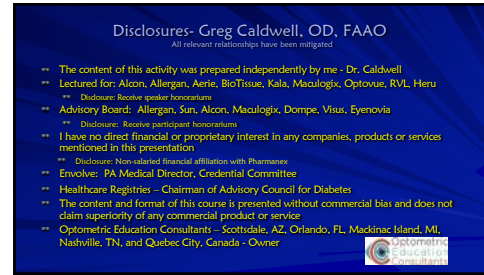
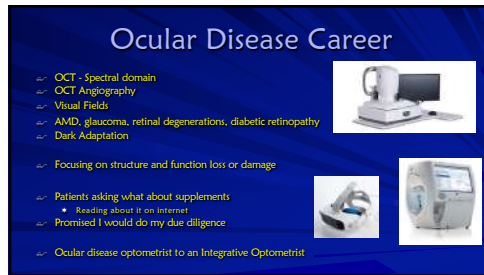


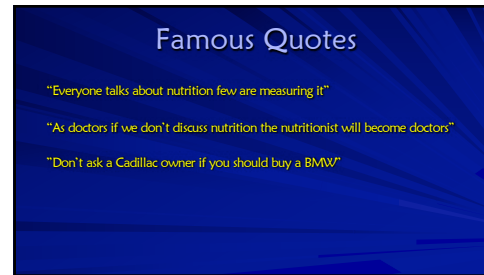
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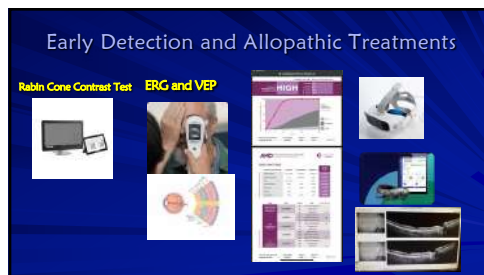
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7



8

Patients Are Expecting

- ~ Early detection
- ~ Wellness
- ~ Prevention

9

Nutraceuticals

- ~ Do not claim that a product will treat, cure, or prevent any disease or health condition (including COVID-19 or viruses) or that the product cured your own ailment

10

Who?

- ~ Recommends a lutein and zeaxanthin supplement?

Figure 1: Nutrition between eye health and systemic outcomes.

11

Thoughts?

Figure 2: Nutrition between eye health and systemic outcomes.

12

Question?

- ~ Who in here would consider themselves as an integrative optometrist?
- ~ Who has done or recommended?
 - * Supplements, vitamins, AREDS2
 - * Omegas, EPA, DHA
 - * Vital tears – ASED
 - * Ciradex – Tea Tree oil
 - * Avenova - Hypochlorous Acid
 - * Regenr-Eyes
 - * Amniotic membranes
 - * Probiotics

13

Allopathic vs Integrative Medicine

- ~ "Allopathic medicine" is a term used for modern or mainstream medicine
 - * Conventional medicine, mainstream medicine, Western medicine, biomedicine
 - * Treating conditions and symptoms with its "opposite"
 - * Health systems in which medical doctors, nurses, pharmacists, and other healthcare professionals are licensed to practice and treat symptoms and diseases
 - * Using medication, surgery, radiation, therapies, and procedures
- ~ Complementary and integrative medicine are commonly used along with mainstream medicine
 - * Naturopathy, naturopathy, chiropractic care, Chinese medicine
- ~ Allopathic or modern medical schools have recently added more study and information on how food and nutrition can help prevent and treat disease
 - * More education is being offered on integrative approaches and potential interactions with mainstream medicine

14

Medical Practices

- ~ Allopathic medicine
 - * Western medicine
- ~ Alternative "homeopathic"
- ~ Functional
 - * Medicine of why, treat the cause
- ~ Integrative medicine
 - * Complementary medicine - Eastern complementing Western


What is integrative medicine?

The practice of integrative medicine refers to the blending of conventional and evidence-based natural and complementary medicines and/or therapies with lifestyle interventions to deliver holistic, patient-centred care.

15

Chronic and Low-Grade Inflammation


Science has proven that chronic, low-grade inflammation can turn into a silent killer that contributes to cardiovascular disease, cancer, type 2 diabetes, diabetic retinopathy, cataracts, macular degeneration, and many other conditions



16

Chronic and Low-Grade Inflammation

Like cancers and other slow-burn diseases, identifying these conditions early can make the difference between full recovery or a dramatically reduced quality of life or even death (vision loss or blindness)



17

"Choose Your Parents Wisely"

- ~ This just isn't as true as it's used to be
- ~ Lifetime health
 - * 8% genetics "Picking your parents wisely"
 - o DNA in our nucleus
 - Can't be influenced
 - * 92% epigenetics
 - o Lifestyle choices = we can influence
 - o Turn on/off gene expression

18

Biomarker

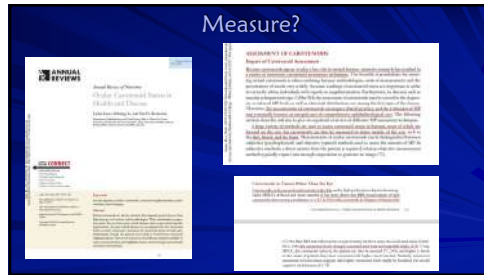
- ~ Test that has meaning
- ~ Biological molecule found in blood, other body fluids, or tissues that is a sign of a normal or abnormal process, or of a condition or disease.
- ~ A biomarker may be used to see how well the body responds to a treatment for a disease or condition
- ~ Blood pressure, blood work, heart rate, genetic testing, IOP

19

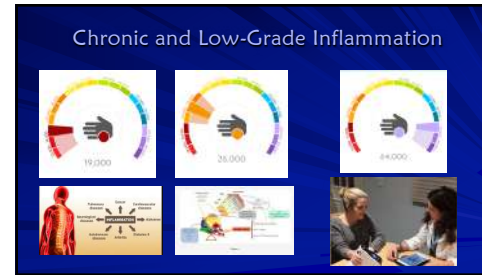
Predictive Biomarker

- ~ Used to identify individuals who are more likely to respond to exposure to a particular medical product or environmental agent
- ~ The response could be a symptomatic benefit, improved survival, or an adverse effect
- ~ A value that we can guide therapy around
 - * HbA1c
 - * C-Reactive Protein
 - * Plasma Homocysteine
 - * Vitamin D (25-HydroxyD)
 - * Omega 3 Index
 - * Carotenoid

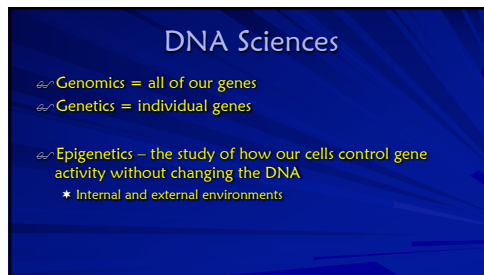
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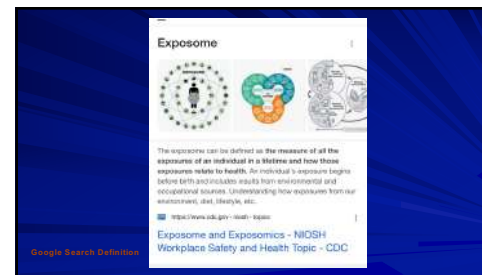
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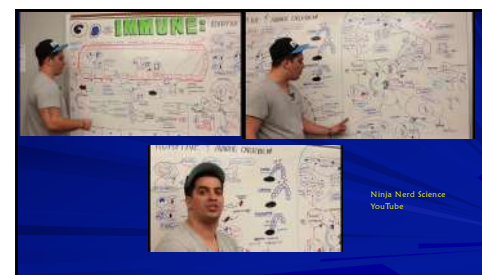
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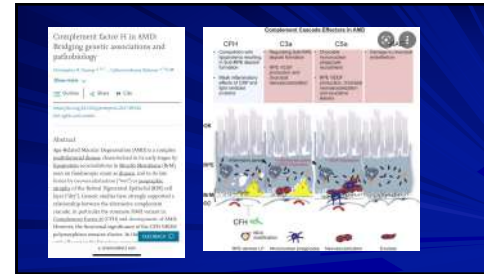
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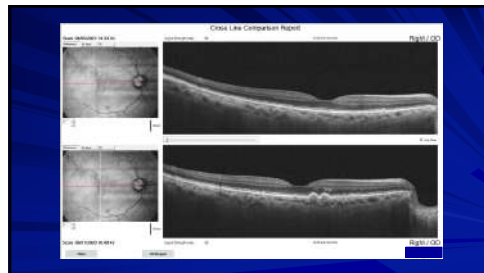
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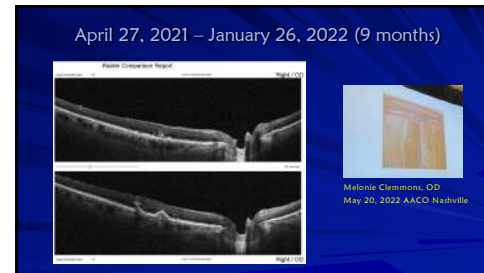
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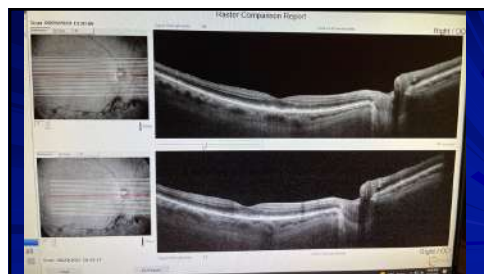
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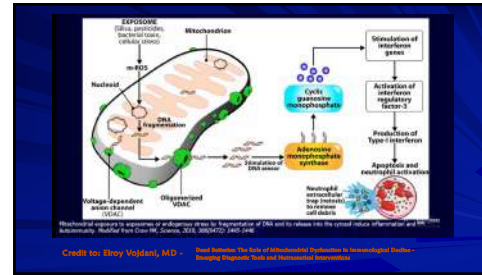
Inflamm-aging

One of the consequences of failing mitochondria due to aging, beyond mtROS, is the release of mtDNA. Plasma levels of mtDNA increase gradually after the 8th decade of life, coinciding with elevated levels of pro-inflammatory cytokines (i.e., TNF- α , IL-6, MIP1A, and IL-1 β).

These data indicate that mtDNA may promote the production of pro-inflammatory cytokines in aging. Because cell stress, senescence and death are a part of the pathophysiology of aging, designing new therapeutic strategies against circulating mtDNA, or other mtDNA/RNA, or their cognate receptors (e.g., TLRs or PRR1) may be a viable strategy to approaching IA and its associated conditions.

Credit to: Elroy Vajzani, MD - Lead Research: The Role of Mitochondrial Dysfunction in Neuroinflammatory Disease - Emerging Programs, Trends and International Perspectives

33



34

Fun Facts I Have Learned About the Mitochondria

- ~ Mitochondria produce energy from organic matter
- ~ Live about 100 days
- ~ They produce 90% of energy in the body
- ~ In return they produce 90% of the free radicals
- ~ When they become dysfunction when get many clinical consequences
- ~ Mitochondria are very sensitive to reactive oxygen and need antioxidant support
- ~ Mitochondria are one of cellular organelles
 - Electron transport chain - uses co-enzyme 10, and many other micronutrients
- Brain cell has 1.2 million/single neuron
- Heart cell has 5,000/cell
- Liver cell has 1000-2000/cell
- Photoreceptor 498/cell
- RPE cells ~700/cell

The ellipsoid contains a densely-packed array of mostly elongated mitochondria arranged longitudinally parallel to the long axis of the photoreceptor. The cell contains **498 individual mitochondria**.

35

Question

~ Do you agree that free radical formation is a progressive process that leads to cell damage or death?

- * Yes
- * No

36

Free Radicals and Antioxidants

How antioxidants reduce free radicals

ANTIOXIDANT + FREE RADICAL → STABLE MOLECULE + FREE RADICAL

HEALTHY CELL → UNHEALTHY CELL

HEALTHY CELL → UNHEALTHY CELL

HEALTHY CELL → UNHEALTHY CELL

37

Oxidative Stress

- ~ Small percentage of oxygen is not completely reduced
- ~ Accumulation of free radicals
- ~ Oxidative damage
- ~ Oxidative stress
- ~ Considered the starting of several diseases
- ~ Responsible for epigenetic alterations
- ~ Mitochondria - vulnerable
- ~ Not going to make this apple new again
 - Prevention is the one of the best medicines

38

Free Radicals

- During metabolism the O_2 molecule splits and energy is released
 - Endogenous free radical formation
- Regain stability the free single oxygen atom (oxygen free radical) seeks and steals electrons from other molecules
 - Superoxide anion – will accept one electron
 - Peroxide – will accept two electrons
- These molecules can be proteins, lipids, and DNA
 - Proteins (enzymes) – kinases, phosphatases, and transcription factors

Reactive oxygen species ([•] = unpaired electrons)				
Oxygen	Superoxide anion	Peroxide	Hydroxyl radical	Hydroperoxyl ion
O_2	$O_2^{\bullet -}$	$O_2^{\bullet -}$	$\bullet OH$	OOH^-

39

Endogenous and Exogenous Free Radical Formation

40

Oh no

- Increasing exogenous free radicals
- Less antioxidant protection in our diet
- More bad and less good

Is an orange of the 1950s equivalent to 21 of today's oranges?

An orange from the 1950s was full of vitamin A, precious for our sight and our immune defenses. To attain the same amount today, you would have to consume 21 of them. Onions and potatoes no longer contain any trace of it. The iron content in meat? Divided by 2. Calcium in broccoli? Divided by 4. To ingest the vitamin C contained in an apple from yesterday, you would have to eat 100 today.

41

The Equalizer

42

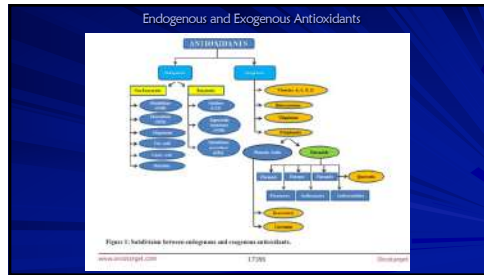
October 23, 2021

43

Nutritional Antioxidants

- Exogenous antioxidants
 - Tocopherols (E), ascorbic acid (C), carotenoids, ubiquinone, and polyphenols
- Well know antioxidants
 - Vitamin C, E, Beta-carotene, lutein, zeaxanthin, selenium, quercetin, and resveratrol
- Mechanisms of action;
 - Neutralize free radicals
 - Repair oxidized membranes
 - Decrease reactive oxygen species
 - Neutral reactive oxygen species

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45

Carotenoids

- Why do hear so much about carotenoids
- Melonie Clemmons, OD May 20, 2022 AACO Nashville

46

Carotenoids

- Organic pigments produced by plants, algae, and bacteria
- Cannot be synthesized by the human body
 - Hydrophobic compounds
 - Important for the phospholipid bilayer
- 700 in nature – 50 human food chain – 15-20 human blood stream
- Macular carotenoids (L and Z) – highest concentration found in the human body
 - Diet derived
 - Henle fibers – between the inner and outer plexiform layers
 - Sequester or absorb blue light

47

Question

- Do you measure carotenoid levels in your office?
 - Yes
 - No

48

Measure?

49

Significance of Carotenoids

50



51



52



53



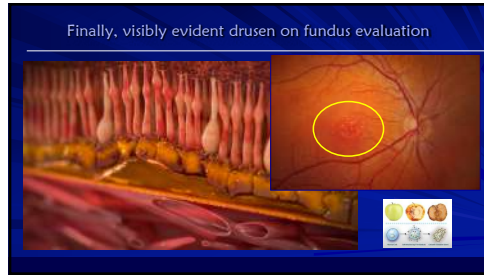
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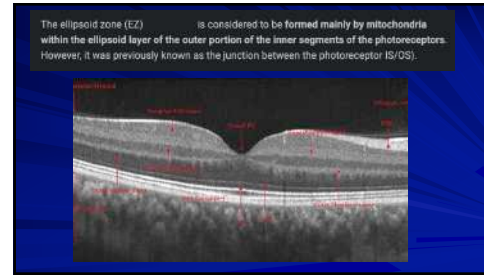
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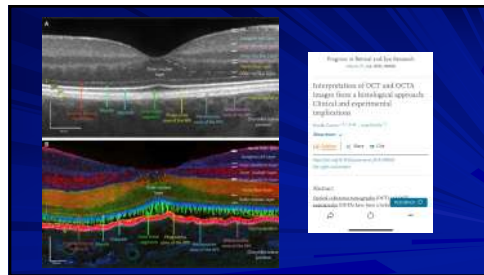
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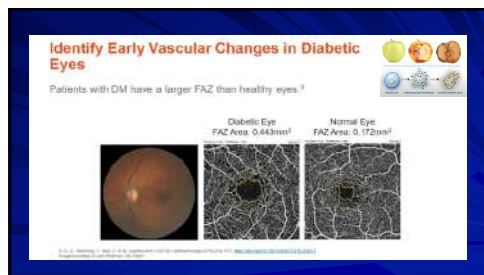
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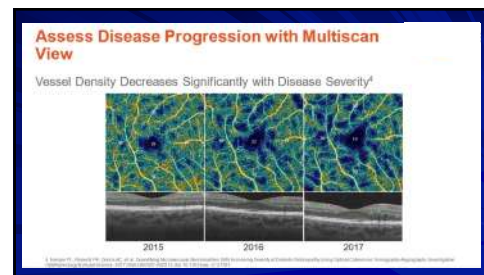
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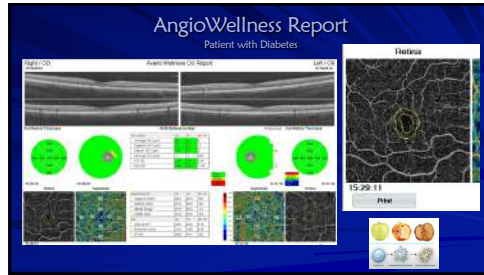
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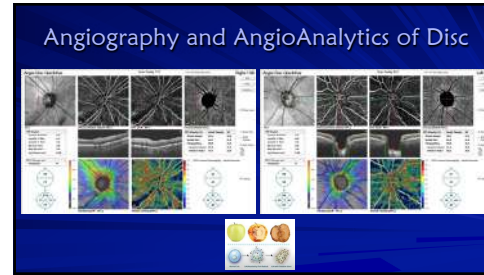
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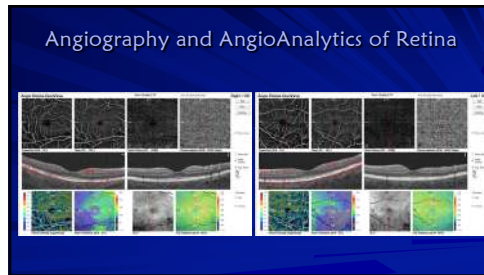
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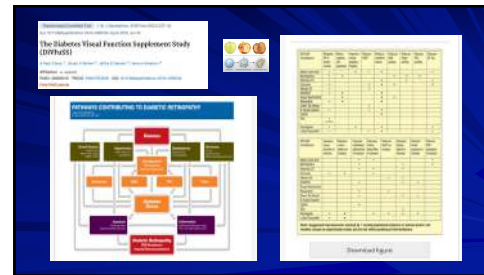
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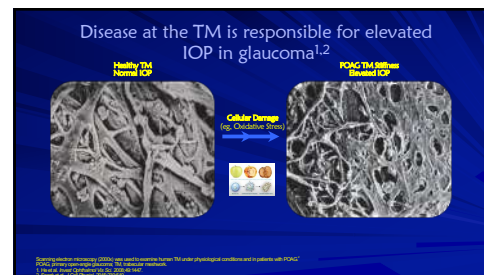
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66

Nutraceuticals for the Treatment of Diabetic Retinopathy
 Abstract
 Diabetic retinopathy (DR) is one of the most serious complications of diabetes mellitus as it is...
 Nutraceuticals: lutein, zeaxanthin, omega-3 fatty acids, vitamins C and E, zinc, selenium, and alpha-lipoic acid.

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68

Glaucoma

PERSPECTIVES ON GLAUCOMA

Antioxidants enhance ocular perfusion in Open Angle Glaucoma

Harris A, et al. Acta Ophthalmol. 2018;doi:10.1111/aos.13530.

"In agreement with previous findings, our results indicate that the supplementation of certain antioxidants may increase blood supply to the orbit and within retinal capillary beds following 4 weeks administration," the authors wrote. "Our data suggest oral antioxidant supplementation may decrease vascular resistance over a longer period of time than previous trials investigated."

69

Treatments for AMD

Early detection and meaningful treatments with significant value, do not cure, but have been shown to slow or halt progression. Not limited to early stages but all stages of AMD

- ★ Prescribe smoking cessation programs
 - Smoking and AMD
 - Depletes serum antioxidants
 - Decreases pigimentary density
 - Increases risk to advanced AMD
- ★ Lifestyle changes
 - Diet
 - Exercise
- ★ Systemic disease management
 - Cardiovascular disease, DM, obesity, high cholesterol

70

Treatment for AMD

- Nutritional supplements
 - ★ Sub-clinical/sub-structural or early disease
 - Controversy flourishes
 - No definitive guideline exists
 - Despite consensus evidence suggests using supplements
 - ★ Intermediate - advance disease
 - No controversy on advocating for supplements
 - ★ AREDS 1
 - Contains Beta-carotene and no lutein or zeaxanthin, no longer recommended
 - Investigated early AMD, no statistically significant benefit
 - ★ AREDS 2
 - Recommended for intermediate and advanced AMD, study protocol
 - ★ The Practical Guide for the Treatment of AMD - 3 primary options
 - Macular pigment supplement
 - Carotenoids: lutein, zeaxanthin, meso-zeaxanthin
 - Carotenoids, antioxidants, zinc, and vitamins C + E
 - AREDS 2
 - Carotenoid macular supplement in subclinical and early AMD. Carotenoid and antioxidant is intermediate and AMD that is progressing

71

Measuring Macular Pigment

- Retina macula biopsy
- Clinical Imaging
 - ★ Subjective
 - ZeaVision MPSII
 - Guardian Mapcat SF
 - ★ Clinical
 - ZeaVision MPR
 - Zea Vision 200
 - Spectralis HRA+OCT
 - Spectralis MPOV

72

Macular Pigment

73

An Evening with Dr. Paul Bernstein

Historical Context I

- 18th century: macula (lutea) first noted by anatomists
- 1940s: initial identification as a xanthophyll by Wald

74

Carotenoid Levels

~ Biomarker of health for diet and lifestyle
* Yale University

~ Phospholipid bi-layer
~ Carotenoids, flavonoids, and polyphenols

The slide features the ARVO logo in the top right corner. On the left, there are two bullet points: 'Biomarker of health for diet and lifestyle' with a sub-bullet '* Yale University', and 'Phospholipid bi-layer' and 'Carotenoids, flavonoids, and polyphenols'. On the right, there is a screenshot of a scientific article titled 'Correlations Between Macular, FFA, and Serum Carotenoids' with the authors' names listed below it.

81

Measuring Carotenoids -Vegetable and Fruit Oxidative Stress

NIH National Institutes of Health
George Demos PhD, PhD

- Quick Test (approx. 30 sec)
- Portable
- Cost Effective
- Remeasure in 60 days
- Reassurance to you and patient

The slide features the NIH logo and the title 'Measuring Carotenoids -Vegetable and Fruit Oxidative Stress' with the presenter's name 'George Demos PhD, PhD'. On the left is a photograph of the measurement device. On the right is a list of five bullet points: 'Quick Test (approx. 30 sec)', 'Portable', 'Cost Effective', 'Remeasure in 60 days', and 'Reassurance to you and patient'.

82

Raman Spectroscopy

The slide features a diagram of Raman spectroscopy. A blue arrow labeled 'LASER SOURCE' points to the right. A green arrow labeled 'SCATTERED LIGHT' points to the left. In the center, there are several clusters of yellow and orange dots representing molecules.

83

Resonance Raman spectroscopic evaluation of skin carotenoids as a biomarker of carotenoid status for human studies

Susan T. Mayne^{1*}, Brenda Carmel², Stephanie Scarmo³, Lisa Johns⁴, Igor V. Ermakov⁵, Werner Gollmann⁶

90 STUDIES

*Arch Biochem Biophys. PMC 2014 Nov 15.

The slide features a screenshot of a scientific article titled 'Resonance Raman spectroscopic evaluation of skin carotenoids as a biomarker of carotenoid status for human studies' by Susan T. Mayne et al. A large blue graphic with the text '90 STUDIES' is overlaid on the article. At the bottom right, there is a citation: '*Arch Biochem Biophys. PMC 2014 Nov 15.'

84

An Evening with Dr. Paul Bernstein

Measurement of Macular Pigment

- HPLC
- Psychophysical
 - Psychophysical
 - Macular pigment
 - Macular pigment
- Image Based
 - Autofluorescence
 - Reflectometry
 - Resonance Raman Spectroscopy (skin and eye)

High Performance Liquid Chromatography

The slide features the title 'An Evening with Dr. Paul Bernstein' and a sub-title 'Measurement of Macular Pigment'. It lists three main methods: 'HPLC', 'Psychophysical' (with sub-points 'Psychophysical' and 'Macular pigment'), and 'Image Based' (with sub-points 'Autofluorescence', 'Reflectometry', and 'Resonance Raman Spectroscopy (skin and eye)'). On the right, there is a sub-section for 'High Performance Liquid Chromatography' and a photograph of laboratory equipment.

85

An Evening with Dr. Paul Bernstein

The Moran AMD Genetic Testing Assessment Study

The Magaria Study

- NIH knowledge of AMD genetic risk lead to quantitative assessment of healthy changes in Magaria Study
- Quantitative, cross-sectional base of pre-symptomatic genetic risk testing and counseling
 - Genetic testing
 - Genetic testing
- Use of novel eye care AMD diagnosis
 - Genetic testing
 - Genetic testing
 - Genetic testing
- Genetic testing
- Genetic testing
- Genetic testing


The slide features the title 'An Evening with Dr. Paul Bernstein' and a sub-title 'The Moran AMD Genetic Testing Assessment Study' with 'The Magaria Study' below it. It lists several bullet points related to genetic testing and AMD diagnosis. On the right, there is a photograph of laboratory equipment.

86

ARVO STUDY

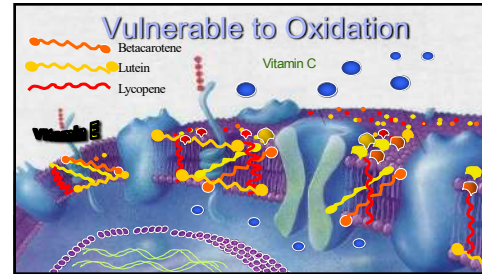
Interrelationships between Macula, Skin and Serum Carotenoids- Paul Bernstein, Werner Gelleman et al ARVO May 2016

Conclusions:
"Our results emphasize the importance of measuring the total amount of carotenoids in the macula region using an objective image based modality such as AFW SpectraS rather than subjective MPOD."
"The macula region is a reservoir of carotenoids and is considered a reasonable biomarker of macula carotenoid status, and correlates better than their respective MPOD levels."

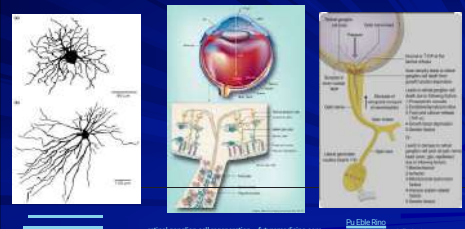


The objective fundus exam is better than the subjective Macular Quantifier and SpectraS for detecting macula pigment.

87



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Dr. Elise Ross
www.eyecare.com

89


Are you taking a supplement?

90

53-year-old man

- Family history of AMD
 - Dad with 43 injections for AMD
- Pre-diabetic with borderline HbA1c
- Vision 20/20 OU
- DFE- retina clear
- OCT normal
- Passes dark adaptation

CONGRATULATIONS ON TAKING THE FIRST STEPS TOWARDS OPTIMIZING YOUR VCS.



91

Ingredient	Amount	Unit
lutein	10mg	mg
zeaxanthin	2mg	mg
beta-carotene	15,000 IU	IU
vitamin C	500mg	mg
vitamin E	100 IU	IU
zinc	15mg	mg
copper	2mg	mg
omega-3 fatty acids	1000mg	mg
astaxanthin	10mg	mg
flavonoids	50mg	mg
resveratrol	5mg	mg
curcumin	50mg	mg
quercetin	100mg	mg
resveratrol	5mg	mg
coenzyme Q10	100mg	mg
acetyl-L-carnitine	1500mg	mg
alpha-lipoic acid	100mg	mg
creatine	5g	g
glycerol	100g	g
water	100g	g
lecithin	100mg	mg
vitamin B12	1000mcg	mcg
vitamin B6	10mg	mg
vitamin B1	10mg	mg
vitamin B2	10mg	mg
vitamin B3	10mg	mg
vitamin B5	10mg	mg
vitamin B7	10mg	mg
vitamin B9	10mg	mg
vitamin K1	10mg	mg
vitamin K2	10mg	mg
vitamin K3	10mg	mg
vitamin K4	10mg	mg
vitamin K5	10mg	mg
vitamin K6	10mg	mg
vitamin K7	10mg	mg
vitamin K8	10mg	mg
vitamin K9	10mg	mg
vitamin K10	10mg	mg
vitamin K11	10mg	mg
vitamin K12	10mg	mg
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vitamin K49	10mg	mg
vitamin K50	10mg	mg

92

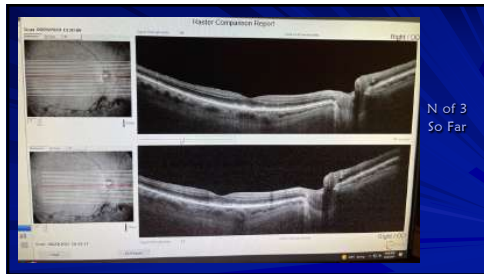
Supplement Facts

Supplement	Amount Per Serving	% Daily Value
Amount Per Serving		
Vitamin A	5000 IU	100%
Vitamin C	1000 mg	200%
Vitamin E	400 IU	80%
Vitamin K	100 mcg	200%
Vitamin B1	10 mg	200%
Vitamin B2	10 mg	200%
Vitamin B3	100 mg	200%
Vitamin B6	10 mg	200%
Vitamin B12	10 mcg	200%
Vitamin D	1000 IU	200%
Vitamin F	1000 mg	200%
Vitamin H	100 mg	200%
Vitamin I	100 mg	200%
Vitamin J	100 mg	200%
Vitamin K	100 mcg	200%
Vitamin L	100 mg	200%
Vitamin M	100 mg	200%
Vitamin N	100 mg	200%
Vitamin O	100 mg	200%
Vitamin P	100 mg	200%
Vitamin Q	100 mg	200%
Vitamin R	100 mg	200%
Vitamin S	100 mg	200%
Vitamin T	100 mg	200%
Vitamin U	100 mg	200%
Vitamin V	100 mg	200%
Vitamin W	100 mg	200%
Vitamin X	100 mg	200%
Vitamin Y	100 mg	200%
Vitamin Z	100 mg	200%
Vitamin AA	100 mg	200%
Vitamin BB	100 mg	200%
Vitamin CC	100 mg	200%
Vitamin DD	100 mg	200%
Vitamin EE	100 mg	200%
Vitamin FF	100 mg	200%
Vitamin GG	100 mg	200%
Vitamin HH	100 mg	200%
Vitamin II	100 mg	200%
Vitamin JJ	100 mg	200%
Vitamin KK	100 mg	200%
Vitamin LL	100 mg	200%
Vitamin MM	100 mg	200%
Vitamin NN	100 mg	200%
Vitamin OO	100 mg	200%
Vitamin PP	100 mg	200%
Vitamin QQ	100 mg	200%
Vitamin RR	100 mg	200%
Vitamin SS	100 mg	200%
Vitamin TT	100 mg	200%
Vitamin UU	100 mg	200%
Vitamin VV	100 mg	200%
Vitamin WW	100 mg	200%
Vitamin XX	100 mg	200%
Vitamin YY	100 mg	200%
Vitamin ZZ	100 mg	200%

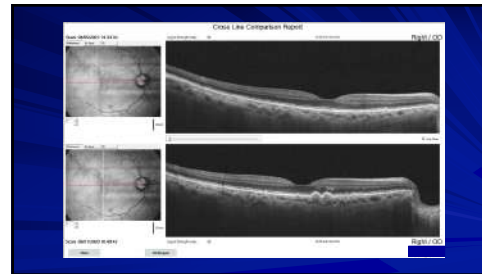
93



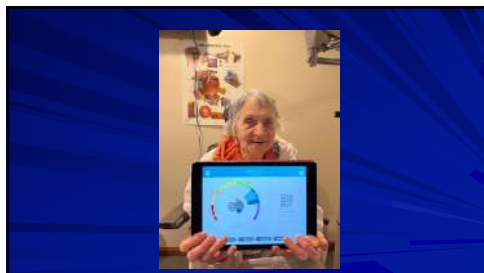
94



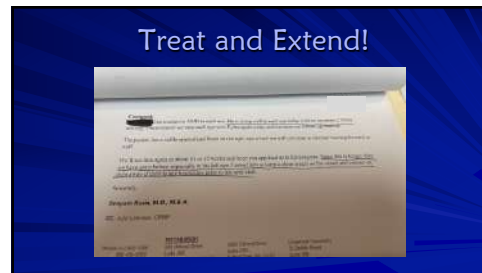
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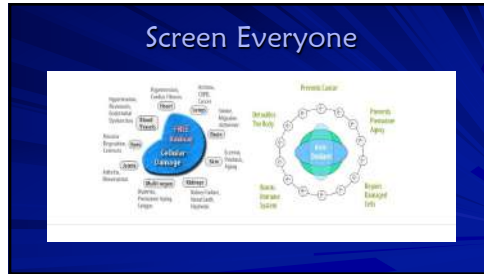
96



97



98

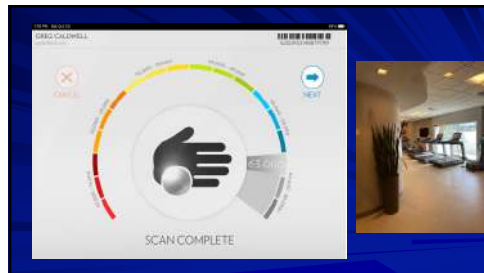


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Greg's Comments

- ~ I think macular pigment is miss named and should be called fovea pigment
- ~ Binding proteins need coenzymes and cofactors
- ~ The macula/fovea is 3rd lens of the eyes – L&Z are important for vision, focus, glare, and contrast
- ~ Many people talk nutrition, very few are measuring it
- ~ If doctors don't become more like nutritionist, nutritionists will become more like doctors
- ~ "Can't supplement out of a poor diet, needs to be done with food"
 - * I bet I have changed more diets by scanning and recommending supplements

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Thank You for This Opportunity

- ~ Do it for:
 - * Yourself
 - * Your family
 - * Your staff
 - * Your patients

A cartoon illustration of a knight in armor standing next to a person in a wheelchair. The knight is holding a sword and a shield, and the person in the wheelchair is holding a staff. They are both looking at each other.

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Nutrition Carotenoids in Ocular Disease and Systemic Health

Greg Caldwell, OD, FAO
Heidelberg, Germany
May 2023

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