BLUE LIGHT SUMMIT 2019

First Annual Forum of Electronics Manufacturers and Eye Care Professionals

TÜVRheinland® Precisely Right. | eyesafe®

Please submit questions to: BLS2019@Eyesafe.com

BLUE LIGHT SUMMIT 2019

WELCOME

Bringing Together Leaders in Blue Light for the Design, Development and Certification of Healthier Display Products

Attendees include:

SAMSUNG

DELL

hp

Lenovo

BOE

AUO

LG Display

HUAWEI

FUJITSU

BenQ

Please submit questions to: BLS2019@Eyesafe.com

BLUE LIGHT SUMMIT 2019

WELCOME

Bringing Together Leaders in Blue Light for the Design, Development and Certification of Healthier Display Products

Attendees include:

40+ device manufacturers representing the majority of consumer electronics produced

From 14 countries

Renowned leaders in Optometry and Ophthalmology

Please submit questions to: BLS2019@Eyesafe.com

Eyesafe Vision Health Advisory Board Includes World Leaders in Optometry and Ophthalmology

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RALPH CHU, MD


H. BURKHARD DICK, MD, PHD


CHAD DOCKTER, OD


DAVID FRIESS, OD


GARY HEITING, OD


MITCHELL JACKSON, MD


PAUL KARPECKI, OD


RICHARD LINDSTROM, MD


SHERI ROWEN, MD


VANCE THOMPSON, MD


WILLIAM TRATTLER, MD


ROBERT WEINSTOCK, MD

VISION HEALTH ADVISORY BOARD

The distinguished ophthalmologists and optometrists who comprise the Eyesafe® Vision Health Advisory Board help guide research regarding the effects of blue light on the eyes and visual system and the development of Eyesafe® standards to protect public health.

Please submit questions to: BLS2019@Eyesafe.com

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JAY YANG

TÜV Rheinland Group

Vice President

Please submit questions to: BLS2019@Eyesafe.com

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JUSTIN BARRETT

Eyesafe CEO

Please submit questions to: BLS2019@Eyesafe.com

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AGENDA

1. BLUE LIGHT HEALTH ISSUES
2. CALIFORNIA RESOLUTION & MARKET PROGRAMS
3. STANDARDS & CERTIFICATION
4. SOLUTIONS
5. Q&A & FOLLOW-UP

Please submit questions to: BLS2019@Eyesafe.com

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BLUE LIGHT HEALTH EFFECTS

How Blue Light Affects Vision and Health: 10 Key Points

GARY HEITING, OD

Eyesafe Director of Vision Research

Please submit questions to: BLS2019@Eyesafe.com

1 What is blue light?

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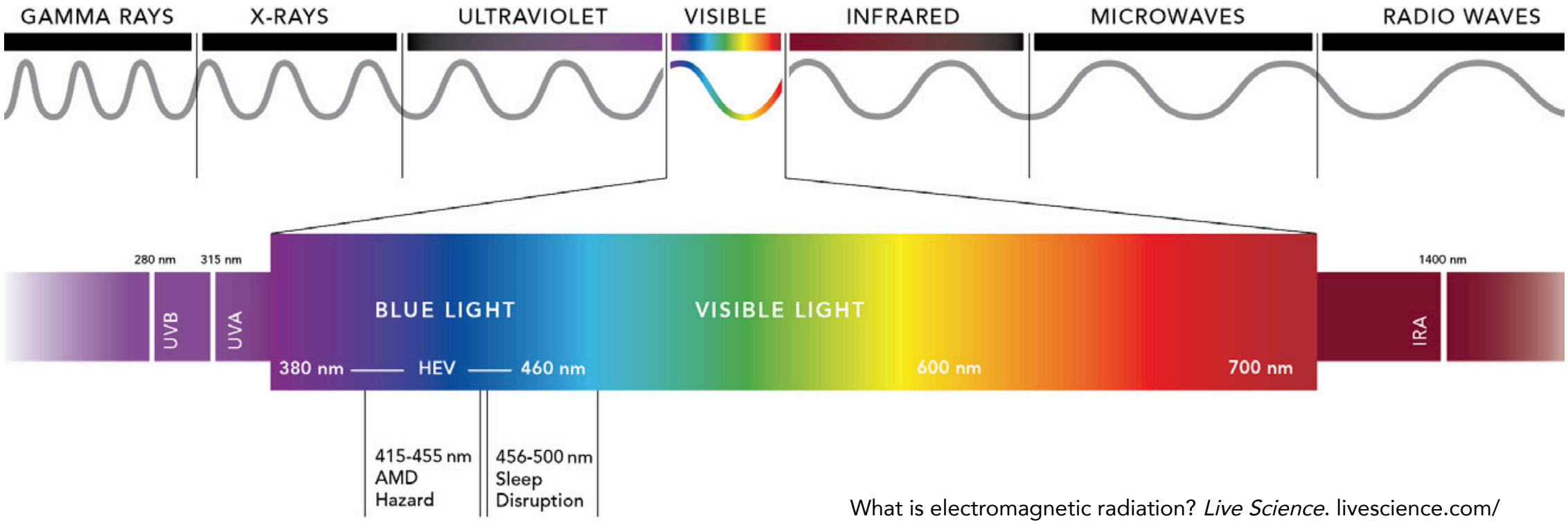
- High-energy visible light (400-500 nm)
- Toxic blue light (415-455 nm) has nearly as much energy as UV-A (315-380 nm)
- Emitted by electronic devices and the sun
- Digital age = More blue light exposure



What is electromagnetic radiation? *Live Science*. livescience.com/38169-electromagnetism.html. March 2015.

1 What is blue light? (cont.)

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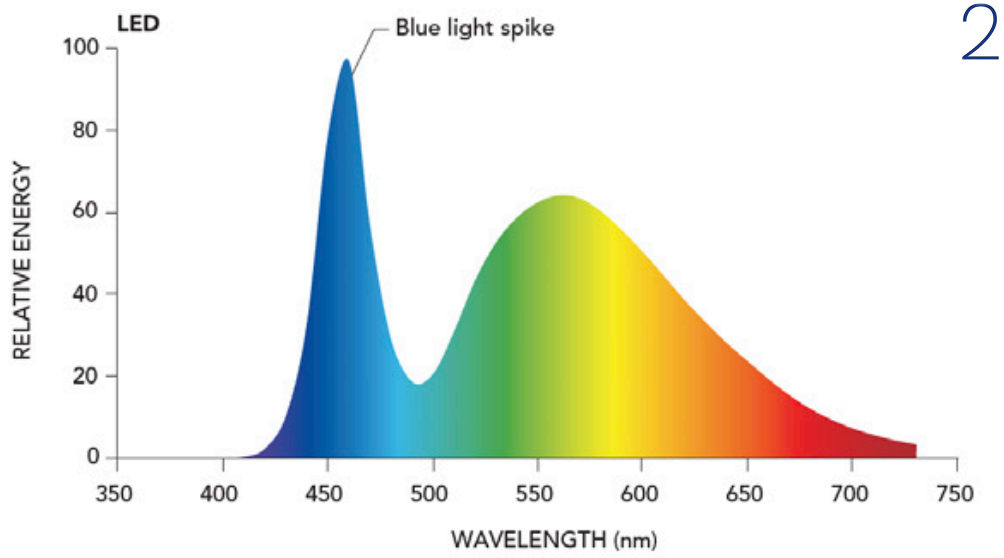
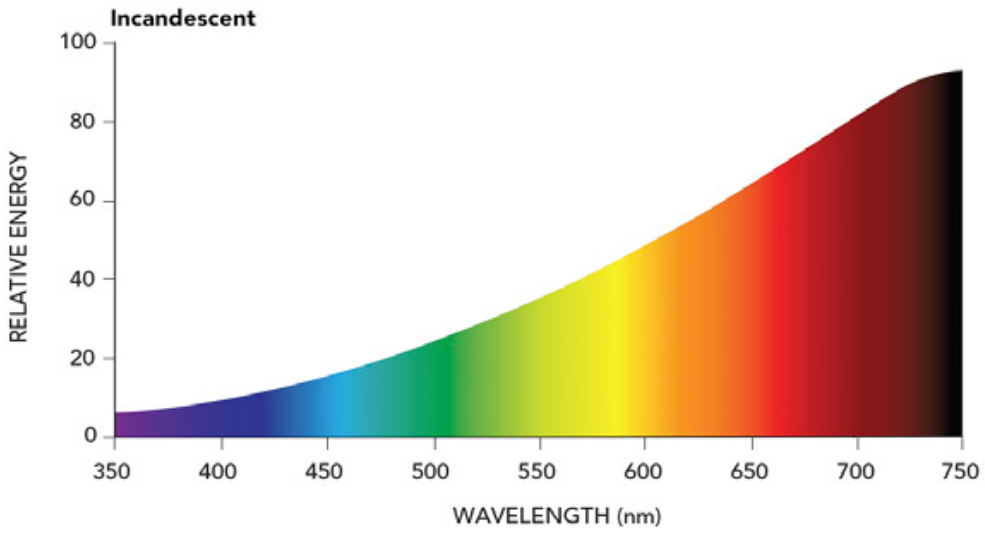
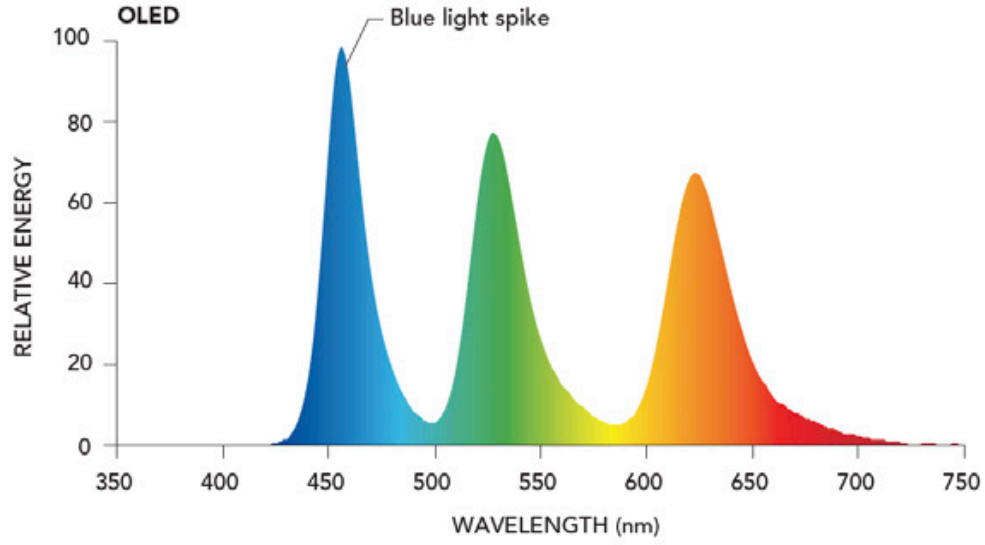
- Light spectra of different source of light are very different.
- Old to new = more blue.
- LED and OLED screens have blue light spikes.
- Screens keep getting brighter.







2 Not all blue light is equal.

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- Toxic blue light (415-455 nm) poses greatest risk to the retina of the eye.
- Longer-wavelength blue light (460-500) drives circadian rhythm.

Wavelength (nm)	Blue Light Hazard	Toxicity Zone Level	Primary Area of Concern
Far UV 200-315	0	1	UV Region: Cataracts & Other
Near UV 315-380	0	1	
380	0.01	1	Surface Symptoms Blue Region: Digital Eye Strain
385	0.0125	1	
390	0.025	1	
395	0.05	1	
400	0.1	2	
405	0.2	2	
410	0.4	2	
415	0.8	3	
420	0.9	4	
425	0.95	4	
430	0.98	4	
435	1	5	Toxic Blue Region: Retinal Cell Damage & AMD
440	1	5	
445	0.97	4	
450	0.94	4	
455	0.9	4	
460	0.8	3	Healthy & Unhealthy Blue Region: Circadian Rhythms, Melatonin Suppression
465	0.7	3	
470	0.62	3	
475	0.55	3	
480	0.45	2	
485	0.4	2	
490	0.22	2	
495	0.16	1	
500	0.1	1	

American National Standard for Occupational and Educational Personal Eye and Face Protection Devices (ANSI/ISEA Z87.1-2015) American National Standards Institute.

3 Children are especially at risk.

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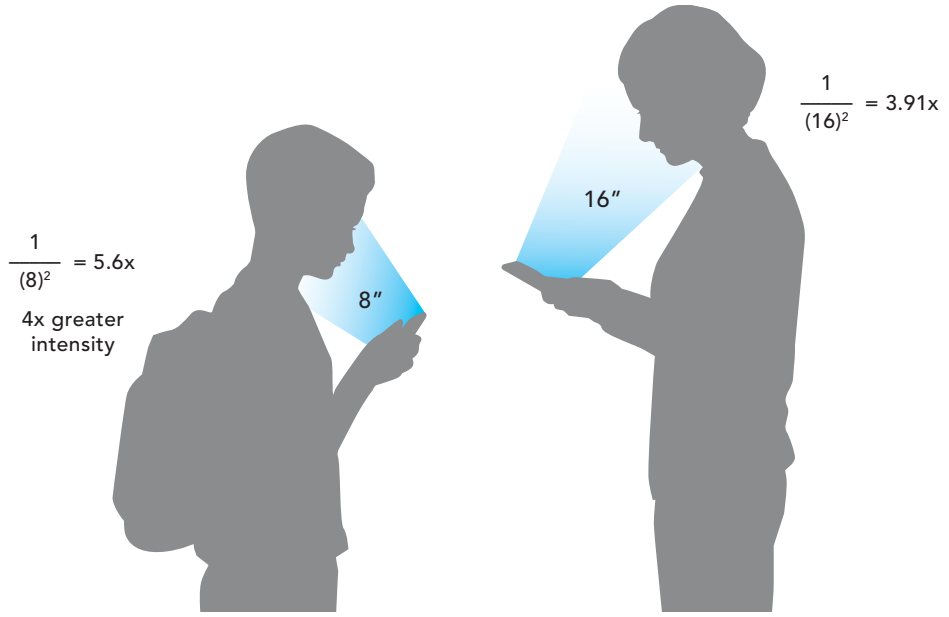
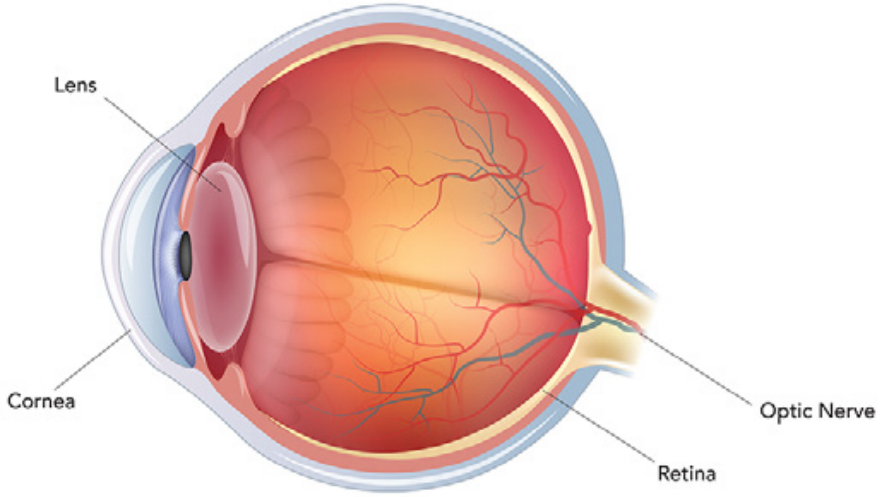
- Children hold devices closer to their eyes.
- Inverse Square Law: ½ distance = 4x energy.
- Immature lens of a child's eye doesn't block blue light as effectively as adult lens.
- At 400 nm, child's retina is exposed to >10x more blue light than adult retina.





Light-emitting diodes (LED) for domestic lighting: Any risks for the eye? Progress in Retinal and Eye Research. F Behar-Cohen, et al. 2011; 30: 239-257.

4 Blue light disrupts sleep.

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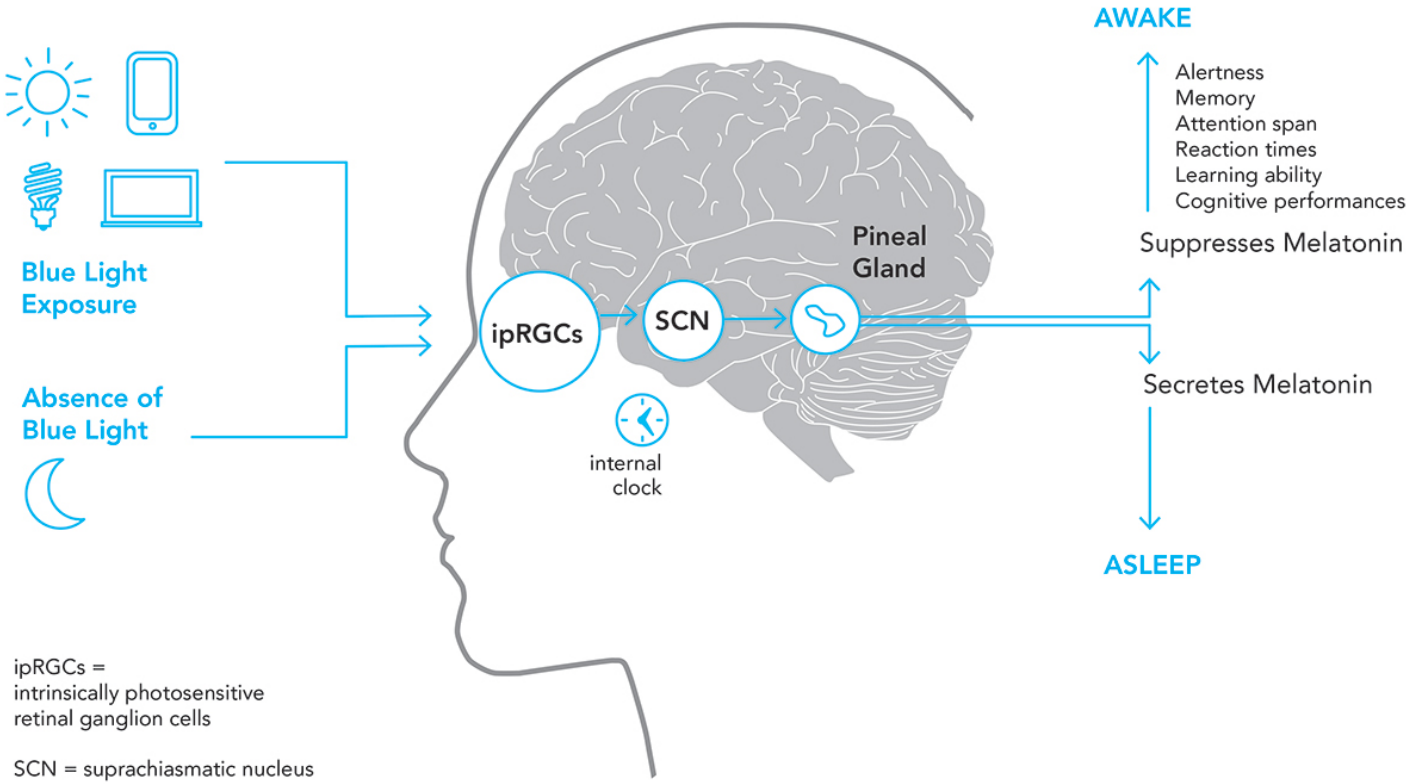
- Blue light from devices used at night make it harder to fall asleep.
- Sleep disruption in children is linked to behavior problems, depression and reduced performance in school.
- Sleep disruption in adults is associated with multiple health problems, including high blood pressure and cardiovascular disease.



Short- and long-term health consequences of sleep disruption. G Medic, et al. *Nature and Science of Sleep*. 2017; 9: 151–161.

5 Blue light is linked to digital eye strain.

- Blue light from electronic devices scatters more inside the eye than other light, which can cause eyestrain.

Effect of light scattering simulation in the eye on different color stimuli perception. G Ikaunieks and M Ozolinsh. In *14th Nordic-Baltic Conference on Biomedical Engineering and Medical Physics*. IFMBE Proceedings Vol 20. 2008. Springer, Berlin, Heidelberg.

6 Blue light causes dry eyes.

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- Researchers in China found blue light damages cells on the surface of the eye, triggering inflammation and dry eye symptoms.
- Mechanism appears to be oxidative stress caused by formation of reactive oxygen species (ROS) in the cornea.

Research progress about the effect and prevention of blue light on eyes. ZC Zhao, et al. *International Journal of Ophthalmology*. 2018; 11(12): 1999–2003.

Protective effects of blue light-blocking shades on phototoxicity in human ocular surface cells. Y Niwano, et al. *BMJ Open Ophthalmology*. 2019; 4: e000217.

7 Blue light damages the retina.

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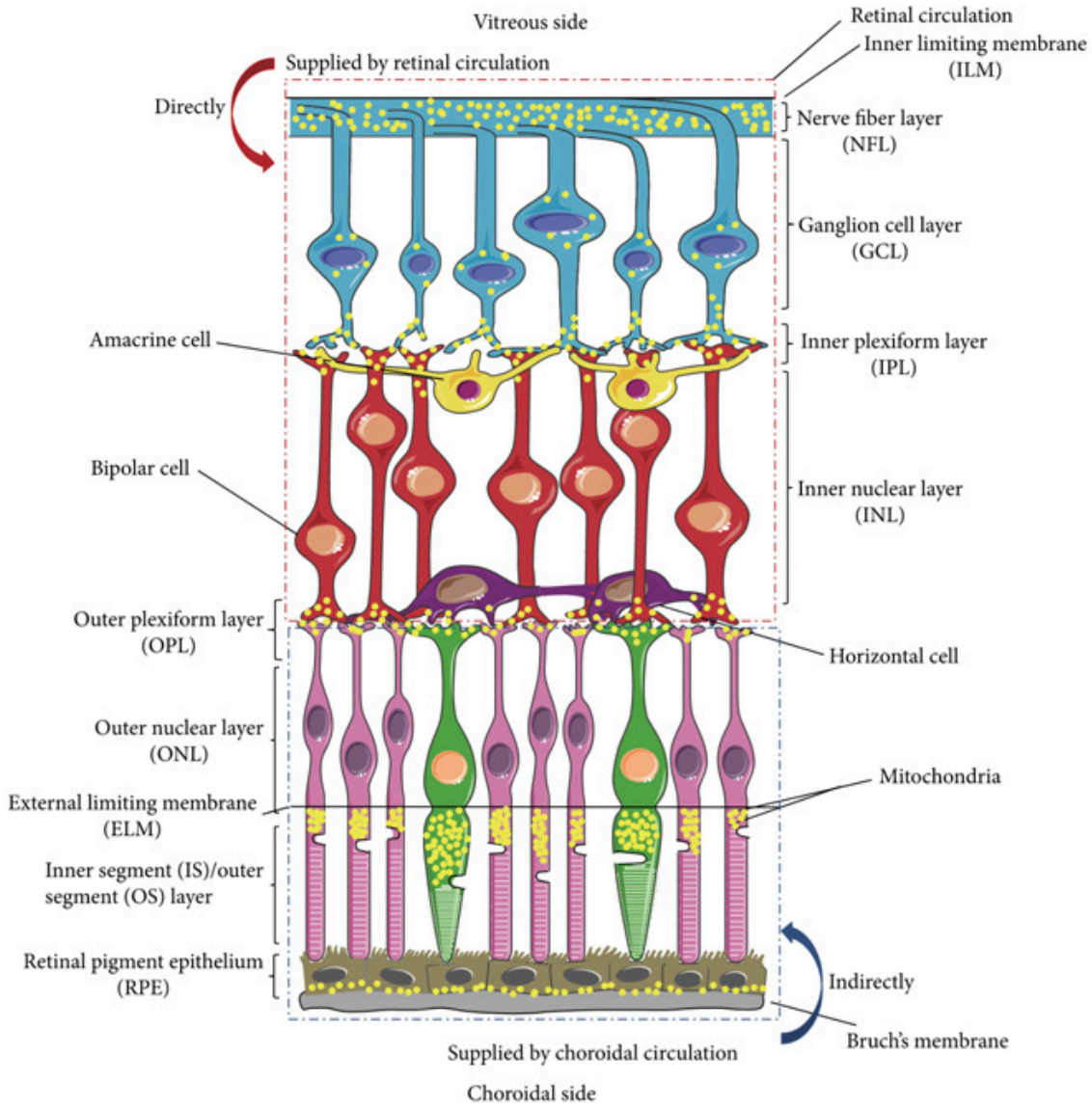
- Blue light damages photoreceptor cells in the retina that could cause permanent vision loss.
- Mechanism appears to be oxidative stress in the mitochondria of cells.
- Similarity to age-related macular degeneration is concerning.

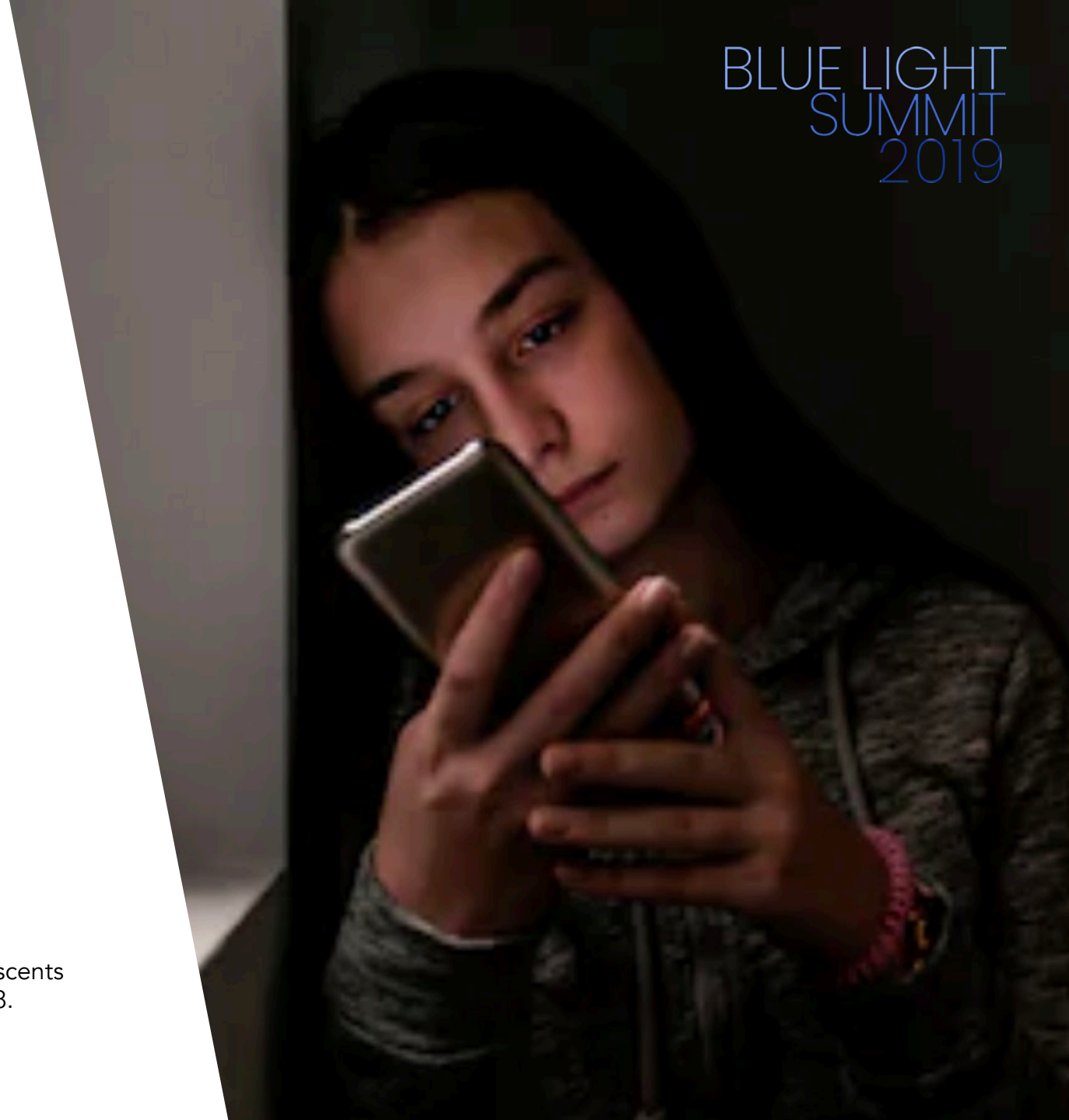


Effects of blue light on the circadian system and eye physiology. G Tosini, et al. *Molecular Vision*. 2016; 22: 61-72.

Mitochondria as potential targets and initiators of the blue light hazard to the retina. JX Tao, et al. *Oxidative Medicine and Cellular Longevity*. 2019; article ID 6435364.

8 Blue light has psychological effects.

- Frequent use of electronic devices appears to be a factor in the increase in mood disorders and negative social behavior among adolescents and young adults.



National trends in the prevalence and treatment of depression in adolescents and young adults. R Mojtabai, et al. *Pediatrics*. 2016; 138(6): e20161878.

9 Blue light impairs cognitive performance.

- Blue light exposure has been linked to decreases in cognitive performance, attention, memory and decision-making.
- A study of night computer workers found the use of a blue light filter significantly improved alertness, cognitive performance and sleep quality.

The effects of screen light filtering software on cognitive performance and sleep among night workers. R Kazemi, et al. *Health Promotion Perspectives*. 2019; 9(3): 233-240.

10 Blue light accelerates aging.

- In a study of fruit flies, researchers found adult flies that were exposed to blue light 12 hrs/day showed accelerated aging effects, including brain degeneration.

- In a recent study in Iran, researchers found blue light exposure from electronic devices caused oxidative stress that's been associated with premature aging of the skin.

Daily blue-light exposure shortens lifespan and cause brain neurodegeneration in Drosophila. TR Nash, et al. *npj Aging and Mechanisms of Disease*. 2019; 5(8).

Can light emitted from smartphone screens and taking selfies cause premature aging and wrinkles? N Arjmandi, et al. *Journal of Biomedical Physics & Engineering*. 2018; 8(4): 447-452.

Blue Light Health Effects: Summary

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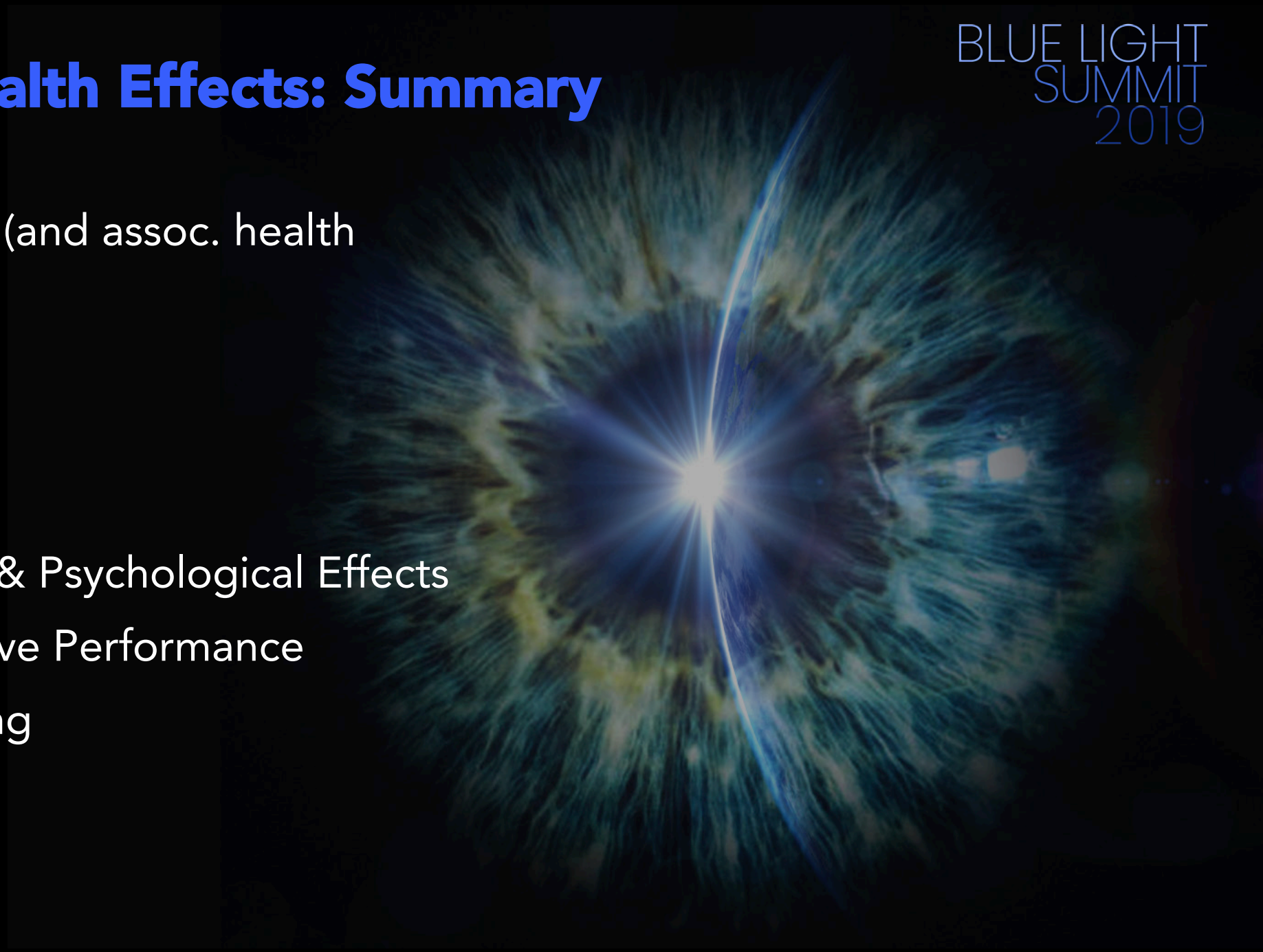
- Sleep Disruption (and assoc. health problems)
- Digital Eye Strain
- Dry Eyes
- Retinal Damage
- Mood Disorders & Psychological Effects
- Reduced Cognitive Performance
- Accelerated Aging



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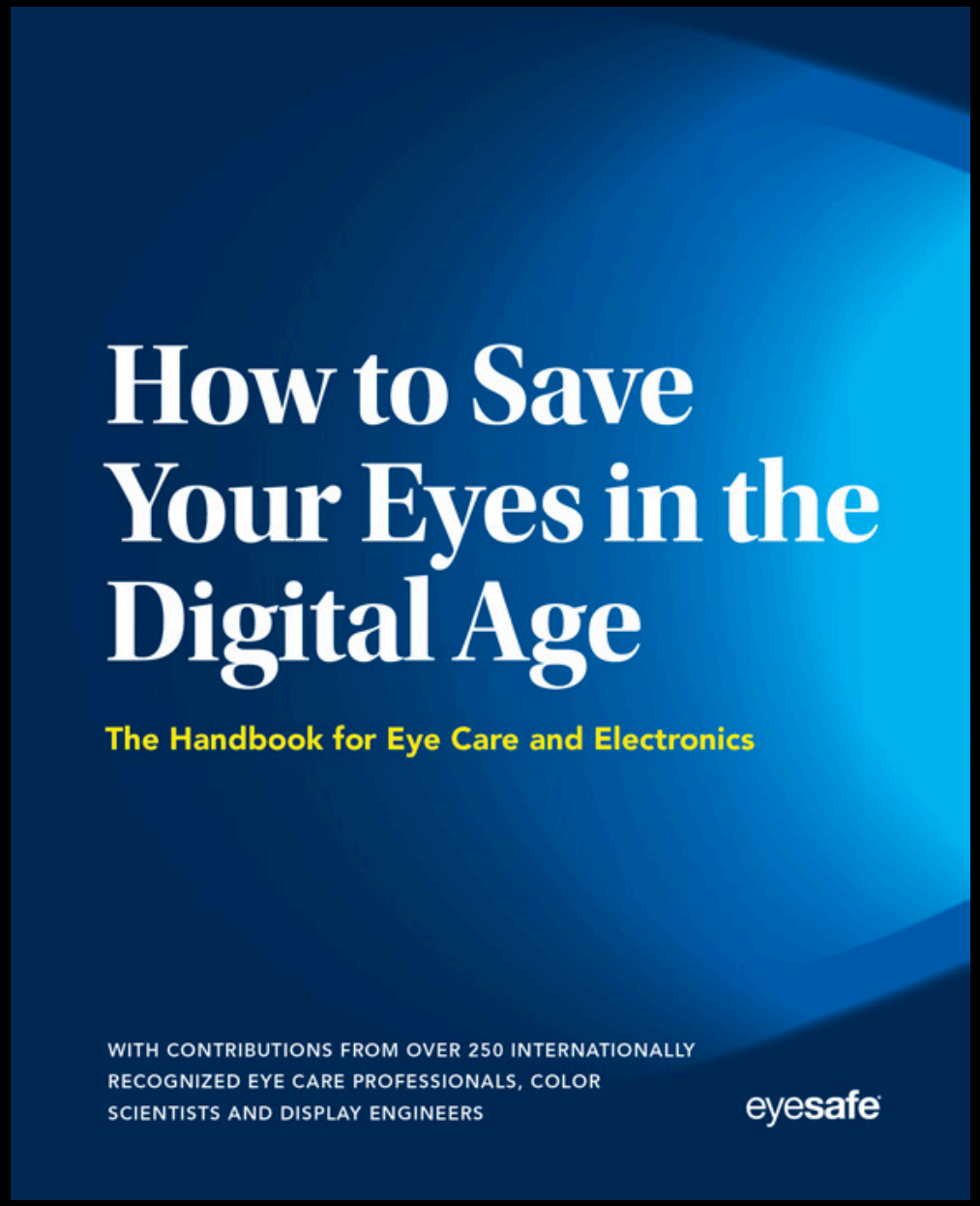

The Essential Blue Light Guide for Electronics Manufacturers and Eye Care Professionals

TO GET YOUR FREE COPY:

BLS2019@eyesafe.com

(English and Chinese available)

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GUIDING RESEARCH

5 Key Blue Light Research Articles

ALYA PENDER, PhD

Eyesafe Research Scientist

Please submit questions to: BLS2019@Eyesafe.com

5 Key Blue Light Research Articles

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1	**Light-emitting diodes (LED) for domestic lighting: Any risks for the eye?** F. Behar-Cohen et al., *Progress in Retinal and Eye Research 2011*, 30, 239-257	→ LEDs and potential risk of phototoxicity → Mechanisms of light-induced damages → Eye physiology of children and adults
2	**Effects of blue light on the circadian system and eye physiology.** G. Tosini et al. *Molecular Vision* 2016; 22, 61-72	→ Effects of blue light on the circadian rhythm → Mechanisms of retinal damage → Cumulative exposure to blue light and its potential effects
3	**Global rise of potential health hazards caused by blue light-induced circadian disruption in modern aging societies.** M. Hatori et al. npj *Aging & Mechanisms of Disease* 2017, 3:9	→ Blue light and its impact on circadian rhythm → Health consequences
4	**Ocular and visual discomfort associated with smartphones, tablets and computers: what we do and do not know.** S. Jaiswal, et al., *Clinical and Experimental Optometry,* 2019.0(0)	→ Effects of digital displays on eye strain → Children → Short-term symptoms when using digital screens
5	**Circadian photoreception: ageing and the eye's important role in systemic health.** PL Turner and MA Mainster. *Br J Ophthalmol.* 2008; 92(11): 1439-44	→ Crystalline lens transmittance with age → Role of retinal ganglion cells in circadian reception

See www.eyesafe.com/research

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CALIFORNIA RESOLUTION & MARKET INITIATIVES

What it means for manufacturers

DAVID FRIESS, OD, FAAO

Eyesafe Vision Health Advisory Board

Please submit questions to: BLS2019@Eyesafe.com

California Blue Light Resolution SCR73

- Unanimously passed by California Senate and Assembly designating October 10th Blue Light Awareness Day each year
- Resolution was introduced by Senator Richard Pan (a pediatrician), passed unanimously in both the Senate and Assembly, and filed with the CA Secretary of State on September 19, 2019.
- The purpose of the resolution is to encourage all Californians (and their children) to **"consider taking protective safety measures in reducing eye exposure to high-energy visible blue light."**

Screen Time and Blue Light Research to Guide Standards

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- Research partnership on the health effects of blue light on the eye, visual system and overall health and wellness.
- Purpose of research is to guide development of Eyesafe industry standards
- Areas of study include dry eye and worker productivity impacts, among other topics

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SALUS UNIVERSITY

Health Insurance Provider Blue Light Solutions

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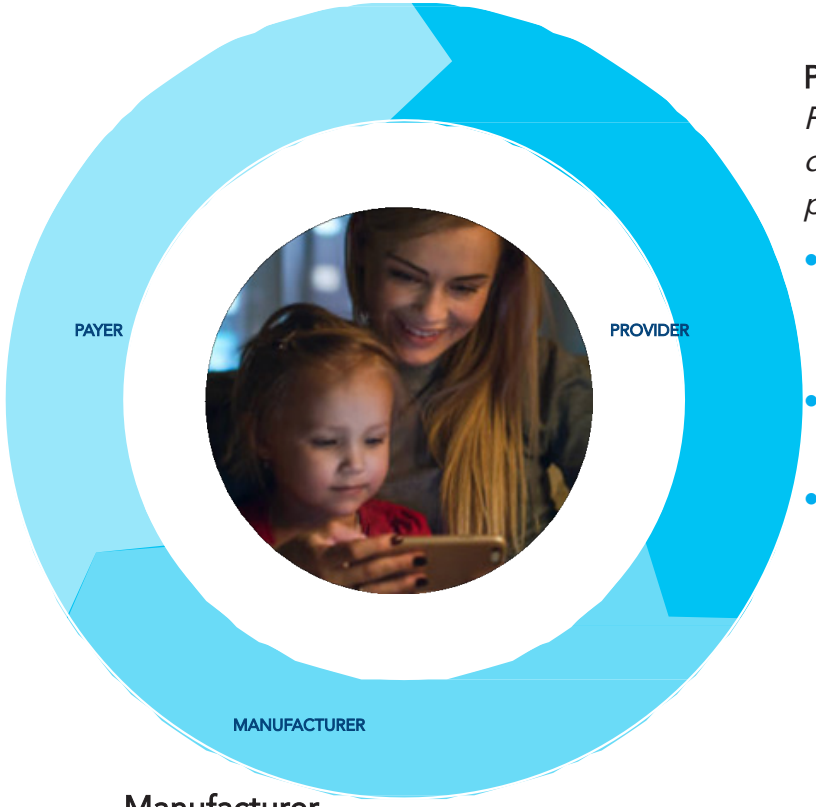
- Eyesafe is working with insurance providers to offer benefits for low blue light solutions
- Insurance members and employers receive discounted offerings for solutions
- Eyemed (55M members) will be announcing coverage for Eyesafe solutions this year

Payer

Problem: Subject to higher expenses from blue light associated conditions

- Incentivize use of blue light filtration technology
- Preventative care to proactively address blue light emissions



Provider

Problem: High use of digital devices driving needless patient interactions

- Order/prescribe blue light filtration technology addressing eye conditions
- Increased patient satisfaction
- Lower cost of treatment

Manufacturer

- Advocate eye health
- Provide healthy solutions to consumers

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STANDARDS

Eyesafe Standards & Requirements

PAUL HERRO

Eyesafe COO

Please submit questions to: BLS2019@Eyesafe.com


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STANDARDS

Eyesafe® Requirements Evolve to Respond to the Changing State of Clinical Research

- Eyesafe 1.0 was released in May, 2019 to establish baseline requirements for blue light emissions and display performance
- Eyesafe 1.1 was released October, 2019 to update the blue light hazard function
- Eyesafe 2.0 is under development and will include detailed specifications related to display performance

Eyesafe Display Requirements

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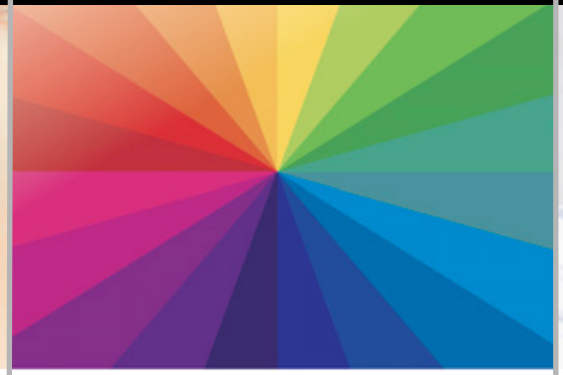
BLUE LIGHT MANAGEMENT

- In the product specifications and marketing, the meaning of low blue light content must be explained and the correctness of this claim is confirmed including blue light defined as range from 380nm-500nm

COLOR ACCURACY



- The CCT shall be within the range of 5500K and 7000K
- Color gamut must be at least 72% of NSTC

SAFETY STANDARDS

- Blue light toxicity factor [Blue light toxicity (μW/cm^2)] vs. total lux must be less than 0.085
- The ratio of light in the range from 415-455nm compared to 400-500nm must be less than 50%
- The product must meet exempt group limits as outlined in EN 62471

Eyesafe established requirements with leaders in the eye and healthcare community, the latest research and recognizing industry standards.

eyesafe® DISPLAY

THIS PRODUCT MEETS EYESAFE® REQUIREMENTS FOR REDUCED BLUE LIGHT EMISSIONS AND COLOR INTEGRITY

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Eyesafe Communicates Device Health and Safety and Reduced Blue Light with High Color Performance

- Eyesafe combines technology and brand licensing and is designed to enable brands to derive maximum value of low blue light displays allowing for:
- Suppliers to incorporate best-in-class technology driven by requirements from globally recognized eye-care professionals
- Brands to take advantage of market leading blue light advocacy, research and education without an individual investment.
- Brands to take advantage of a leading consumer brand and identification for their product
- Brands to differentiate their products as “health first”

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CERTIFICATIONS

TUV Rheinland & Eyesafe Standard Certification Process

STANLEY LIU

TÜV Rheinland Group

Technical Competence Center Director

Please submit questions to: BLS2019@Eyesafe.com

Milestone to reduce blue light

From 1st industrial try to TÜV Low Blue Light Certification…

- **New solution for anti-blue light film (10 Valid Certificates)**

1st try in Android Mobile Phones APP

- Year 2013
- Declared blue light reduce by linearly reducing luminance in %
- Significant change in CCT

TÜV LBL Certification Method 1

- Year 2014
- Ratio Blue light to luminance level less than 20%
- Blue to Green Ratio less than 2

TÜV LBL Certification Method 2

- Year 2016
- The ratio of light in the range from 415nm - 455nm compared to 400nm – 500nm shall be less than 50%.
- CCT shall be 5500-7000K

TÜV Retina Protection Factor

- Year 2018
- Luminance reduction ratio
- Hazardous blue light reduction ratio
- Change of CCT

- **994 Valid Certificates**
- **Industrial referred solution**
- **Consumer purchase guide for health**

TÜV Rheinland is Now Certifying Eyesafe Display Requirements

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- Announcing new industry mark representing health and safety for manufacturers
- Representing efficacy in protection from blue light and color quality
- Identifies achievements of Eyesafe Standard health requirements

Eyesafe Standard Validation Service

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TÜV AK Certificate + test report based on Eyesafe standard

EYESAFE CERTIFICATE	
TÜV CERTIFICATION MODEL • TÜV Test Mark certificate + Test report • Based on Eyesafe requirements • Sample: 1 • Document: Eyesafe document • Lead time: 2-3 weeks	

Eyesafe Certification by TÜV Rheinland

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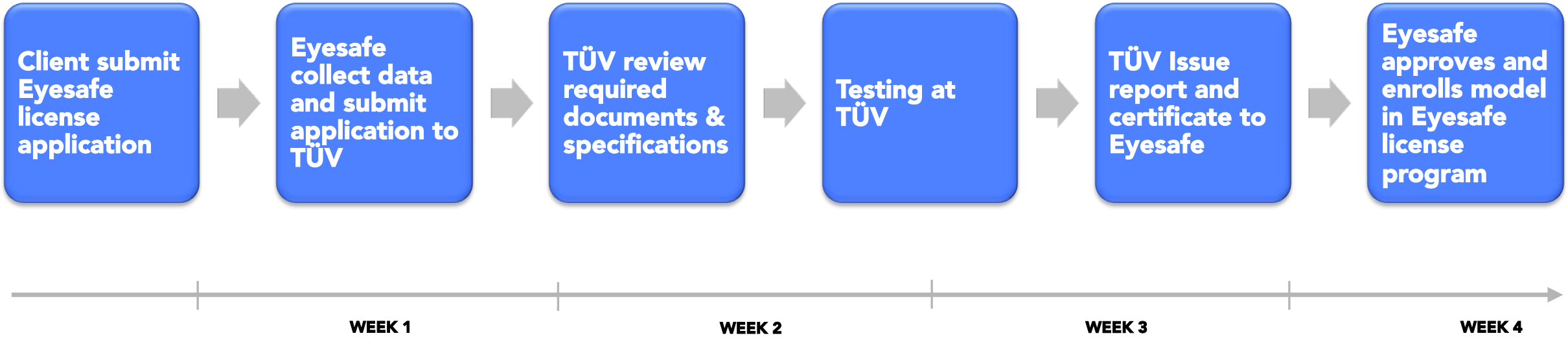
- TÜV will receive the panel and validate achievement of requirements to the Eyesafe Standard



NOTE: Requires commercial agreement with Eyesafe and participation in the Eyesafe Program

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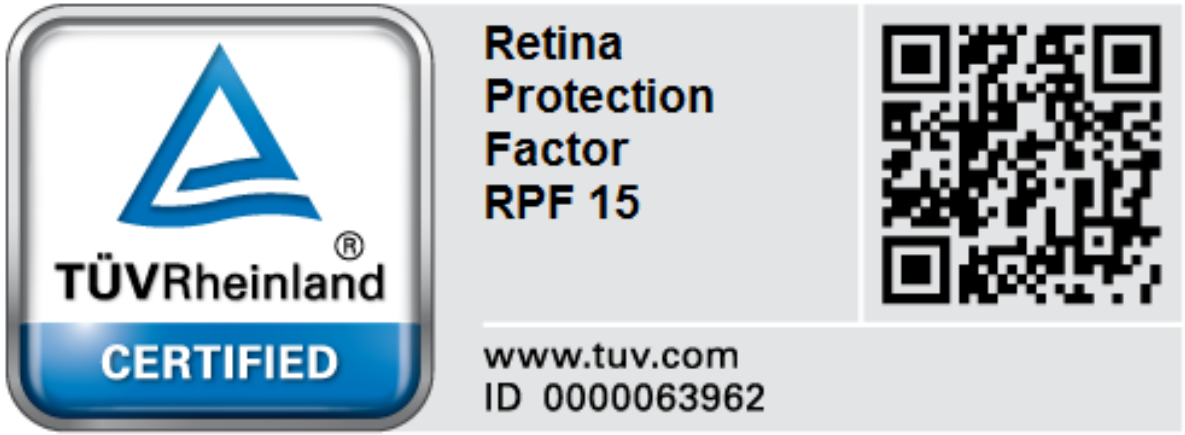
TÜV Certification for Accessory Film—Retina Protection Factor

Applicable to accessory optical film and display product module that has the function to reduce hazardous blue light.



RPF Classification Rules：

Classification Requirement	RPF Level	Luminance reduction	Change of CCT
RPF15	15	≤20%	≤250K
RPF20	20	≤20%	≤350K
RPF30	30	≤20%	≤500K

Meet with TÜV Rheinland and Eyesafe at China International Import Expo November 5th-10th

CHINA INTERNATIONAL IMPORT EXPO
中国国际进口博览会
CIIE

Contact us to arrange a meeting 11/5-11/10

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SOLUTIONS

Eyesafe Technology & Display Solutions

DEREK HARRIS, PhD

Eyesafe VP Research & Development

Please submit questions to: BLS2019@Eyesafe.com

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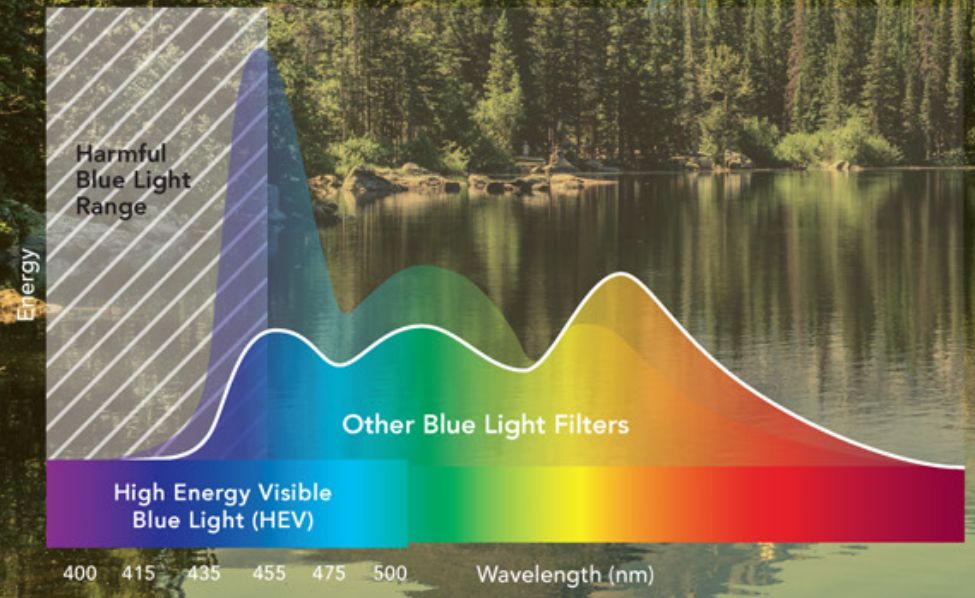
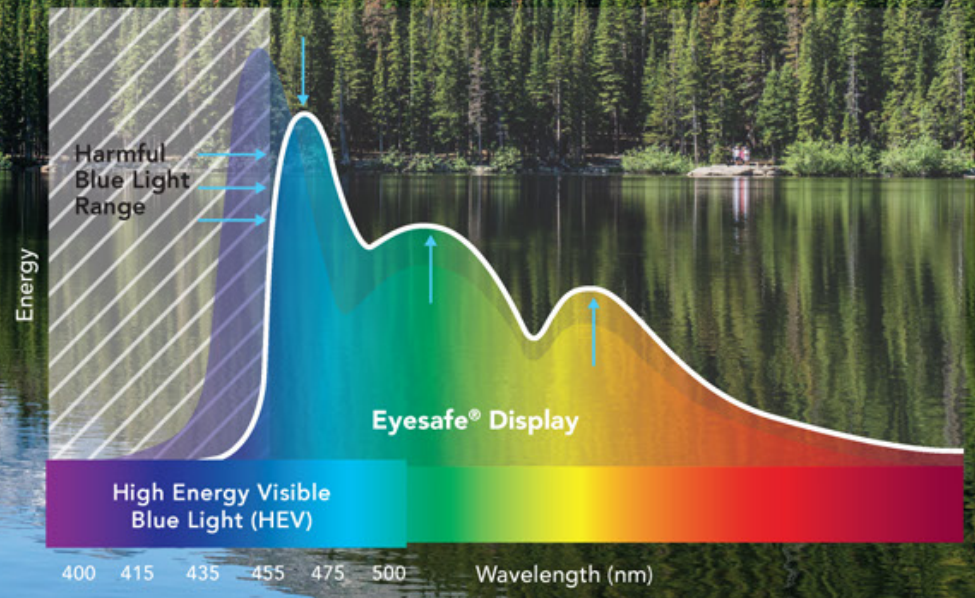
OTHER BLUE LIGHT FILTERS



Others adjust the blue light by shifting color to warmer hues which impacts color

EYESAFE® DISPLAY



Eyesafe® Display redesigns light emission and the color filter for beautiful color with less blue light

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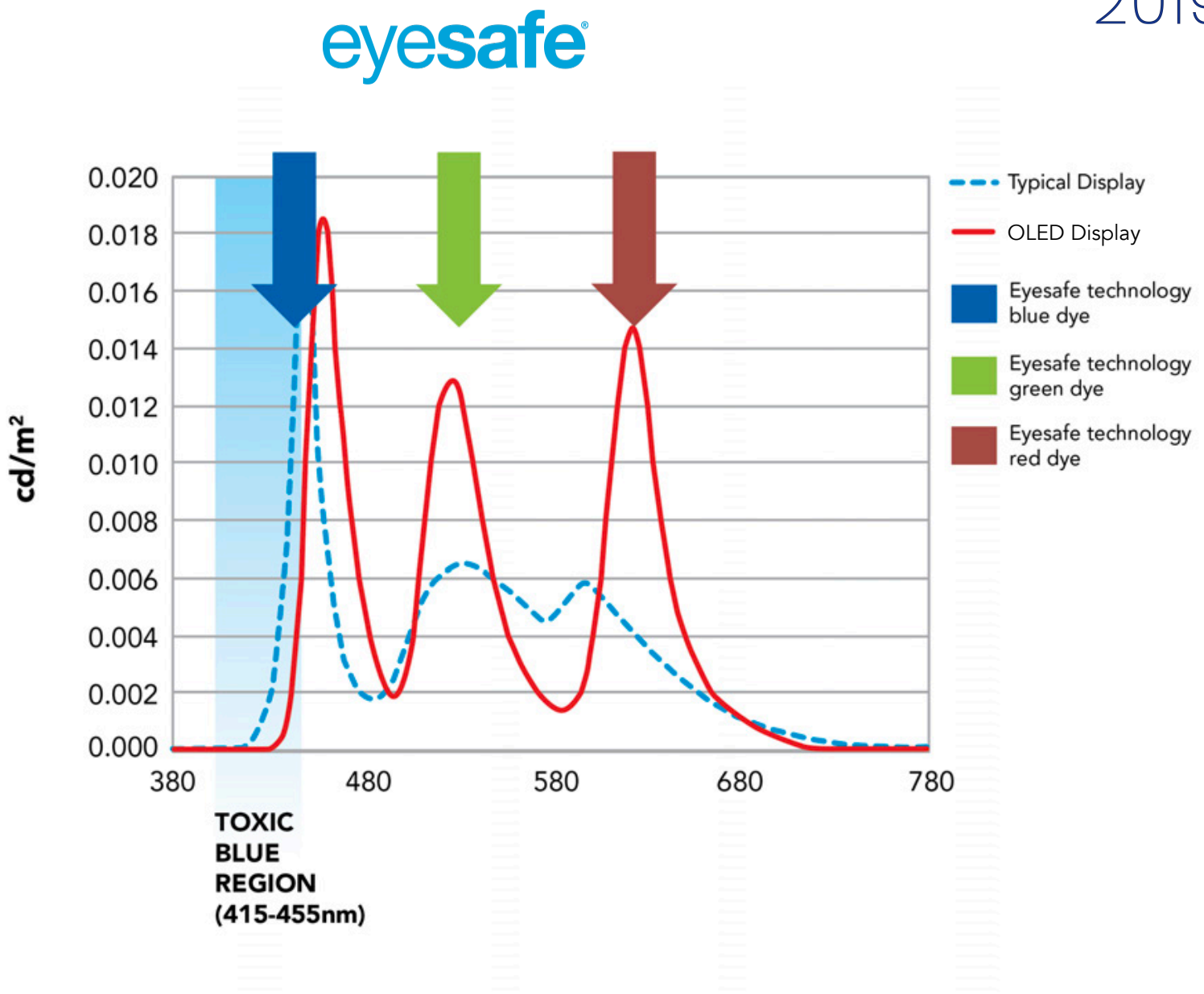
Eyesafe Surgically Manages Blue Light While Maintaining Color Performance

- Eyesafe dyes provide best-in-class blue light management while maintaining color performance
- Targeted filtration focused in the most toxic blue light range
- Achieves Eyesafe® Standard requirements



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DISPLAY

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SCREEN PROTECTION

Eyesafe Technical Solutions

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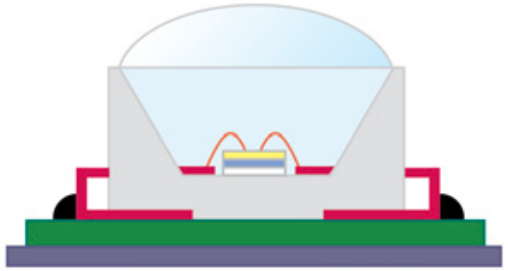

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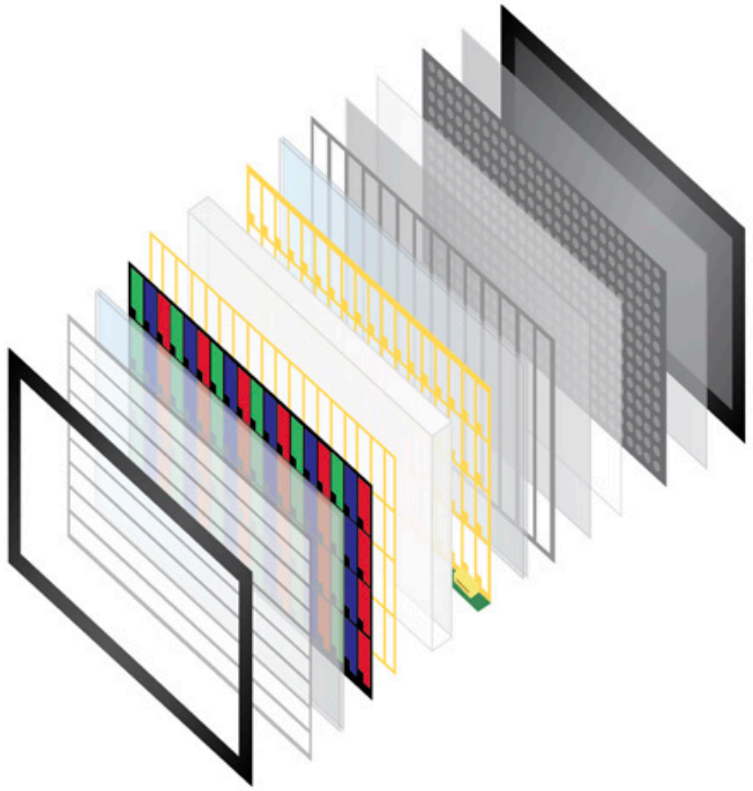
LED



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FILM COATING

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ADHESIVE

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YOUR QUESTIONS

Please submit questions to: BLS2019@Eyesafe.com

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NEXT STEPS

1. Submit Blue Light Health Issues & Research Questions to Vision Health Advisory Board
2. Get the Handbook in English or Chinese from Eyesafe and TÜV Rheinland
3. Submit Questions on Standards, Certification and Solutions
4. Meet with Eyesafe and TÜV Rheinland at CIIE
5. Review materials at Bluelightsummit.com

- Contact TUV Rheinland: **Stanley.Liu@tuv.com**
- Contact Eyesafe: **Paul@eyesafe.com**

Please submit questions to: BLS2019@Eyesafe.com