

# **BLUE LIGHT: THE GOOD, THE BAD AND THE UGLY**

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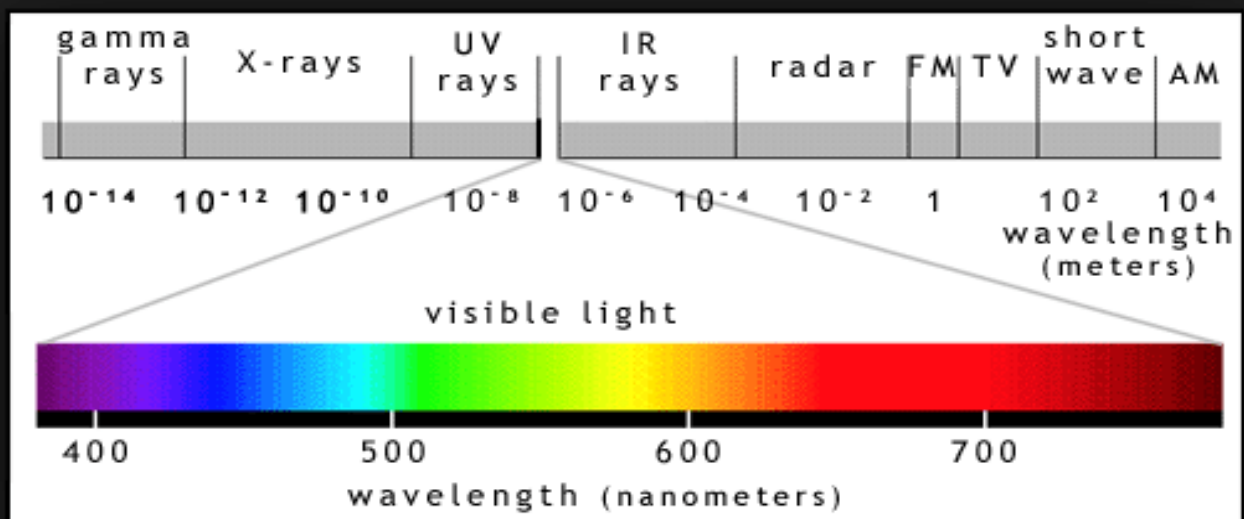
## **FINANCIAL DISCLOSURE**

- **I HAVE NO FINANCIAL INTEREST IN ANY OF THE PRODUCTS MENTIONED IN THIS PRESENTATION**
- **I HAVE NO FINANCIAL CONFLICT OF INTEREST**

TQ????



## LIGHT SPECTRUM

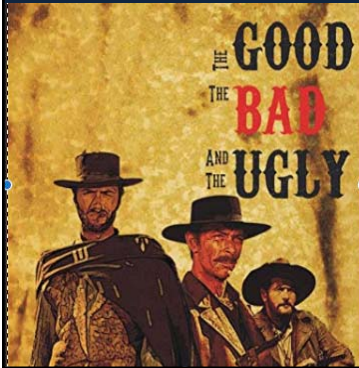


# VISIBLE SPECTRUM

Wavelengths between 380 nm and 780 nm

Blue Light wavelength between 400 nm to 450 nm

High Energy of the visible spectrum: above the UV spectrum



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### Blue Light

Should You Be Worried About Blue Light?


Are Computer Glasses Worth It?

Computers, Digital Devices and Eye Strain

## Should You Be Worried About Blue Light?

Leer en Español: ¿Debe preocuparnos el uso de la luz azul?

Written By: Celia Vimont  
Reviewed By: Rahul Khurana, MD




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## Will blue light from electronic devices increase my risk of macular degeneration and blindness?

POSTED APRIL 08, 2019, 10:30 AM

**David Ramsey, MD, PhD, MPH**  
Contributor



ALL ABOUT VISION

Eye Care Glasses Sunglasses Contact Lenses

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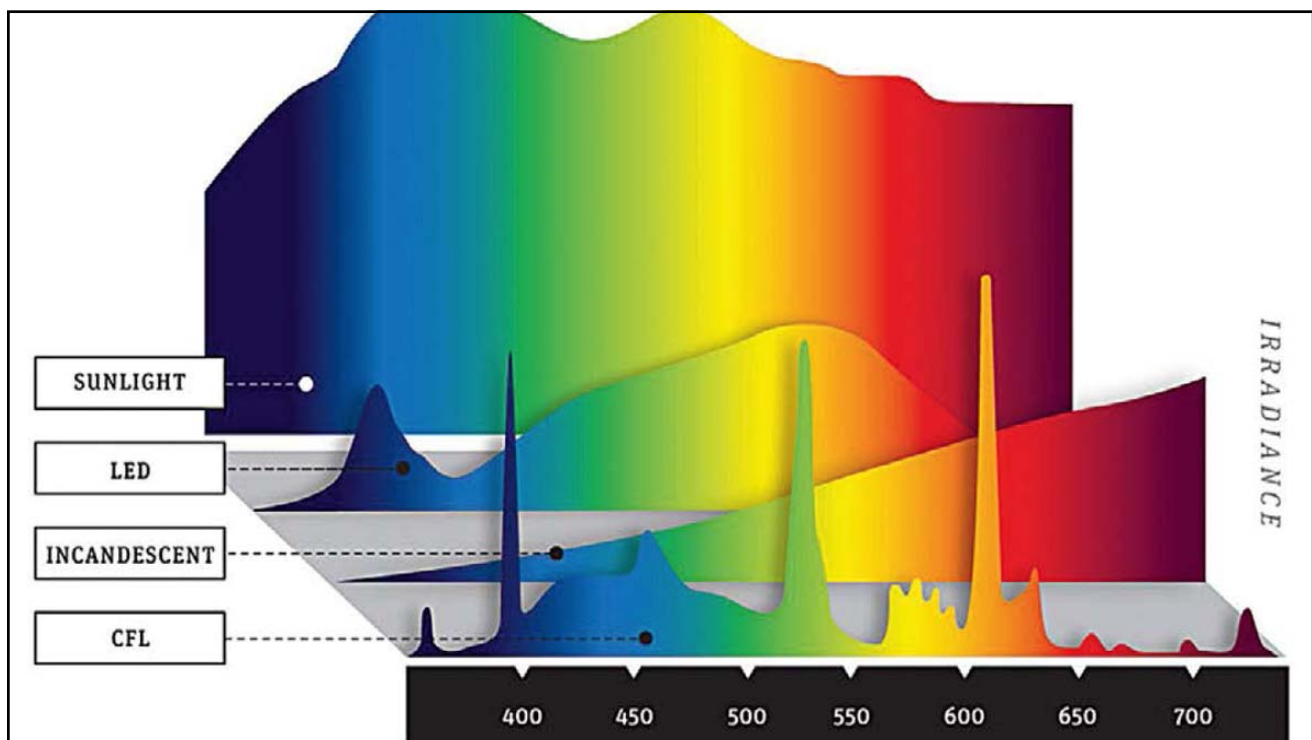
## Blue Light: It's Both Bad And Good For Your Eyes

By Gary Heiting, OD

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On This Page: What is blue light? • Seven key points about blue light • Blue light filters and protective eyewear

## SOURCES OF BLUE LIGHT





## DIGITAL DEVICES

80% of Americans use for more than 2 hours daily

60% of Americans use for more than 5 hours daily

67% use 2 or more devices at one time



## TECHNOLOGY USAGE BY AGE

72% aged 0-8 YO use mobile devices for movies or games

more than 2 hours daily

6 hours for 8-10 YO and 9 hours for 11-14 YO

94% of children aged 3-18 have access to a computer

86% aged 18-29 YO/ 83% aged 30-49 YO own smartphones



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**To grow up healthy, children need to sit less and play more**

## DEVELOPMENT OF MYOPIA



### IN THE UNITED STATES

- *INCIDENCE 42%*
- *DOUBLED SINCE 1971*
- *NEAR WORK INDUCED?*

In Asia 90% of teenagers and adults are nearsighted



## MYOPIA AWARENESS WEEK

The [World Council of Optometry](#) and [Brien Holden Vision Institute](#) are collaborating to bring us Myopia Awareness Week, 13 - 19 May 2019.



Institute for Control of  
Eye Myopia in Children

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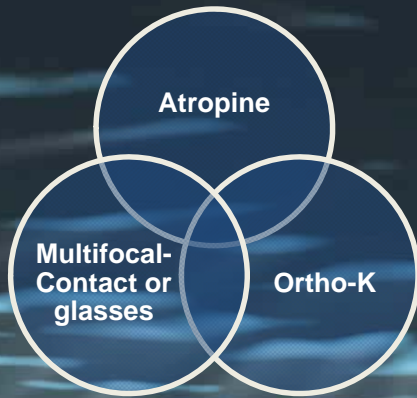


## INCREASED RISK

- Glaucoma
- Retinal detachment
- Cataracts
- Blindness



## MYOPIA CONTROL



- Atropine-low dosage >1%
- Multifocal contacts or glasses
- Ortho-K

[www.myopiacontrol.org](http://www.myopiacontrol.org)

## DIGITAL VISION SYNDROME

90% of users experience periodic asthenopic symptoms

Eyestrain	Ocular Discomfort	Dry eye
Headache	Blurred Vision	Diplopia



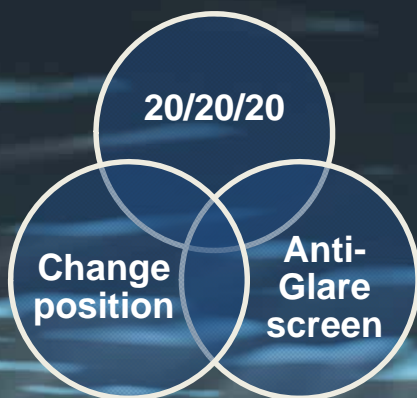


## CAUSES OF COMPUTER VISION SYNDROME



- Poor lighting/ Glare
- Poor Posture: working distance or seating position
- Uncorrected Visual Problem

## TREATMENT OF COMPUTER VISION SYNDROME



- 20-20-20
- Change position
- Anti-glare screen


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### Crizal PREVENCIA

CREATED FROM  
RESEARCH AND  
COLLABORATION

Crizal Prevencia lenses are the result of several years of research in collaboration with the Vision Institute in Paris, which helped us develop the first clear lenses that selectively filter **blue-violet light** and contribute to reducing its potential harmful effects on the eye.

### PROTECT YOUR VISION

Computer screens, smartphones, tablets, fluorescent bulbs—blue light is all around, and the sun is actually the largest source of it. Some of it is helpful, like Beneficial Blue Light (which is blue turquoise and defined as 465-495 nm on the light spectrum), which helps regulate the sleep cycle, your mood, and cognitive performances.

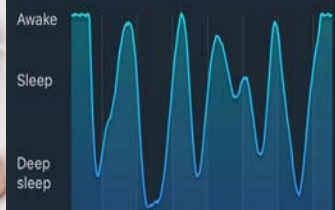
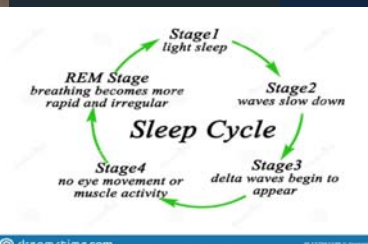
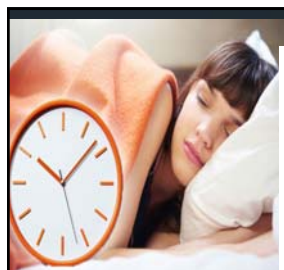
However, long-term and continuous exposure to Harmful Blue Light (or **blue-violet light**) can contribute to long-term damage of your eyes. Those at highest risk are people with a family history or exhibiting signs of AMD, and working professionals, children, teens, and gamers.

Crizal Prevencia lenses reduce exposure to Harmful Blue Light while still allowing beneficial blue-turquoise light to pass through. Plus, they provide all the benefits of no-glare lenses. Help protect your eyes from **blue-violet light** with Crizal Prevencia lenses.

# Blue Light Computer Glasses

Protect Your Eyes. Perform Beyond.

SHOP NOW



## THE GOOD

### SLEEP CYCLE

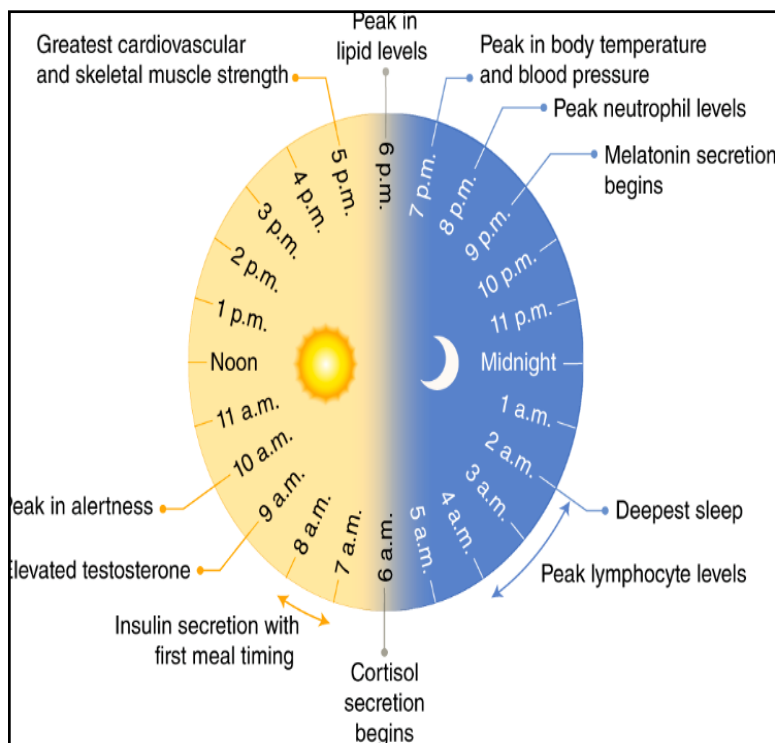
# PHOTORECEPTORS



## THREE KINDS

- *CONES*
- *RODS*
- *INTRINSICALLY PHOTSENSITIVE RETINAL GANGLION CELLS (ipRGCs)*

ipRGCs play a major role in non-image forming photoreception  
-circadian photic entrainment and pupillary light response



## HUMAN CIRCADIAN RHYTHM

- **MELATONIN SECRETION BEGINS~ 9 PM**
- **CORTISOL SECRETION BEGINS~ 6AM**
- **INSULIN SECRETION WITH THE FIRST MEAL BETWEEN 7-8 AM**

## HUMAN CIRCADIAN RHYTHMS



### IN THE PRESENCE OF BLUE LIGHT

- *GANGLION CELLS SUPPRESS MELATONIN PRODUCTION IN THE PINEAL GLAND*
- *AND/OR STIMULATING THE SUPRACHIASMATIC NUCLEUS OF THE HYPOTHALAMUS*
- *MELATONIN HORMONE: OUR BODIES KNOW THAT IT IS TIME TO SLEEP*
- *DAYTIME=ALERT, ENERGIZED, INCREASED COGNITIVE FUNCTIONS*

Research study measured the effects of iPads on Melatonin in teenagers; at one hour no notable change, however after 2 hours melatonin was drastically inhibited

## CHILDREN AND TEENAGERS

- Need 9 hours each night
- Staying up late to study for a test leads to fewer hours of deep sleep
- More likely to exhibit behavior problems and have trouble paying attention
- Can increase the risk of depression



## ADULTS

- 30% of adults report sleeping less than 6 hours per night routinely
- On average Americans sleep 1 ½ hours less than the average sleep time 50 years ago
- Studies show an increase in cortisol levels after just one night of sleep deprivation contributes to glucose dysregulation by making cells more resistant to insulin
- After one week of sleep deprivation glucose tolerance is reduced by 40%-making the body less effective at converting glucose to energy therefore
  - Glucose effectiveness was reduced 30%

## LACK OF SLEEP

- **DEPRESSION/ANXIETY**
- **EXERCISE LESS- TIRED**
- **EAT MORE~ OBESITY**
- **AFFECTS COGNITIVE PERFORMANCE**
- **LONG-TERM SLEEP DEPRIVATION  
EVENTUALLY LEADS TO DEATH**



## HORMONES

Leptin hormone that leaves people feeling full after a meal and it regulates the rate at which the body burns fat

Leptin was reduced in subjects that were sleep restricted for 2 nights

Ghrelin "hunger hormone" increased by poor sleep- leading to more calories consumed than burned

Thyroid Stimulating Hormone and Testosterone changes that lead to decrease in insulin sensitivity and higher blood glucose

## DIABETES

- **ACCORDING TO THE CENTER FOR DISEASE CONTROL MORE THAN 100 MILLION AMERICANS CURRENTLY HAVE DIABETES OR PRE-DIABETES**
- **36% OF ADULTS IN THE US ARE OBESE WHICH IS THE PRIME RISK FACTOR FOR DIABETES**
- **OBESENITY HAS DOUBLED WORLDWIDE OVER THE PAST 4 DECADES**



## LACK OF SLEEP

- *Diabetes*
- *Stroke*
- *High blood pressure*
- *Cardiovascular disease*
- *Cancer*



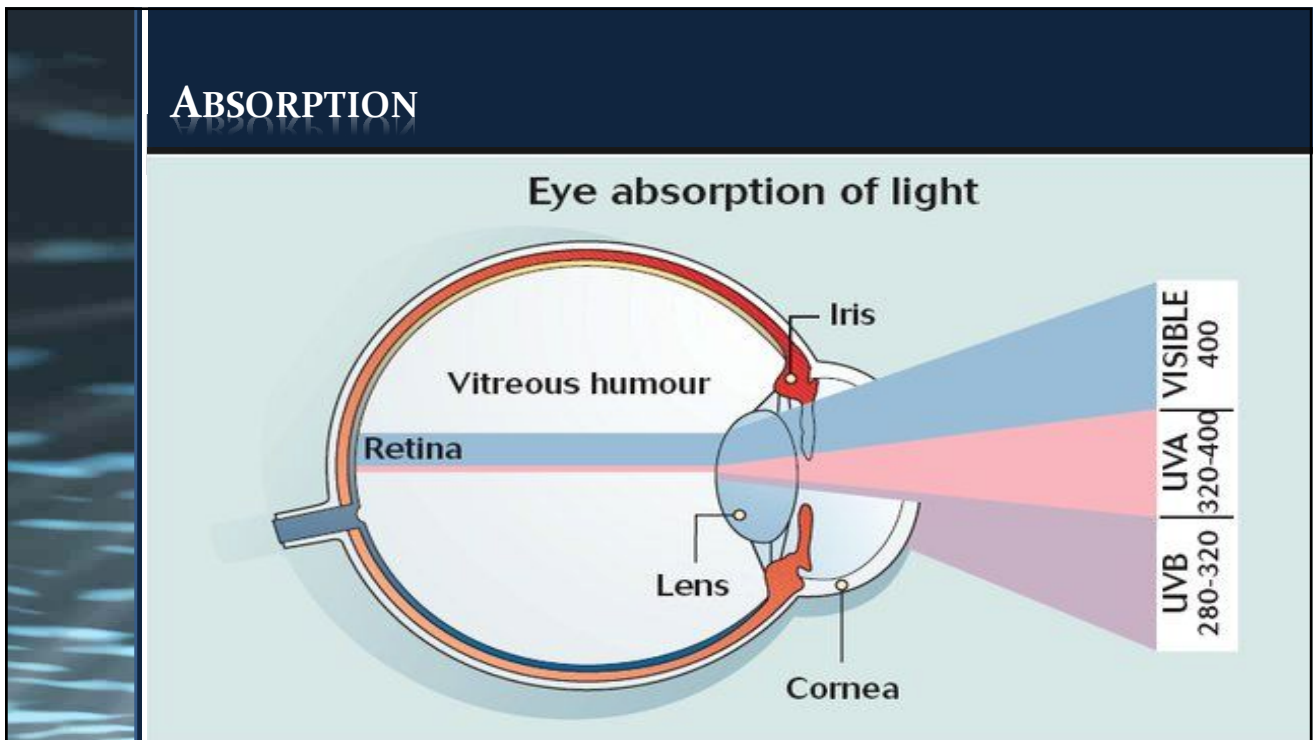
The National Center for Health Statistics estimates that, for 2015-2016 in the U.S., 39.8% of adults aged 20 and over were obese (including 7.6% with severe obesity) and that another 31.8% were overweight. Obesity rates have increased for all population groups in the United States over the last several decades

## CHILDREN

Less exercise	Socialization
Vitamin D deficiency	Critical thinking skills
Less ability to focus	Less creative







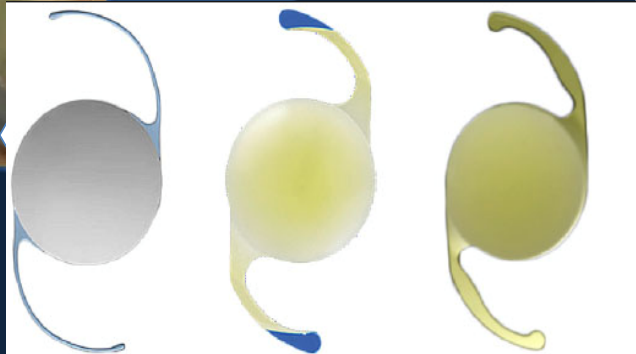
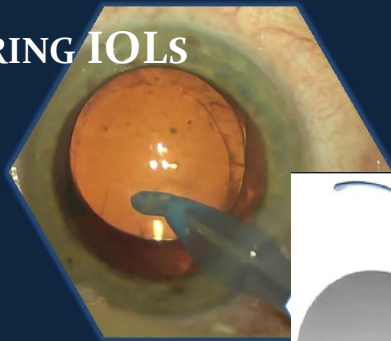
## AGE DEPENDENT CHANGE IN LENS ABSORPTION

- Clear Lens will transmit light at 330 nm
- Transmittance is 90% of 450 nm
- Adult lens which acts as a “yellow” filter transmits less at 400 nm
- Reaches 70-80% at 540 nm
- Therefore protection of children’s eyes is more important because higher levels of UV and blue light are reaching the retina

## CATARACT FORMATION

- Age reduces metabolic efficiency
- Oxidative Stress Reduces ability to detoxify
- Production of Free Radicals
  - Smoking
  - DM
  - Alcohol/Drug abuse
  - Radiation (UV)

## BLUE-FILTERING IOLs



## ADVANTAGES



- **REDUCED GLARE AND PHOTOPHOBIA**
- **PRESERVED CONTRAST SENSITIVITY**
- **MACULAR PROTECTION**
- **REDUCED CYANOPSIA**

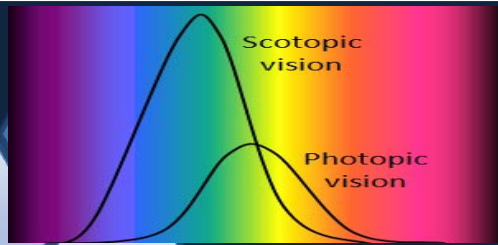
Study published in 2009 by Nolan et al. showed the blue-light filtering IOL was significantly more effective at protecting the RPE than those without blue-filter

## DISADVANTAGES

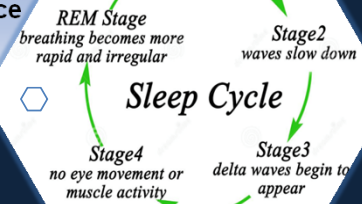


Altered  
Color  
Perception

Scotopic  
vision loss



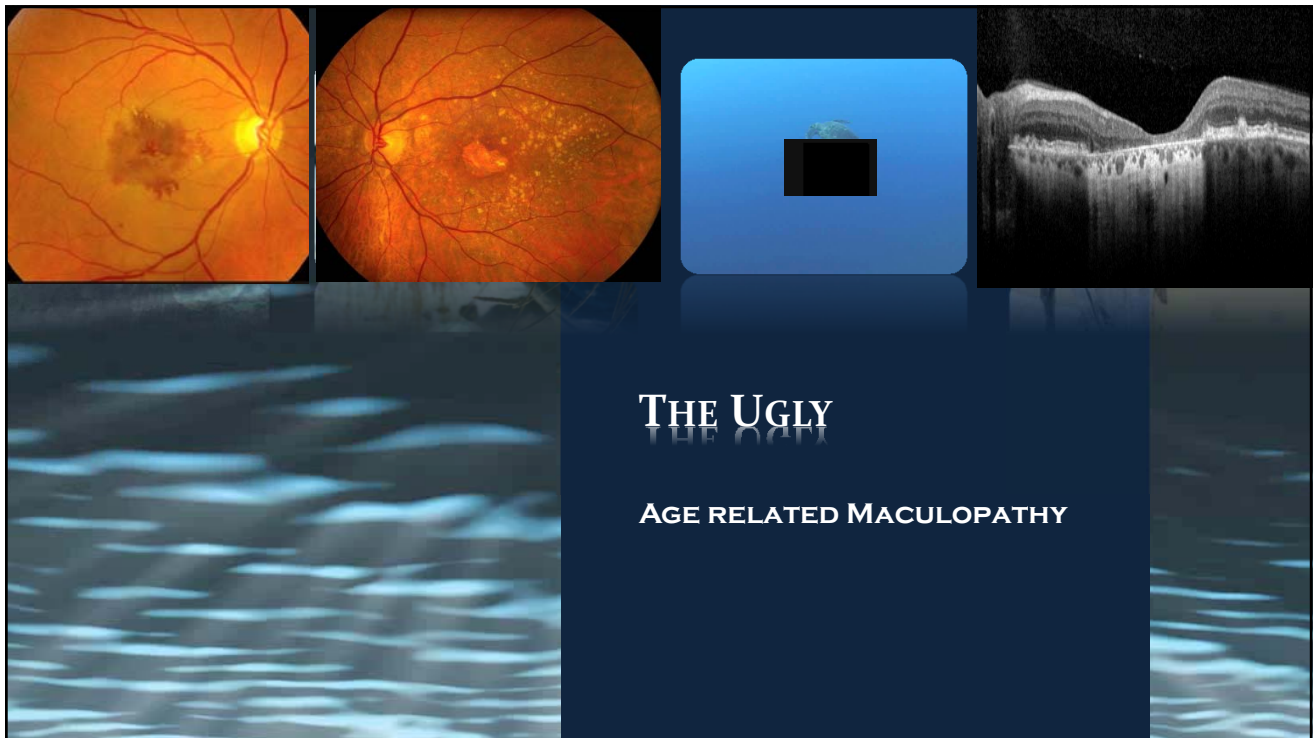
Sleep  
Disturbance



## DRIVING








## AGE RELATED MACULOPATHY

- **MOST COMMON CAUSE OF VISION LOSS AFTER AGE 60 YO**
- **BLUE LIGHT (440 NM) HAS BEEN SHOWN TO HAVE A MAJOR IMPACT ON PHOTORECEPTOR AND RPE FUNCTION**
- **INDUCING PHOTOCHEMICAL AND APOPTOTIC CELL DEATH**



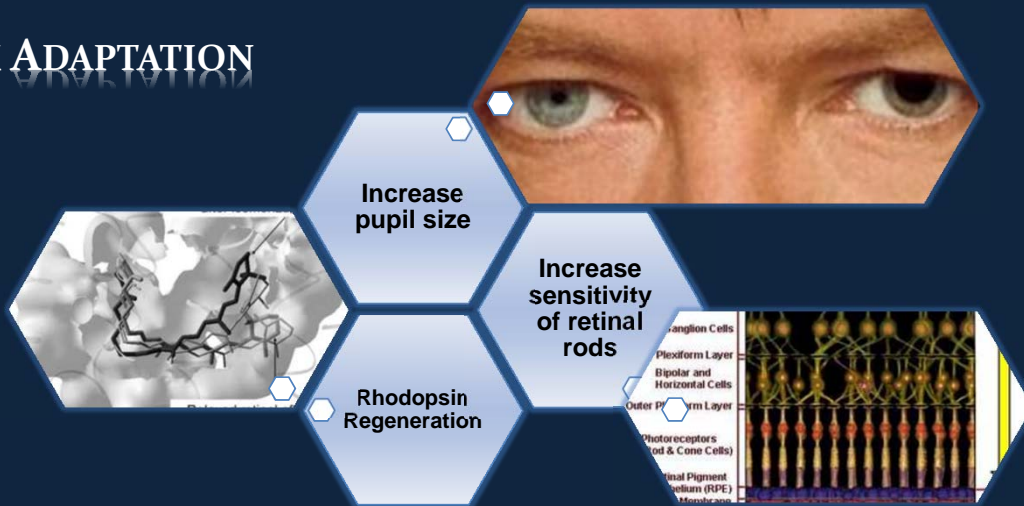
## MACULAR DEGENERATION

- Phototoxicity
- Retinal defenses decline with Age
- Exposure Additive
- Other factors
  - Smoking
  - Genetic
  - Alcohol/Drug abuse
  - Radiation (UV)

## LIPOFUSCIN

- Phototoxic chemical
- Accumulates in the retina as the eye ages
- Peak absorption is 430 nm
- Photons absorbed result in production of reactive oxygen species and free radicals
- Damage ocular tissue
- Reduce the ability of the RPE cells to regulate photoreceptor cell turnover

## DARK ADAPTATION



## DARK ADAPTATION

- Alabama Study on Early Age-Related Macular Degeneration
  - 325 aged 60-86 years of age
  - Fundus looks clinically normal by color photography

*Those with abnormal dark adaptation (>12.3 minutes) were almost 2 times more likely to have AMD at the follow-up (3 years later) as compared to those who had normal dark adaptation*

Slowed dark adaptation is a functional marker for increased AMD risk

## TREATMENT GUIDELINES

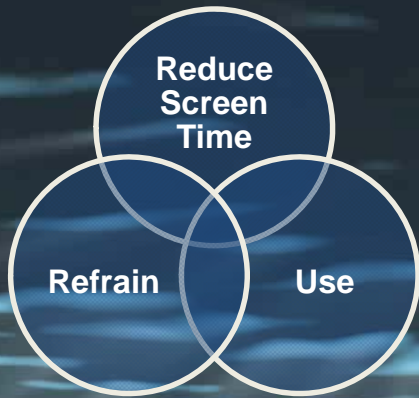
- Wet AMD= intravitreal Anti VEGF
- Dry AMD= effects 80% patients
  - Lifestyle changes; Weight loss and smoking cessation
  - Vitamin supplements

## Dry AMD and AREDS Vitamins

- Vitamin C (500 mg)
- Vitamin E (400 IU)
- Lutein (10 mg)
- Zeaxanthin (2 mg)
- Zinc (80 mg)
- Copper (2 mg)







## TAKE HOME MESSAGE

- **Reduce Screen Time** especially in children
- **Use** filters to block blue light (IOL)
- **Refrain** from using 2 hours before bedtime

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QUESTIONS???