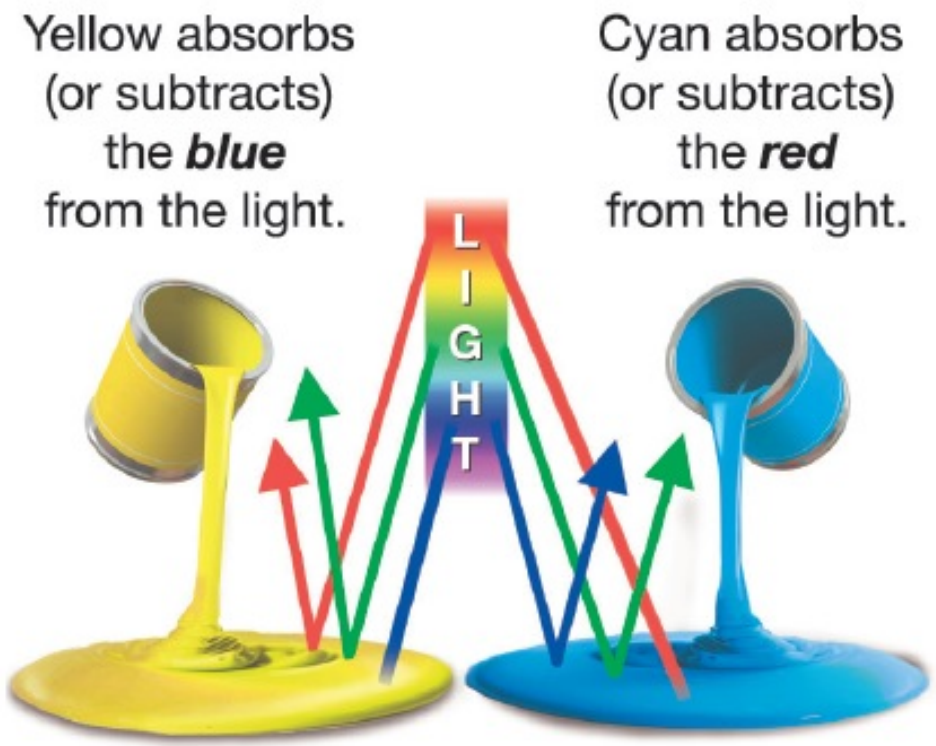
The subtractive primary colors



Black = magenta + yellow + cyan
Red = magenta + yellow
Green = cyan + yellow
Blue = magenta + cyan

The CMYK color process

- The subtractive color process is often called *CMYK* for the four pigments it uses.
- CMYK stands for cyan, magenta, yellow, and black.



Why plants are green

- **Plants absorb energy from light and convert it to chemical energy in process called *photosynthesis*.**

- ***Chlorophyll* is the main pigment of plants absorbs red and blue light and reflects green light.**

Why plants are green

Plants must reflect some light to avoid absorbing too much energy.

- **A plant will die if placed under only green light!**