

Carotenoids- Prescribing for Ocular Health and Visual Performance

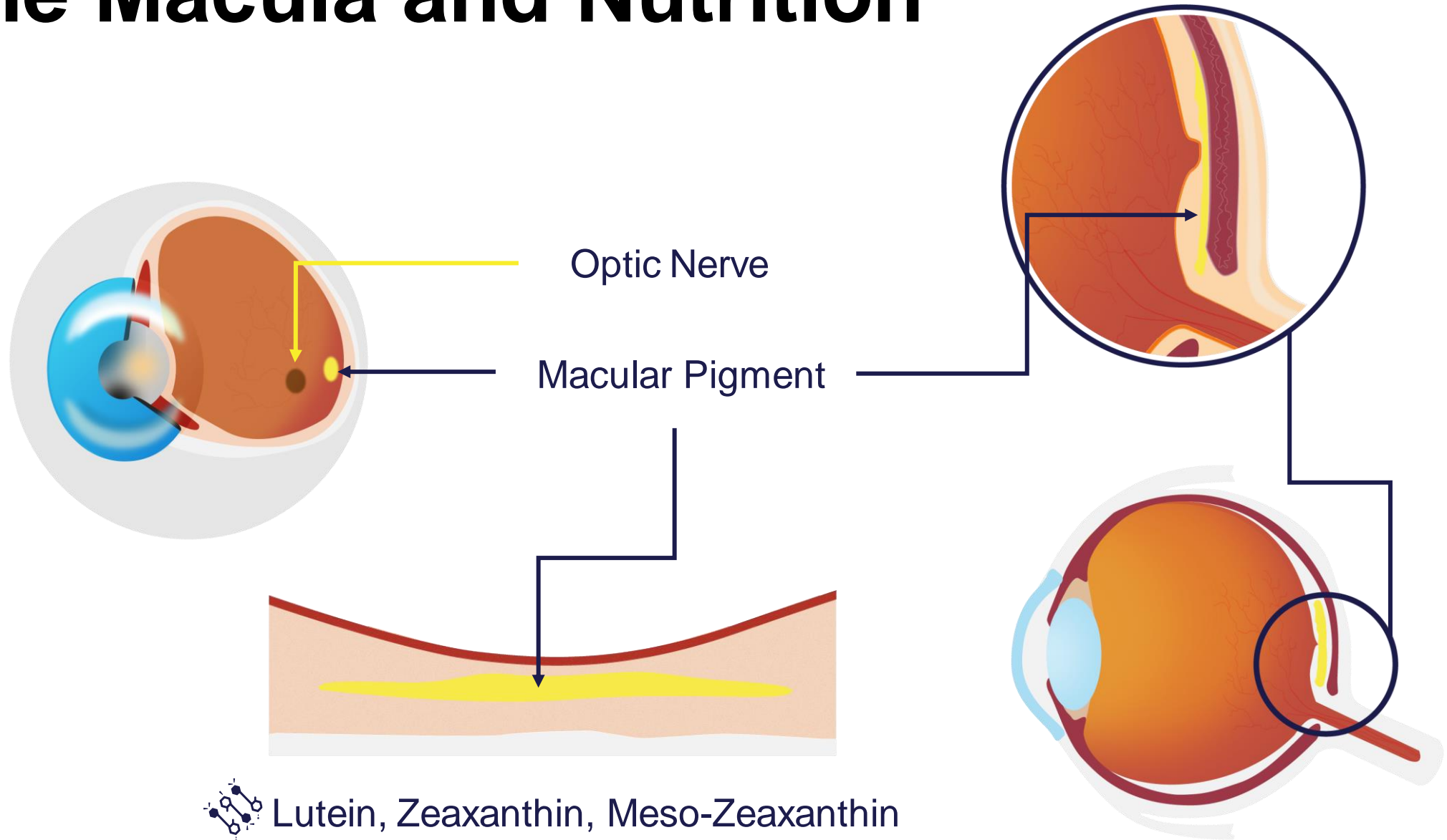
Jennifer L. Stewart, OD



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- Chief Vision Officer: OD Perspectives
- Co-founder/Chief Vision Officer: Performance 20/20
- Executive Board: International Sports Vision
- Speaker/Consultant: Macuhealth
- Professional Affairs Team: Coopervision
- Professional Editor: Independent Strong
- Sports Vision Consultant
- Delegate, NECO Alumni Board of Directors
- Adjunct Assistant Professor: NECO

The Macula and Nutrition





Macular Carotenoids

Meso-Zeaxanthin

- Most potent
- Found at the fovea
- Found in green leafy vegetables
- Also found in the skin of fish (salmon)- but need a lot!
- Body can convert L to MZ- but 20% cannot (prevalent in AMD patients)
- When combined with L and Z- more effective than they are on their own

Macular Carotenoids

Zeaxanthin

- Sharpens central vision
- Reduce effects of glare
- Maintain healthy visual acuity
- Absorbs high energy light (along with MZ)
- Found in brain and other organs

Macular Carotenoids

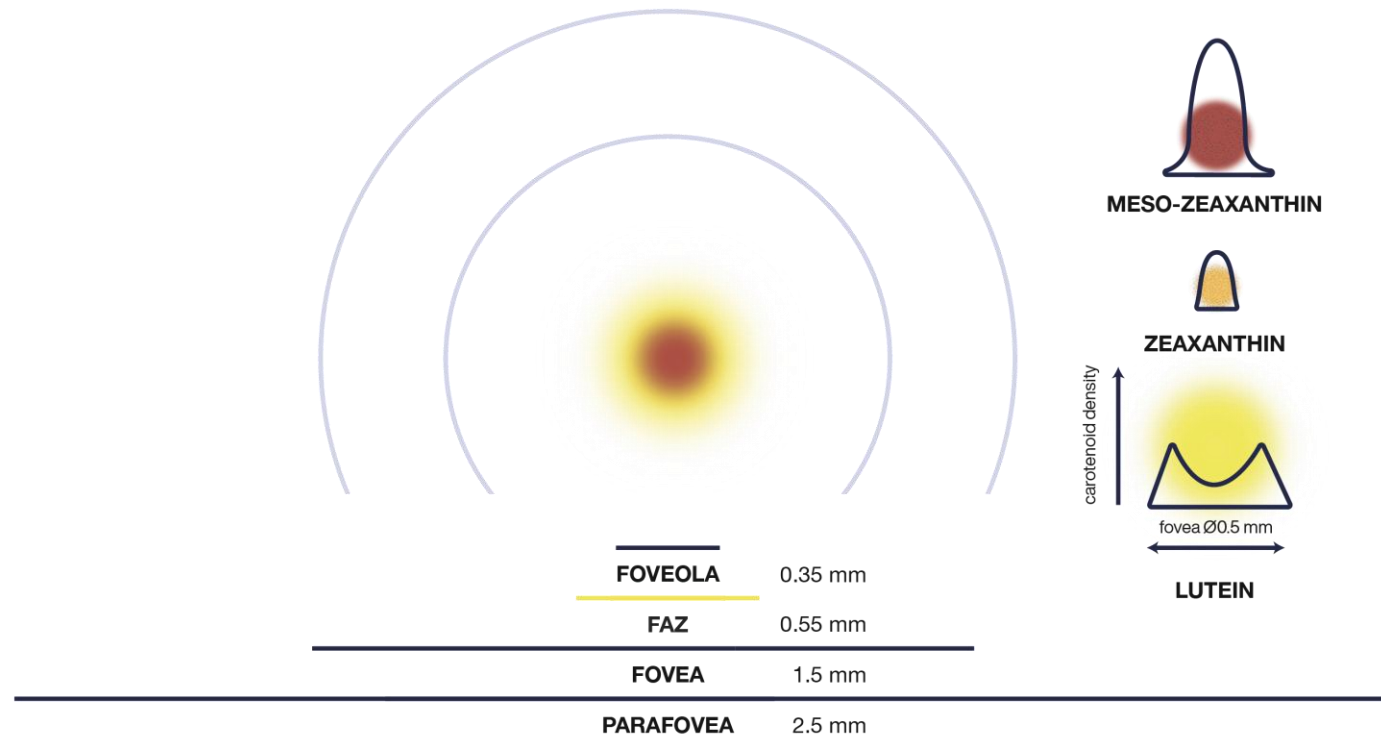
Lutein

- Filters short wavelengths of blue light
- Antioxidant
- Less dense at the fovea
- Found in green leafy vegetables, egg yolks

Macular Carotenoids

- Humans CANNOT manufacture carotenoids
- Only produced by plants
- Starts development in utero (mother's diet)
- Average person consumes only 1-2mg daily

Distribution of Macular Carotenoids



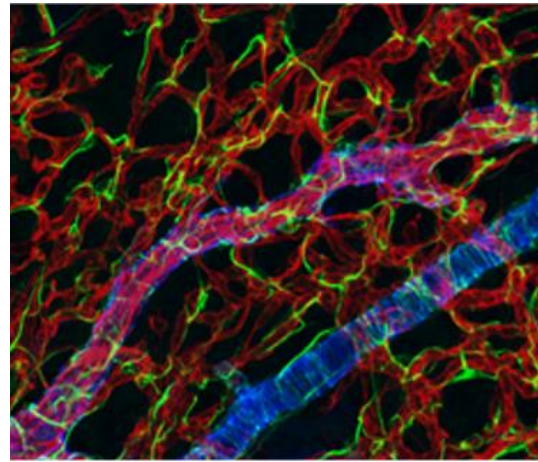
Sources of Macular Carotenoids



Nature (700)



Diet (50)

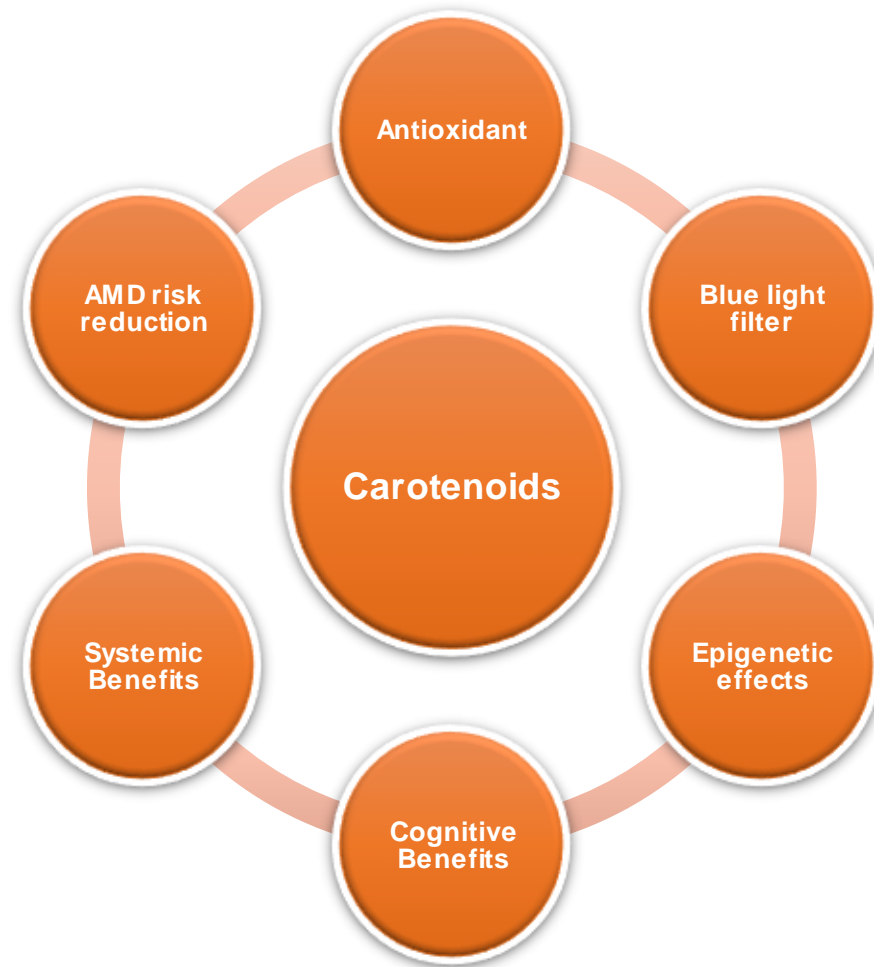


Blood Serum (<20)



Eye (3)

Effects of Macular Carotenoids



Macular Carotenoids: Additional Benefits

Cognitive Function

To produce vision, the retina captures information and sends it through the optic nerve to be processed by the brain.

Locations of carotenoids in the brain

Frontal Lobe
(higher mental processing)

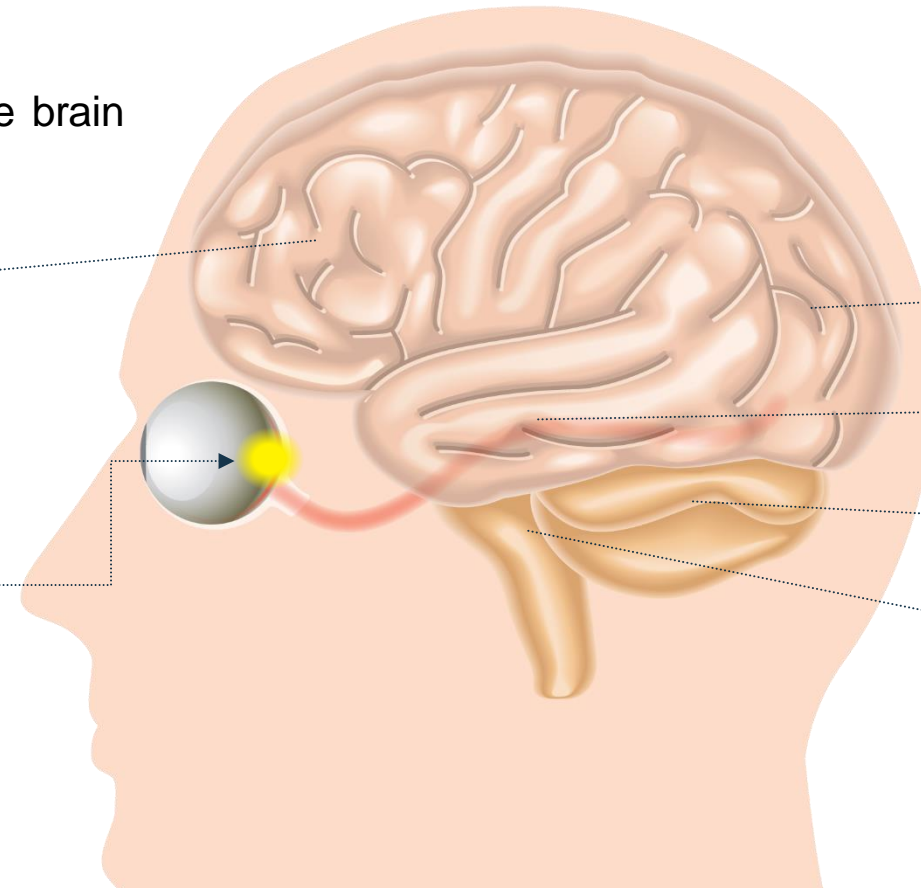
Occipital Lobe
(visual processing)

Temporal Lobe
(speech, vision, long-term memory)

Cerebellum
(balance, attention, language)

Pons
(facial expression, horizontal gaze)

Macular Pigment
(antioxidation, light filtration)



Support Cognitive Function

Carotenoid deposition in the brain improves visual processing and overall cognitive function measures.

Locations of carotenoids in the brain

Frontal Lobe
(higher mental processing)

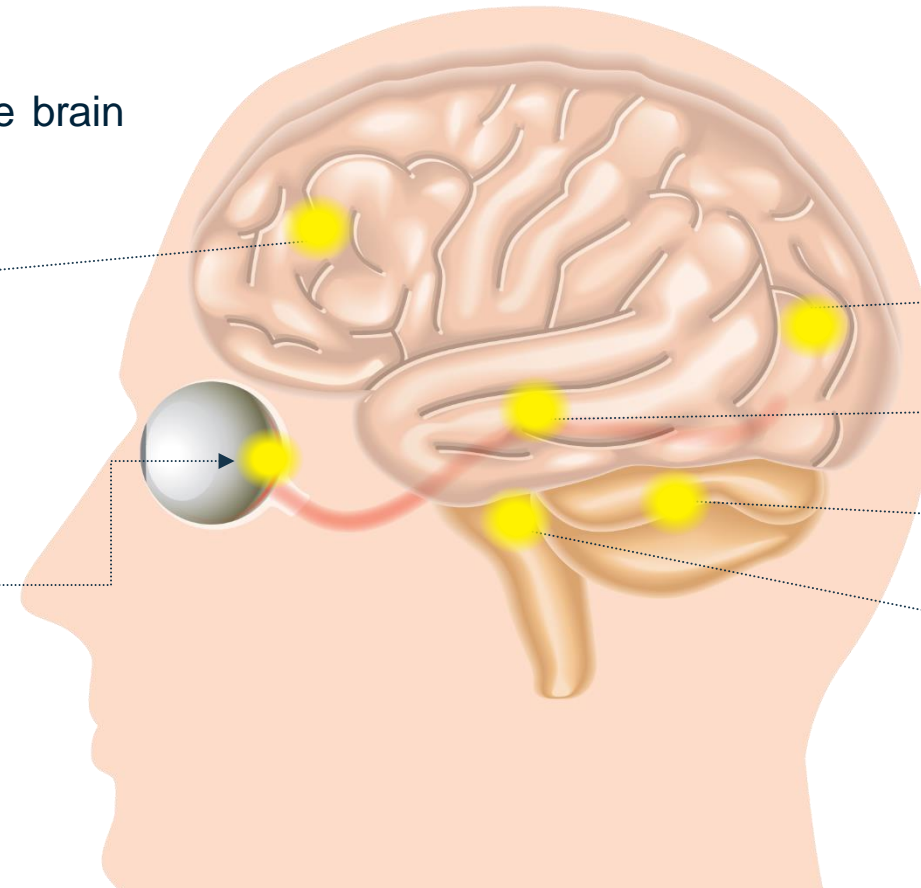
Macular Pigment
(antioxidation, light filtration)

Occipital Lobe
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Temporal Lobe
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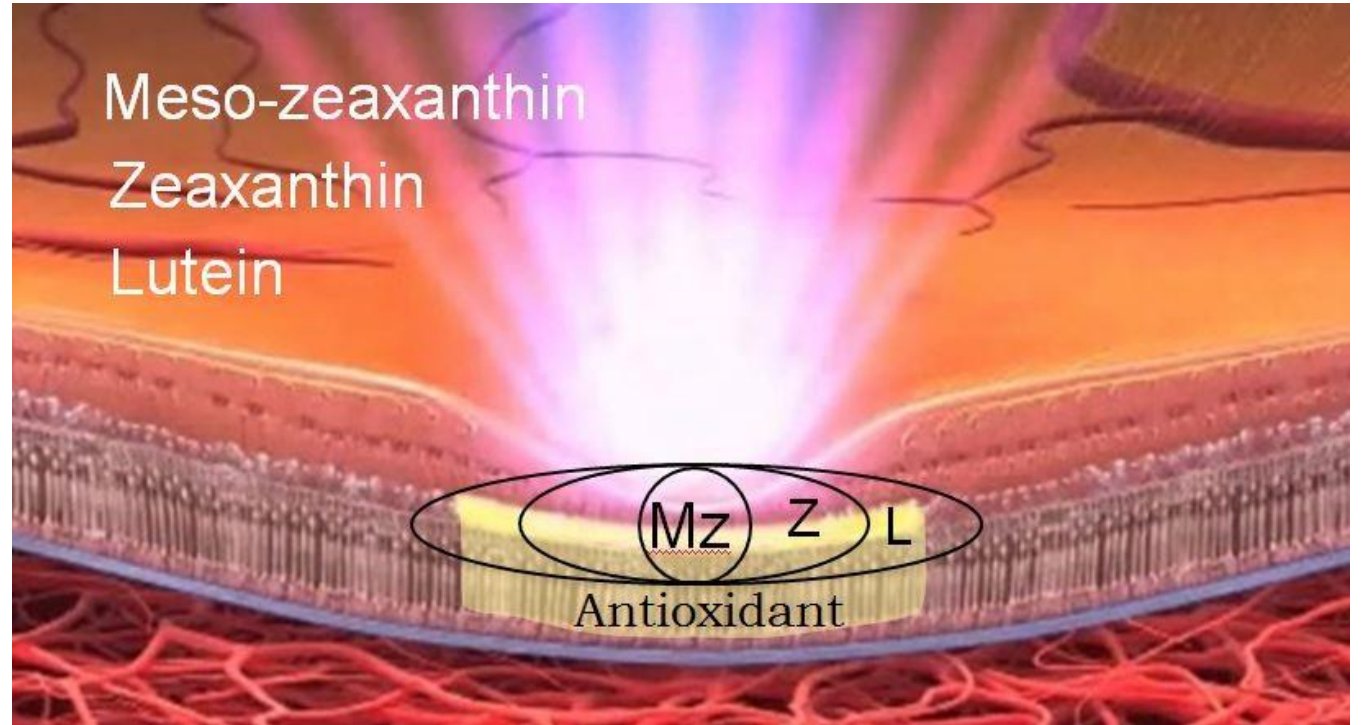
Cerebellum
(balance, attention, language)

Pons
(facial expression, horizontal gaze)



The Macula: Powerful Yet Vulnerable

- Very high metabolic rate
- Many free radicals to quench
- Accounts for 90% of conscious visual processing
- Provides central vision



Role of Oxidative Stress in Disease



Free radicals caused by:

- Cellular metabolism
- The environment
- Lifestyle & Choices



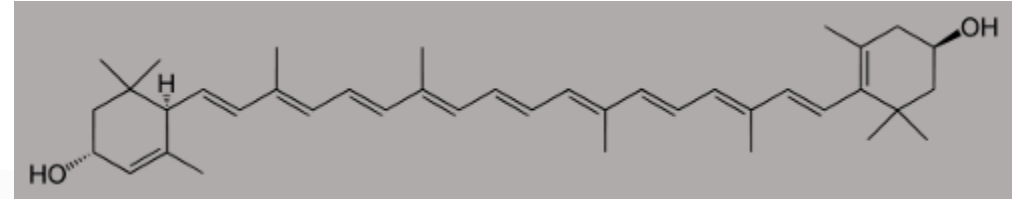
Oxidative Stress



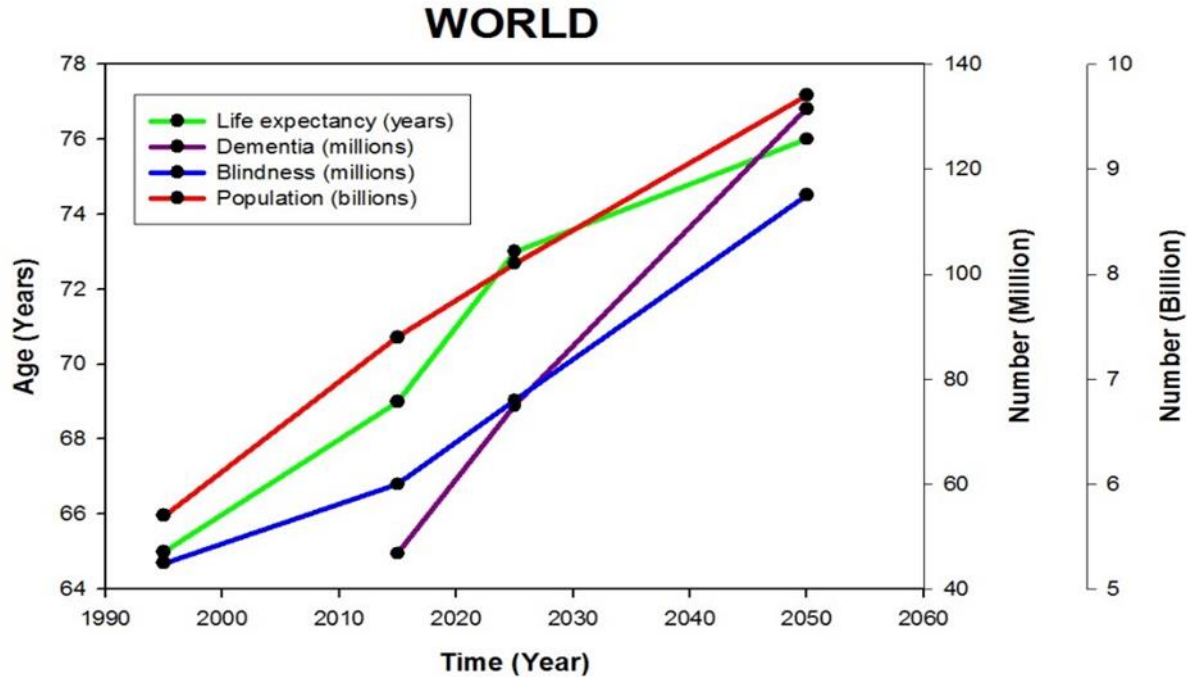
Reduced by Antioxidants

- There are many antioxidants in our diet
Vitamins C, E, Zinc, Lutein, Zeaxanthin
and Meso-Zeaxanthin to name a few...
- Antioxidants donate / accept electrons to
stabilize free radical
- Only 3 antioxidants present at the
macula: Lutein, Zeaxanthin, Meso-
Zeaxanthin

Chemical structure of lutein



The Aging Population

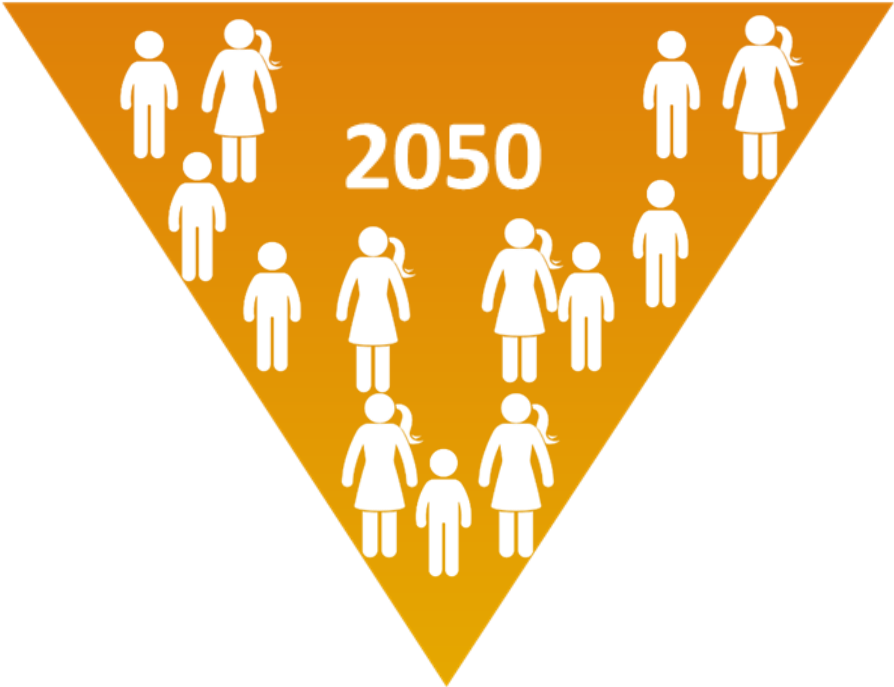


Ref: World Health Organization; Central Statistics Office

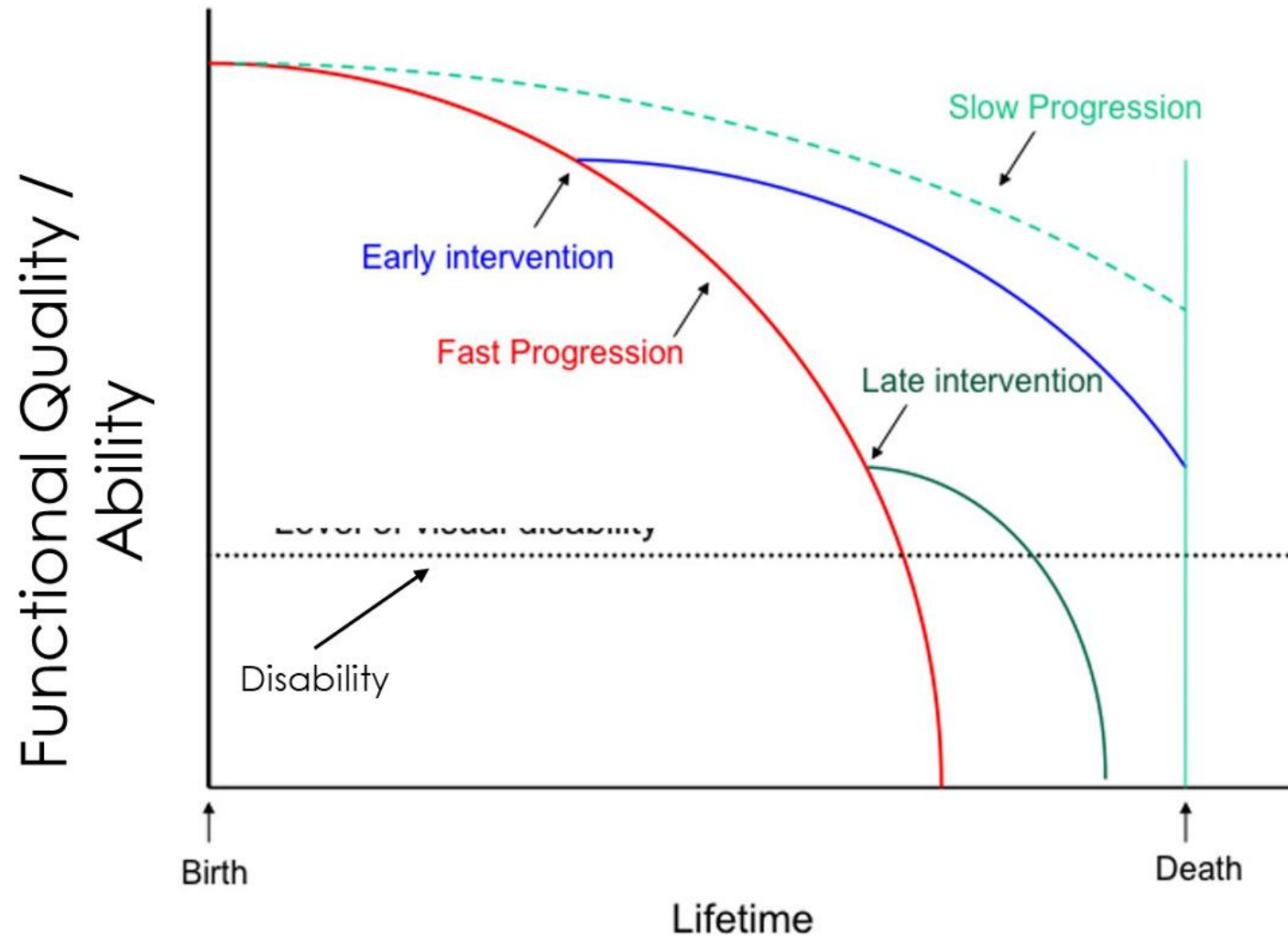
- Population 
- Life expectancy 
- Age-related diseases 

Refs: World Health Organisation; Central Statistics Office; Alzheimer's Society of Ireland; Green et al 2016.

The Aging Population and AMD

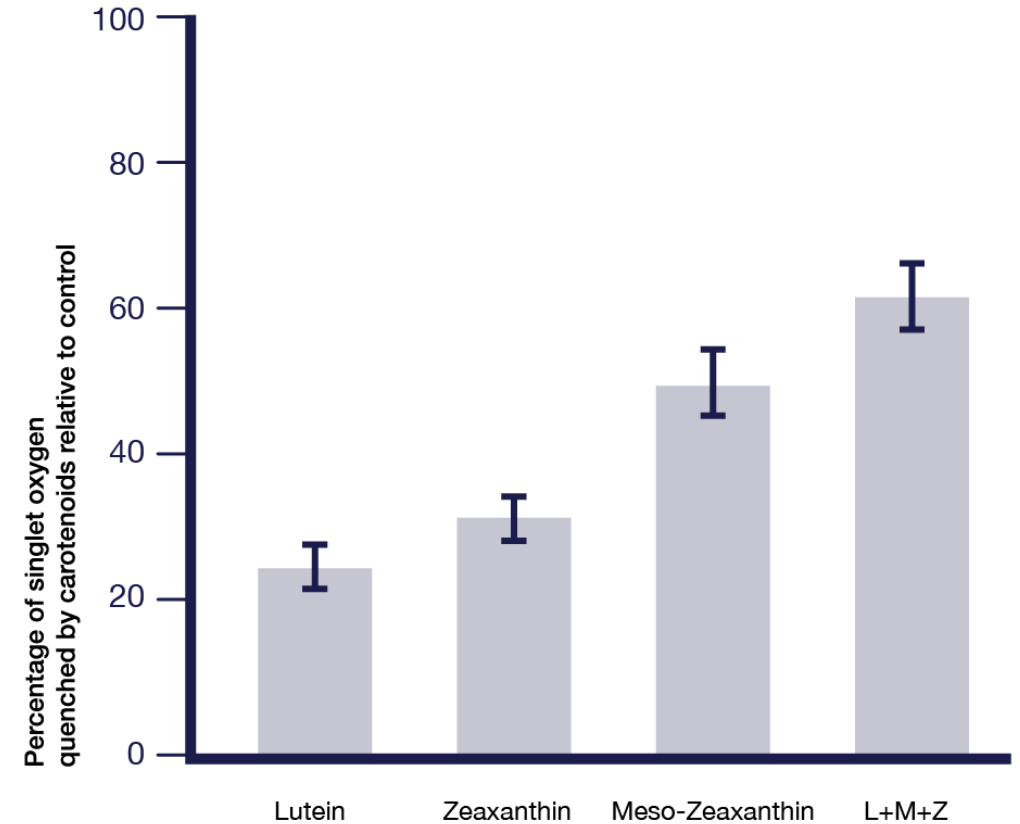


“Getting out in front” of age-related problems



The Triple Carotenoid Formula

- The macular carotenoids are all exceptional antioxidants
- MZ has the highest antioxidant capacity, followed by Z, and L
- Synergistic effect of the 3 carotenoids together



Binxing Li, Fasial Ahmed, Paul S. Bernstein. Studies on the singlet oxygen scavenging mechanism of human macular pigment. *Arch. Biochem. Biophys.* (2010), doi:10.1016/j.abb.2010.07.024

The Importance of Meso-Zeaxanthin

- Of the 3 macular carotenoids, **MZ is the most powerful antioxidant**, found in the center of the fovea – where oxidative stress is highest¹
- Estimated that 15 - 20% of population has impaired conversion of Lutein into Meso-Zeaxanthin²
- Triple carotenoid formula demonstrated to augment the entire MP spatial profile; a high lutein-only formula was unable to rebuild the central region^{2,3}

References: 1. Li, et al. Studies on the singlet oxygen scavenging mechanism of human macular pigment. *Arch. Biochem. Biophys.* 2010.
2. Nolan et al. Macular carotenoid supplementation in subjects with atypical spatial profiles of macular pigment. *Exp Eye Res.* 2012.
3. Akuffo et al. Sustained supplementation and monitored response with differing carotenoid formulations in early age-related macular degeneration. *Eye*, 2015

The Importance of Meso-Zeaxanthin

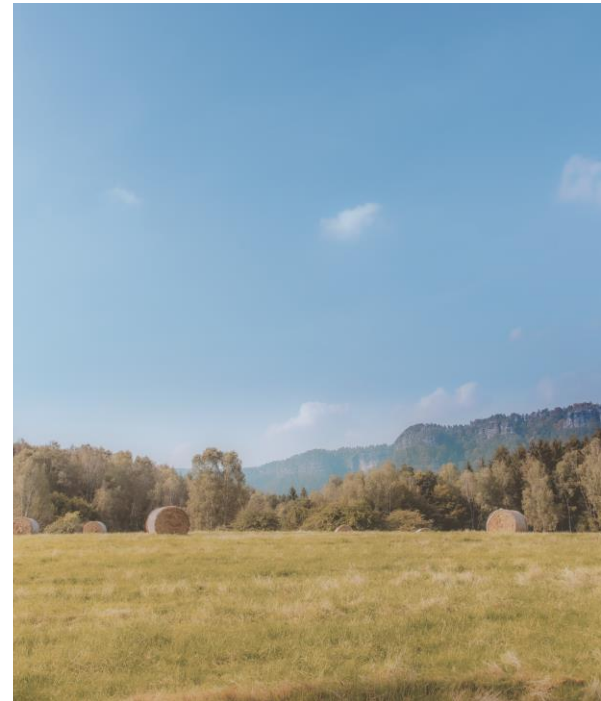
- Independent analysis of 20 peer-reviewed studies support the inclusion of MZ in any retinal health supplement to be maximally effective.¹
- CREST AMD: Head-to-head randomized clinical trial validating MZ in an AREDS 2 formula.² 75% of visual performance measures improved over two years in early AMD population.

References: 1. Ma L, et al. Lutein, Zeaxanthin and Meso-zeaxanthin Supplementation Associated with Macular Pigment Optical Density. *Nutrients*. 2016

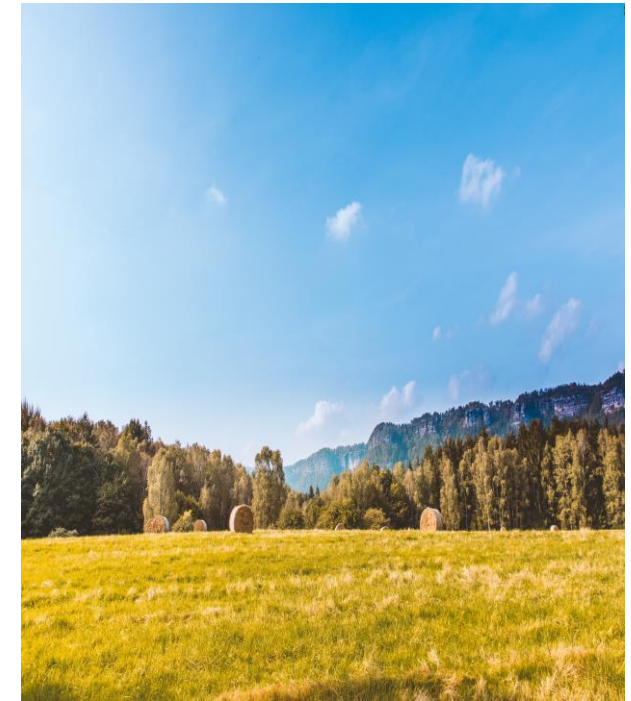
2. Akuffo, et al. Sustained supplementation and monitored response with differing carotenoid formulations in early age-related macular degeneration. *Eye* 2015

The Importance of Meso-Zeaxanthin

- Patients with 20/20 vision, low macular pigment density
- 1 year of taking triple carotenoid formula: statistically significant improvements in contrast sensitivity
- Achieve sharper, high-definition vision in healthy patients

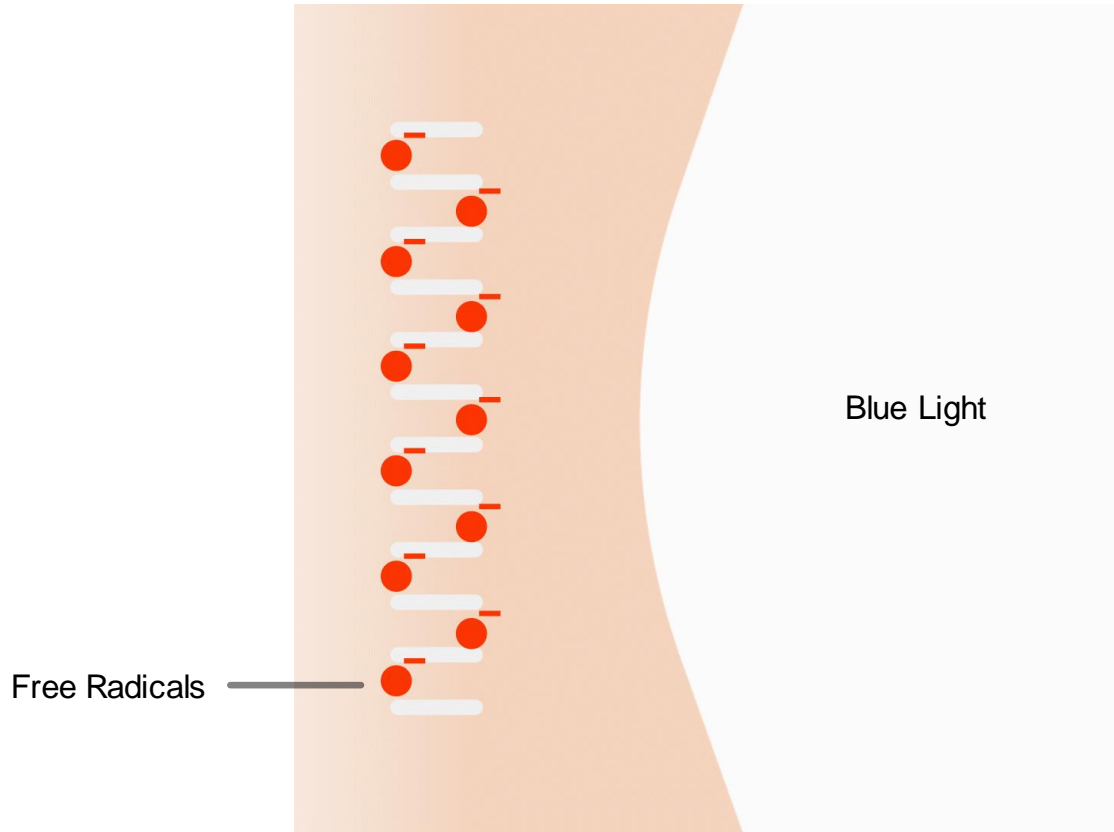


Before

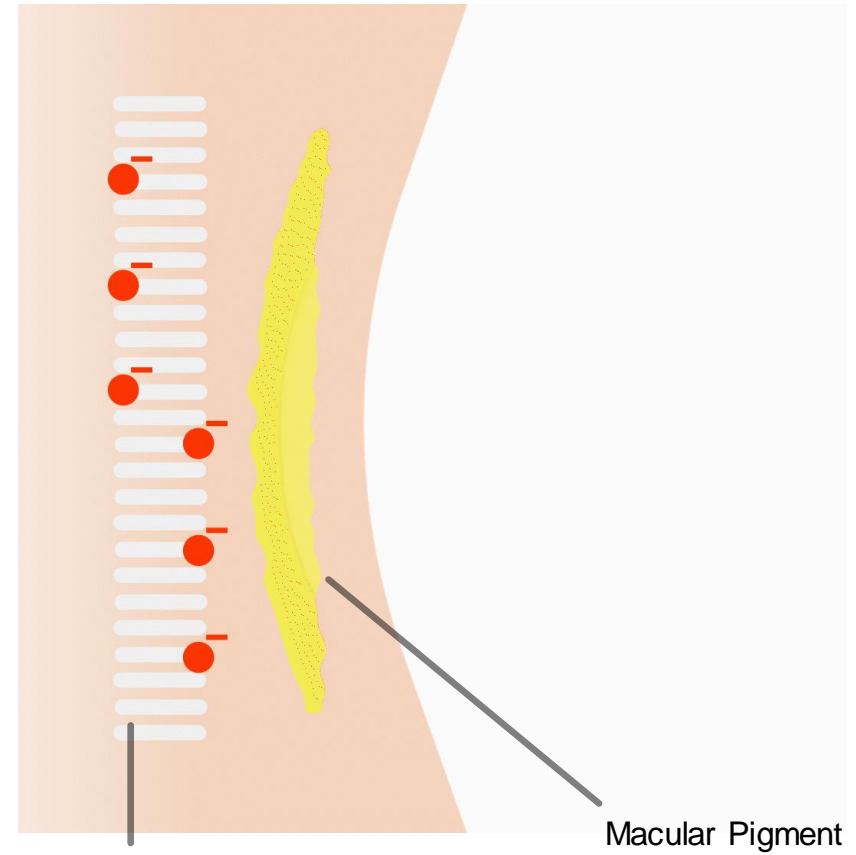


After

Blue Light Filtration



Macula without macular pigment



Macula with macular pigment

Visual Performance: More Than Acuity

1. Speed: temporal visual processing

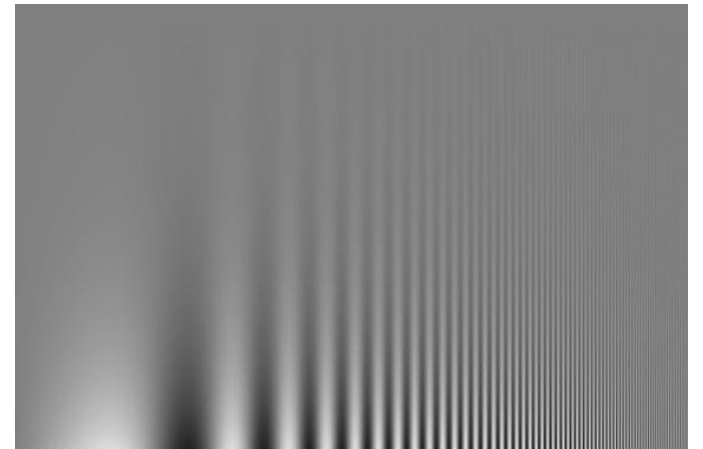
- a) Reaction Time
- b) Prediction
- c) Decision-Making



2. Contrast Sensitivity

3. Glare

- Discomfort
- Disability glare
- Photostress recovery



Vision in Low-Light Conditions



4. Visual Adaptation

Macular pigment significantly related to speed of dark adaptation / vision in low-light conditions

Visual Performance in the Real World

Owsley & Sloane (1987): Contrast sensitivity at middle and low spatial frequencies (e.g. 6 cpd) was a significant predictor of real-world object detection and identification. *Faces, road signs, basic objects.*

- CS is a better predictor of performance than age!
- VA not a significant contributor to real-world visual performance.



British Journal of Ophthalmology, 1987, 71, 791-796

Contrast sensitivity, acuity, and the perception of 'real-world' targets

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From the ¹Department of Ophthalmology, School of Medicine, Eye Foundation Hospital, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA, and the ²Department of Psychology, School of Social and Behavioural Sciences, University of Alabama at Birmingham, Birmingham, Alabama 35294, USA

SUMMARY A major assumption underlying the use of contrast sensitivity testing is that it predicts whether a patient has difficulty seeing objects encountered in everyday life. However, there has been no large-scale attempt to examine whether this putative relationship actually exists. We have examined this assumption using a clinic based sample of adults aged 20-77 years. Contrast thresholds were measured for both: (1) gratings of 0.5-22.8 cycles/degree; and (2) real-world targets (faces, road signs, objects). Multiple regression techniques indicated that the best predictors of thresholds for real-world targets were age and middle to low spatial frequencies. Models incorporating these variables accounted for 25-40% of the variance. Although acuity significantly correlated with thresholds for real-world targets, the inclusion of acuity as a predictor variable did not improve the model. These data provide direct evidence that spatial contrast sensitivity can effectively predict how well patients see targets typical of everyday life.

Measurement of Contrast Sensitivity



1.25%



2.5%



5%



6.3%



8.0%



10%

Contrast Sensitivity

Supplementation with triple carotenoid formula demonstrates improved contrast sensitivity

in patients with 20/20 vision at just one year

in patients with Early AMD over 3 years



Contrast Sensitivity



CONTRAST IN REAL LIFE



High Contrast



Low Contrast

CREST Normal Study

Double-blind, placebo-controlled, 1-year study in patients with 20/20 vision and low macular pigment density

Patient in on triple carotenoid supplement demonstrated statistically significant improvements in contrast sensitivity

Ability to achieve sharper, high definition vision in healthy patients



MOST Conclusions



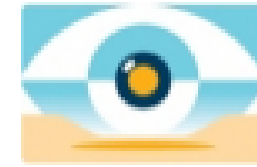
3-year study in EARLY AMD Population

Triple carotenoid formula benefits:

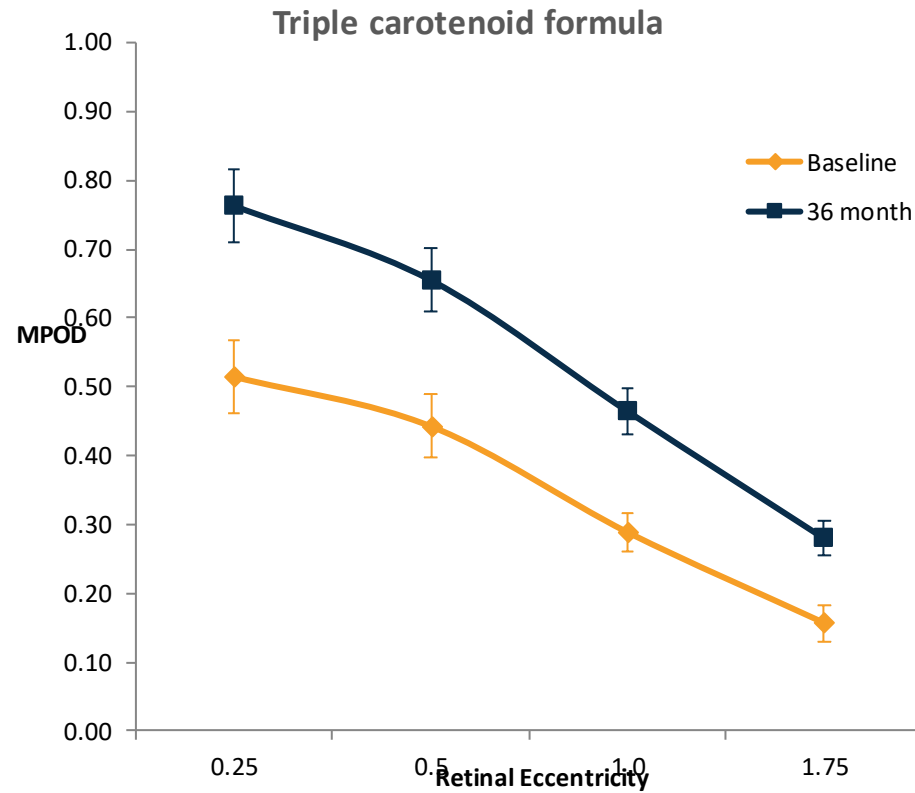
Best formula to increase macular pigment density

Contrast Sensitivity Improvements: Patients saw better!

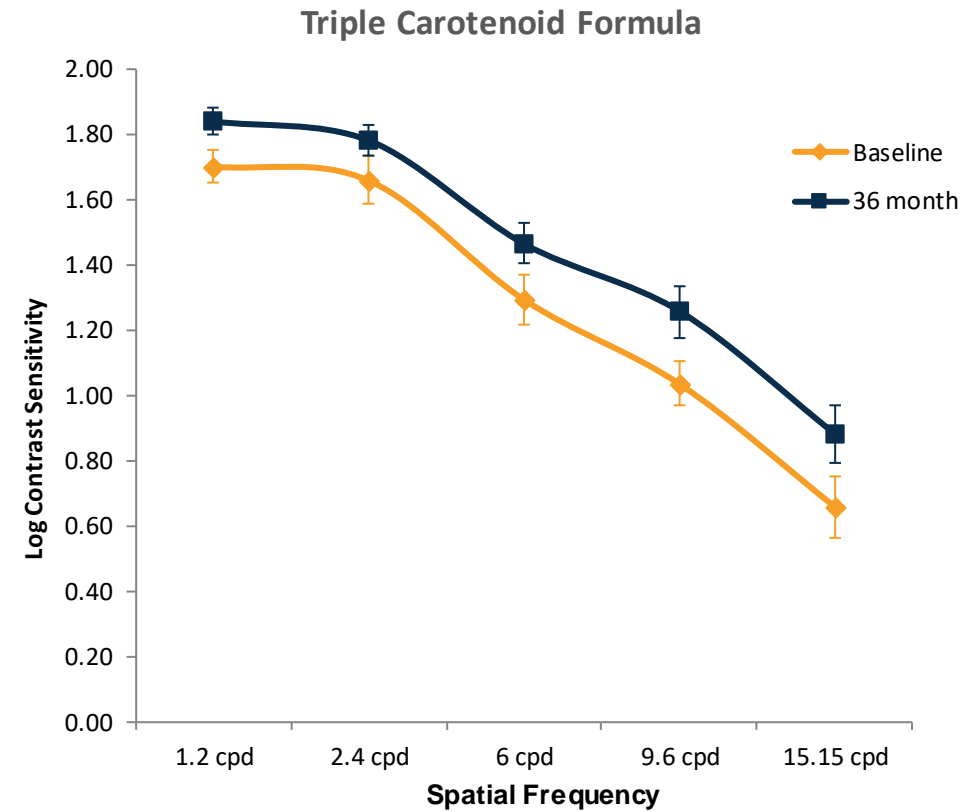
MOST Conclusions



MPOD at 36 Months



Letter CS at 36 Months

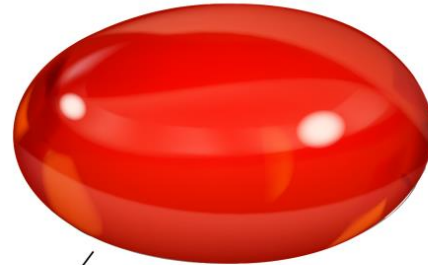


Formulation and Manufacturing Matter

Some forms of encapsulation are extremely vulnerable to oxidation & light exposure

- A recent study found that of 46 supplements tested, 61% did not meet the amount claimed on the label for carotenoid content

Oil Filled Softgel Capsule

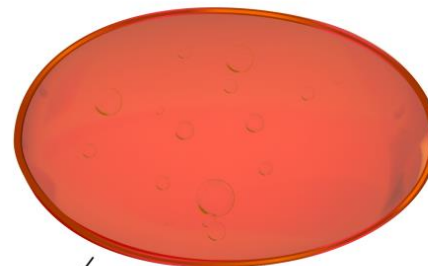


SHELL
gelatin water plasticizer, for airtight enclosing

Powder Filled Capsule



SHELL
cap and body interlock to form a secure leak-free closure



Oil and carotenoid filled capsule



Powder and carotenoid filled capsule

Best Practices

- Practice must be all in- start at the front desk
 - Bring a list of all medications and supplements
- Website/social media/email blasts/POP
- Pre-test
 - Technician
 - OCT
 - MPOD testing

Best Practices

- In the exam room
 - Discuss results (OCT/MPOD)
 - Family history
 - Patient history/risk factors
 - Visual performance
 - Glare?
- Doctor prescribing

Best Practices

- Stocking versus auto-ship?
- Bundle pricing (year supply discount)
- 6 month supply with visit scheduled
- One bottle isn't enough!
- "I/We take it too!"
- Keep it simple

Handling Objections

- Don't take it personally
- Opportunity to educate
- 15 second dialogue
- Be confident!

Who Can Benefit?

- AMD patients
- Family history of AMD
- 20/20 not happy
- Athletes
- Children
- High Performance Careers
- Everyone?

1-48 of over 2,000 results for "eye vitamins"

Sort by: Featured

Amazon Prime

prime

Delivery Day

Get It by Tomorrow

Amazon Local Stores

Whole Foods Market

Climate Pledge Friendly

Climate Pledge Friendly

Department

- Antioxidant Nutritional Supplements
- Lutein Nutritional Supplements
- Carotenoids Nutritional Supplements
- Blended Vitamin & Mineral Supplements
- Diet & Sports Nutrition
- Fruit Extract Supplements
- Bilberry Herbal Supplements
- See All 14 Departments

Customer Reviews

- ★★★★★ & Up
- ★★★★☆ & Up
- ★★★☆☆ & Up
- ★★☆☆☆ & Up

Brand

- TruNature
- PreserVision
- Systane
- Nordic Naturals
- Eyecheck
- Swanson
- Lipotriad
- See more

Price

- Under \$25
- \$25 to \$50
- \$50 to \$100
- \$100 to \$200
- \$200 & Above

\$ Min \$ Max Go

Deals



Save on PreserVision Shop PreserVision



PreserVision AREDS 2 Eye Vitamin & Mineral Supplement, Contains Lutein, Vitamin C, Zeaxan... 4.5 stars 42,663



PreserVision AREDS 2 Eye Vitamin & Mineral Supplement, Contains Lutein, Vitamin C, Zeaxan... 4.5 stars 3,225

RESULTS



Sponsored Bausch + Lomb OcuVite Lutein 25mg Lutein & Zeaxanthin Supplement, 30 Softgels 30 Count (Pack of 1) \$12.38 (\$0.41/Count) \$15.99



Sponsored Lutein 40 Mg with Zeaxanthin, Helps Support Eye Health*, 60 Ct, by Puritan's Pride 60 Count (Pack of 1) \$8.02 (\$0.13/Count) \$8.79



Sponsored PreserVision AREDS 2 Eye Vitamin & Mineral Supplement, Contains Lutein, Vitamin C, Zeaxanthin, Zinc & Vitamin E... 60 Count (Pack of 1) \$18.75 (\$0.31/Count) \$29.99



Sponsored Bausch + Lomb OcuVite Vitamin & Mineral Supplement Tablets with Lutein, 120 Count Bottle (Pack of 2) 120 Count (Pack of 2) \$25.76 (\$0.11/Count) \$29.79





THANK YOU!