

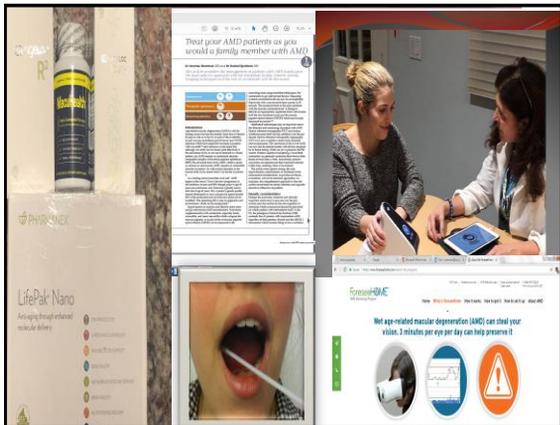




- Ocular Carotenoids ( Triplets)
  - Lutein
  - Zeaxanthin
  - Meso-Zeaxanthin
  - See the Carotenoid triplets



If Sherman is going to pop a pill, and I do, it's going to contain **all three carotenoids**.



**PROFESSOR JOHN NOLAN**

Howard Chair in Human Nutrition, Fulbright Scholar, ERC Grant Recipient, ORCID ID 0000-0002-5503-7084.



- RESEARCH SUMMARY:**
  - FUNDING IN EURO: Bar chart showing funding from 2002 to 2020.
  - PUBLICATIONS PER YEAR: Bar chart showing the number of publications from 2002 to 2020.
- EDUCATION:**
  - PhD (2005) - University of Limerick
  - PhD (2005) - University of Limerick
  - Fulbright Scholarship (Postdoctoral Degree, 2006)
- ACADEMIC PROFILE:**
  - 37 Peer-Reviewed Publications
- RECENT FUNDED PROJECTS:**
  - ERC
  - CHEST
  - LEAF
  - CARES

Logos for NRCI and ANNIDIS are at the bottom right.

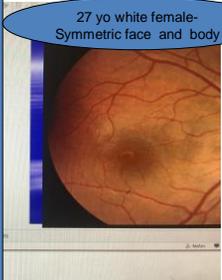
### The Little Disc That Could (Little Engine that Could)

All Functional Tests Normal:

- VA 20/20, 20/20
- Normal Pupils
- No APD
- Normal threshold fields
- Normal Contast Sensitivity
- Normal Color Vision
- Nomal Pattern VEPS

(patient seen in 1990's- Prior to GDx and HRT)

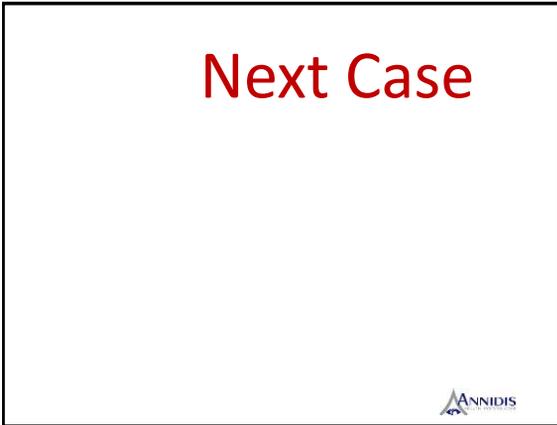
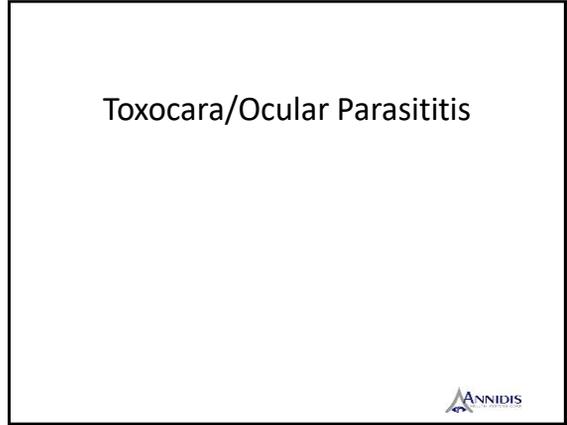
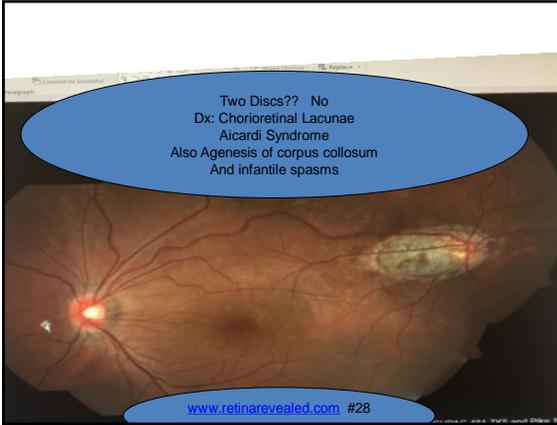
27 yo white female- Symmetric face and body



ANNIDIS logo at the bottom right.

# Next Case

ANNIDIS logo at the bottom right.



### Gnat Tracks Fade Following Vitrectomy

**History and Chief Complaint**  
A 16 yo boy presented with sudden vision loss in his right eye and headaches. He recalled that he may have poked himself in the same eye with his finger the previous evening. Upon questioning, the patient stated that numerous gnats were flying around at the time of the finger poke

**Clinical Findings**  
VA (CC) Hand motion R 20/25 L  
Goldmann IQPs 12 R 12 L  
Slit lamp revealed a mild anterior chamber reaction with an occasional cell in the right eye.

**OPTOMAP**  
The right fundus image reveals an apparent hemorrhage blocking the view of the disc and macula. In addition, "tracks" of various shapes, some curvilinear, some nearly circular are observed in all quadrants. The tracks are perhaps best visible on the green separation view (Figure 2), and somewhat less prominent on the red separation view (not shown). Some round hemorrhages are also scattered throughout. The left fundus was completely unremarkable (not shown).

**Differential Diagnosis**  
The "tracks" or migratory pathways on the Optomap clearly indicate that a small, living, motile organism has previously moved throughout most of the retina. The tracks are similar in thickness to the large retinal veins exiting the disc and hence larger than 100 microns. The tracks are observable on both the red and green separation views and are likely at the level of the retinal pigment epithelium (RPE). When the tracks were formed, the organism was likely in the potential space between

the neuro-sensory retina and the RPE. The vitreal hemorrhage obscuring the view of the disc and macula likely contains the organism at the time the image was acquired. Two likely mechanisms for an organism to reach the retina would be ingestion or direct penetration. The world's literature reveals numerous species that are known to leave larval migratory pathways in the eye including botfly, reindeer warble fly, and cuterebra larvae. According to Duke-Elder, in human cuterebra infection larvae are deposited on the skin near the eye from a person's hands and enter the eye by direct penetration. He goes on to state that they penetrate rapidly without being noticed. Gnat larvae are about 5 microns in size, and hence smaller than a red blood cell and perhaps in this case penetrated through the eye and then lodged in the retina.

**Disposition and Follow-up**  
The patient was referred to a retinal surgeon who performed a pars plana vitrectomy. The surgeon noted that the vitreous premacular hemorrhage extended to the inferior part of the globe where vitrectomy was continued and eventually a single larva from a presumed fly was seen inside the eye. The vitreous cutter was used to remove the larva without difficulty. Remarkably, one year later, the patient has normal VA and the Optomap image is virtually normal with only scant evidence of the previous tracks. However, cataract formation is common following vitrectomy.

Co-authored with Jerry H. Ellis, O.D., Steve Charles, M.D., and Monica Aswani, BS

**References**  
Duke-Elder, W. S., System of Ophthalmology, vol. 9, St. Louis: C. V. Mosby, 1966, p. 490.  
Mason GI. Bilateral ophthalmomyiasis interna. Am J Ophthalmol. 1981 Jan;91(1):65-70.

ANNIDIS



Referred for :  
Bilateral Retinal Folds

Are these real or artifacts??

Let's evaluate the anterior segment

**Persistent Fetal Vasculature-  
Hyaloid artery fails to regress-  
Mittendorf dot**

# Next Case



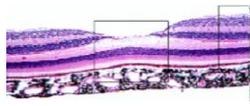
### Helmholtz Invented the Ophthalmoscope in the 1860's

- With an SD OCT, we are learning that most retinal disorders are invisible to ophthalmoscopy in the early stages but easily detected with SD OCT.
- 150 years after Helmholtz, SD OCT is rapidly relegating ophthalmoscopy to a much more modest role in diagnosis.



### But Why Back to Retinal Anatomy?

- Do you remember the 10 layers of the retina?
- Do you recall that the 9 neuro-sensory layers of the retina are invisible to ophthalmoscopy and only the RPE is visible?
- Have you ever said, Mrs. Jones, I am going to examine your rods and cones?

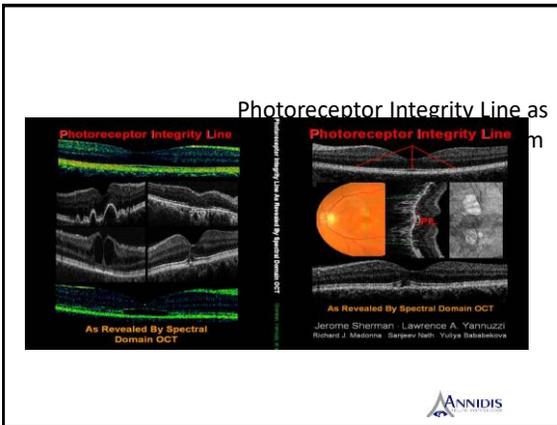
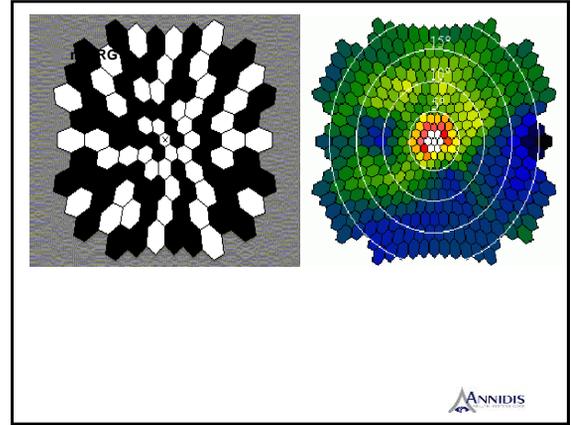
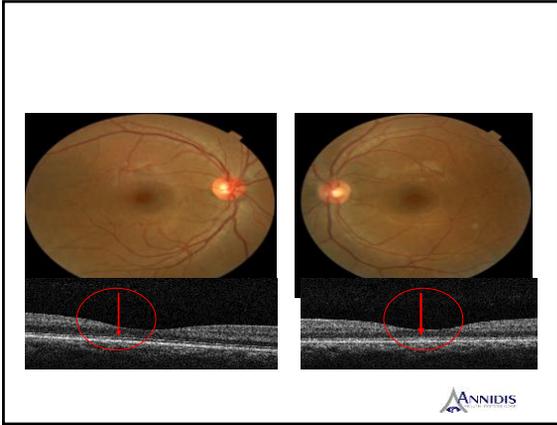


## Game Changing Case

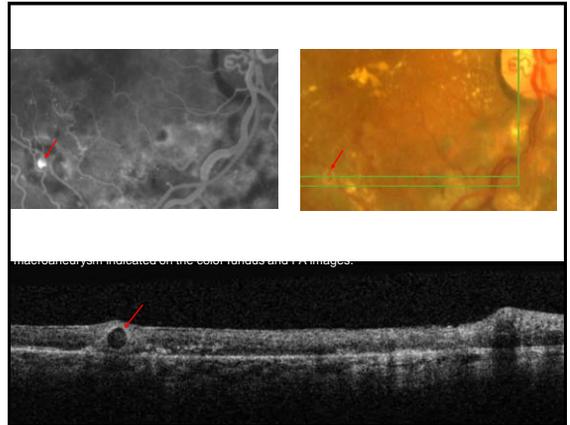
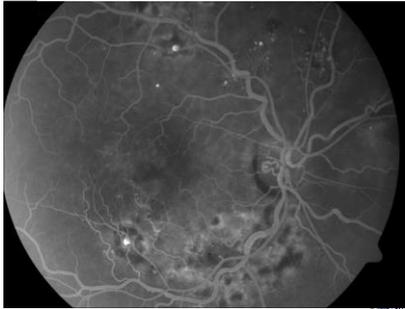
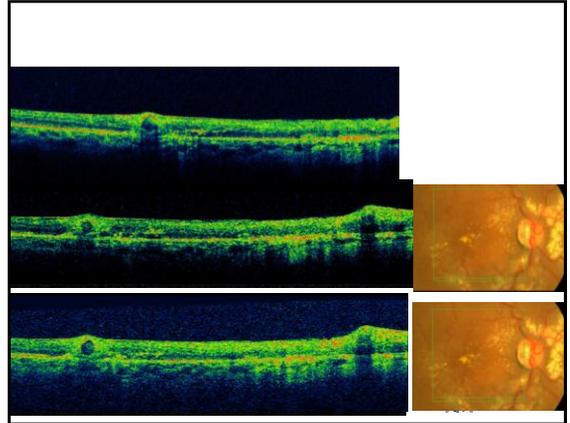
PCON Aug 2008

AZOOR  
Acute Zonal Occult Outer  
Retinopathy

### Retina - Histology

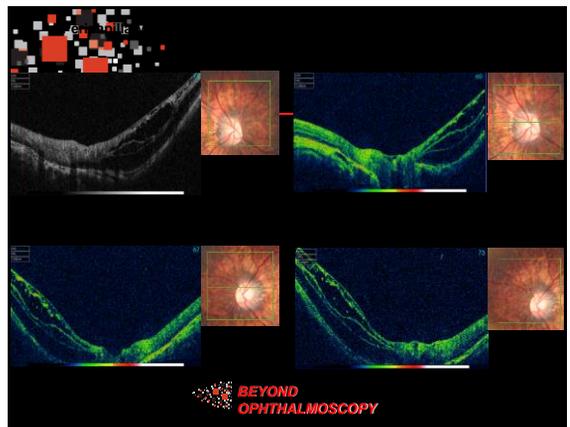


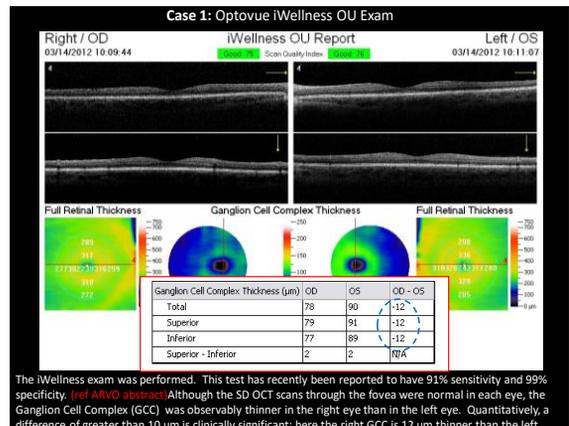
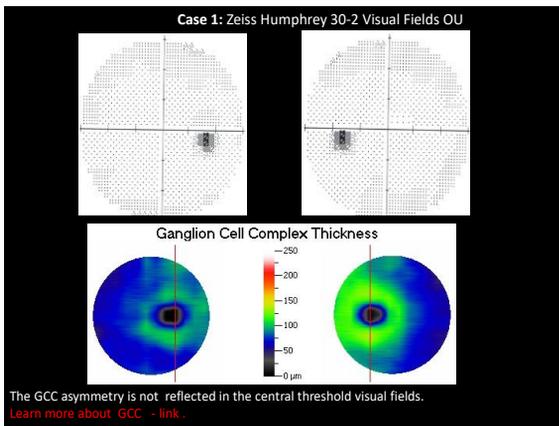
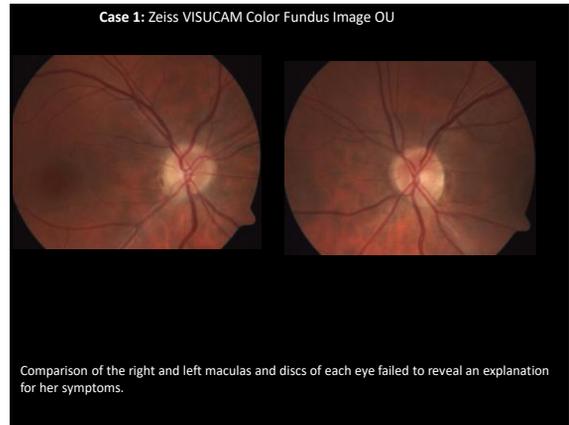
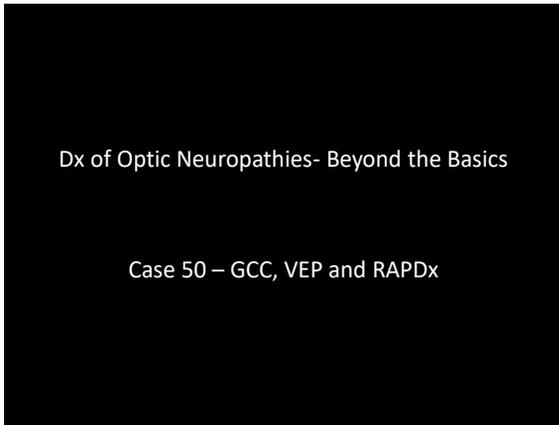
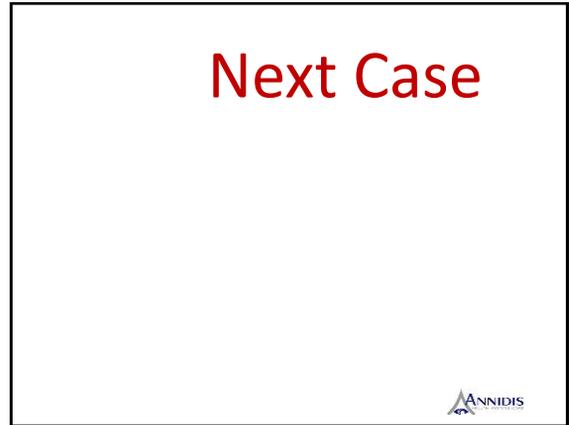
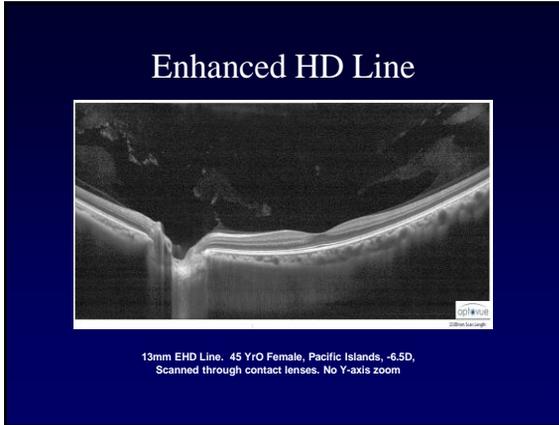
# Next Case



macular edema indicates on the color fundus and FA images.

# Next Case





Page 23

**V**

**IT**

**A M I**

**N E S V**

**I T A M I N E S V**

**I T A M I N E S V**

**V - vascular**

**I - infectious**

**T - trauma**

**A - autoimmune**

**M - metabolic**

**I - inherited**

**N - N - neurodegenerative**

**E - endocrine**

**S - senile**

**V - vitamin deficiency**

**I - inflammatory**

**T - toxic**

**A - allergic**

**M - mass lesions**

**I - idiopathic**

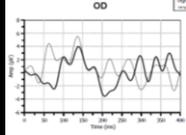
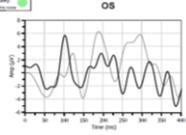
**N - nutritional**

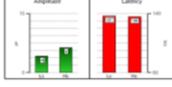
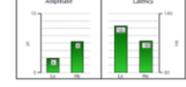
**E - environmental**

**S - stress**



**Case 1: Diopsys™ Nova-DN OU**

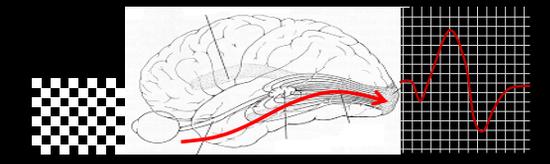



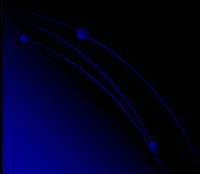
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Amplitude Low Contrast	4.17	3.56	0.57	µV	
Amplitude High Contrast	6.30	7.04	1.04	µV	
Latency Low Contrast	136.71	123.04	13.67	ms	Delayed
Latency High Contrast	130.73	102.53	10.26	ms	Delayed

In our 29 yo patient with blurred vision in her right eye, the VEPs are normal in amplitude but delayed in the right eye. Under high contrast conditions, the VEP P100 latency is delayed by 33 msec in the right eye when compared to the normal latency in the left eye. (Under standard Nova-DN conditions, the entire pattern reversal stimulus contains 32x32 checks) **MADE THE DIFFERENCE APPROPRIATE CONTINUOUSLY**

**VISUAL EVOKED POTENTIAL**  
ASSESSMENT OF NEURO-VISUAL FUNCTION



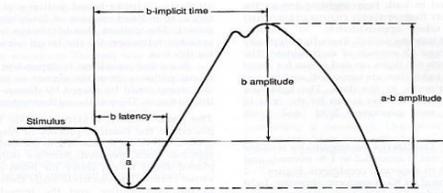
# Next Case



The appearance of the retina does not always correlate with the function of the retina.

Normal appearing retina-flat ERG (LCA)

RP appearing retina-normal ERG (pseudo RP)



**NOTE:**

- a-b amplitude (major interest) is measured in  $\mu V$ .
- Average 60-150  $\mu V$  photopic; 300-500  $\mu V$  scotopic with high intensity flash (photopic is usually 30% of scotopic).
- Average b implicit is 30 ms photopic and 50 ms scotopic.

WAVEFORM	RETINAL COMPONENT	ALTERED IN
Photopic A	Cones	Cone dystrophies
Scotopic A	Rods	Congenital stationary night blindness
Photopic B	Inner nuclear layer (cones)	
Scotopic B	Inner nuclear layer (rods)	
Flicker ERG	Macular cones	Cone dystrophies (macular degeneration)

Components of the photopic clinical ERG.

## Cover Your Bases...

- **1<sup>st</sup> Base:** Is the best correctable VA 20/20 in each eye? If not, a clinically supportable explanation needs to be found. This may involve hi-tech diagnostic testing
- **2<sup>nd</sup> Base:** All patients deserve IOP measurements
- **3<sup>rd</sup> Base:** All patients deserve a fundus exam, preferably dilated.
- **Home Plate:** All patients deserve visual fields, preferably automated.

## Cover your Bases

- Over 90% of malpractice allegations disappear
  - when you cover the four bases
  - When you communicate



## Amblyopia is the single most dangerous diagnosis that an eye clinician can make

- By diagnosing amblyopia, the clinician concludes that the patient does not have an organic problem but only a functional one.
- Amblyopia should be a diagnosis of exclusion.

## How Dangerous/ how Costly?

- Well-respected, thorough optometrist
- Sees a 12 y-o female
- BCVA: OD 20/40 OS: 20/20
  - Normal color vision
  - Normal gross conf. VF
  - Normal pupils
  - Normal anterior and posterior seg exam
  - Takes photos
- No strabismus; no anisometropia
- Dx: Amblyopia OD
- Plan: RTC 1 year

## Patient returns 1 year later.....

- VA OD: 20/800 VA OS: 20/20
- Refers out to a friendly retinal specialist
- Fundus and pupils still normal
- MRI: Large chiasmal mass
- Surgery: Complicated 2\* mass size
- Hydrocephalus develops
- VA when pt. wakes up:
  - NLP OU!

## Family Sues the OD.....

- OD should have referred pt out when VA was 20/40
- Or performed additional tests
- OD's malpractice co. refused to settle
- Case went to jury trial
  - OD lost
- Jury award: 9.2 million dollars
  - Largest award in this state for vision loss
- OD could not pay-plaintiff's atty's convince OD to sue his malpractice carrier for not settling in the first place
- OD closes the practice and a young girl is blind for life

# Next Case




- ## LESSONS TO BE LEARNED
- Risks and benefits of cataract surgery should be explained to a patient
  - ICE, by definition, is a corneal endothelial disease and hence a endothelial cell count should be obtained prior to surgery.
  - Don't think just the surgeon gets sued!

- ## New Mystery Case 2022
- 35 yo male who is a 4.5 D myope OU, wakes up one morning with blurred vision LE
  - Seen 3 hrs later and has a 4 D cyl for 1<sup>st</sup> time
  - BC VA 20/50 LE Pachy under 500 u OU
  - 2 days later, all ok! VA 20/20 and no cylinder
  - Wk later VA down again and Dx iritis LE only
  - Konan ECC demonstrates guttata LE only
  - After pred forte 2 days, epith lesion ?dendrite
  - Rx acyclovir po for herpes simplex



# Next Case



### III. Diagnosis of Blurred Vision due to Cataracts Proves Wrong and Patient *Dies*

- A 45 yo “anal compulsive” patient presented for new glasses- reduced vision OU at D & N . He has no other symptoms or contributory history.
- VA cc 20/25- R & L with no change in lens prescription. Slit lamp exam revealed mild cataracts OU.
- IOPs and the fundus exam were unremarkable. Fields were not performed.

## DIAGNOSIS

- Doc advised patient that all is well except for very mild cataracts and that the patient should return in two years for the next exam.
- Patient presented in 1992, 1994, 1996, and 1998 to the same optometrist with the same diagnosis (fields never performed).
- However, in 1994, patient noted in his diary that his complaint was blurred vision, worse in the left than the right eye, and worse in the left visual field.

## OUTCOME

- During the 8th year following the initial complaint, the patient decided to have cataract surgery and is seen by a well known cataract surgeon
- Pre-surgical eval revealed only negligible cataracts and a field screening discovered a bitemporal hemianopsia.
- MRI= a diagnosis of a very large pituitary adenoma
  - Surgeon: trans-sphenoidal route to remove the mass.

## Uh-Oh...

This failed and the patient, after informed consent, had major neuro-surgery described to the patient as “cracking the skull.” One month after the “successful” removal of the mass, the patient **died in the hospital due to complications of the second surgery.**

## ALLEGED MALPRACTICE

- Although the patient died, his **health diary** clearly revealed **reduced vision in the “left eye to the left” 6 yrs before** Dx of the brain tumor.
- Expert stated that a several minute VF screening, never performed on any of the 4 exams, would have revealed a temporal field loss and would have led to a timely Dx of tumor.
- An expert witness in neurosurgery commented, “It is far easier to remove **a grape than a grapefruit**” and that “trans-sphenoidal surgery years earlier would have been successful” and “it is more probable than not that the patient would still be alive with virtually normal vision” if the diagnosis was made years earlier
- The case was settled for an undisclosed amount but in the millions.



## VIII. The watery, red eye- how can you be sued?



### Visit # 1

- 32 y.o. diabetic presented with c.c. of right eye irritation for 3 days RE also watery and red but not stuck down in A.M.
- VA: 20/20- - 20/20-
- S.L.: 2+ cells + 2+ flare +2+ hyperemia OD and 2+ SPK (corneal defect drawn slightly temporal to visual axis)
- Dx: Kerato-uveitis OD
- Rx: PF q 2h OD
- HA QID OD
- Occuflox QID OD
- RTC: 1 day

### Visit #2

- Patient returns in 1 day - feels a little better
- VA: 20/20 - 20/20
- S.L.: trace cells and flare, 1+ corneal edema, small abrasion - same location as before
- Doctor noted patient diabetic: slow healer
- Rx: patch with occumycin ung
- RTC: 1 day

### Visit #3

- Next day seen by different doctor in same office
- S.L.: abrasion resolving 80% OD
- 2+ corneal and conjunctival edema
- + 1+ hyperemia, 1+ cells and 1+ flare OD
- Rx: resume previous meds
- PF 1% q 2H, Occuflox QID, HA QID OD
- RTC: 1 day

### Visit #4

- Next day seen by 2nd doctor
- c.c.: patient feels a lot better
- VA: 20/20-3 20/20
- drawing of cornea labeled as clear
- minimal edema, good VA
- Rx: DC Homatropine
- Occuflox to BID
- taper PF q 4H, QID, TID BID OD
- No RTC unless symptoms persist or worsen

### Visit #5

- 10 wks later
- c.c. eye irritation rt eye - also blurry 2 wks
- "tried drops from before"
- 1+ corneal edema, trace cells and flare
- doctor draws "healing abrasion in same location as previously"
- Dx: RCE (recurrent corneal erosion)
- Rx: dilate homatropine
- Muro 128q ung HS OD
- Refresh Plus 6x day OD
- RTC: 5 days

## Visit #6

- VA worsens, now has pain OD; presents to different doctor in different office
- c.c. rt eye red 2 wks, vision reduced 1 wk
- IDDM 20 yrs
- VA: RE LP only and LE 20/25
- TA: 70 OD, 21 OS
- S.L.: corneal bullae with drawing shown later to match location as previously
- GONIO: opened angle with reddish tint-NVA
- DFE: Proliferative diabetic retinopathy OU  
Rx: IOPs reduction with 6 meds.

## Visit #6 (continued...)

- PRP within 1 wk OD then OS
- Final VA: NLP OD, 20/40 OS
- Did care deviate?
- Problem with problem specific vs problem-oriented exam
- "Tip of the iceberg"
- **Actual chain of events**
- Long-standing diabetic retinopathy which progressed to proliferative stage without macula involvement followed by rubeosis, neovascular glaucoma, sky high IOPs, corneal edema, corneal bullae

## Why an iritis in a diabetic patient?

- The new blood vessels on the iris are fragile and prone to leak.
- Hence the "inflammation" is not a true iritis and the treatment must be directed to the cause.
- Because of the corneal bullae, present from the first visit on but misdiagnosed, the IOP must have been elevated for months.

## Next Case



### IV. A One Disc Diameter "Choroidal Nevus" Leads to **Death**

- A 45 yo myope presented for a routine exam. His only complaint was slightly blurred vision at near through his 2 yo scratched reading glasses. No eye or health history. He started wearing glasses after failing the vision screening back in the first grade.
- A minor change in prescription yielded 20/20 VA OU at D & N
- DFE revealed a "one dd choroidal nevus" that was sketched the same size as the disc and located one dd temporal to the macula OD.
- When the patient was told about the little "freckle" he was surprised since no doctor had ever mentioned the "congenital lesion" during multiple exams over 4 decades.



### DIAGNOSIS and FOLLOW-UP

- The OD Dx'ed a small nevus OD and some mild peripheral thinning in the peripheral retina.
- New Rx & patient told **RTC 2 yrs.**
- One year later, patient experienced light flashes. He immediately reported this and was seen within a day by a retinal specialist in the practice who Dx'ed a **non-rhegmatogenous RD**
- B-scan: large mass was observed along with RD
- Ophthalmic oncologist did proton beam irradiation for the large amelanotic MM.
- Although the patient did well for several years, **metastasis led to death.**



### ALLEGED MALPRACTICE

- Based upon the course of events, the 1dd "nevus" **must have been a small melanoma** and **a year delay** in diagnosis, more likely than not led to a premature death.
- The case was settled several weeks before a jury trial was to begin for a **reported 2 million dollars**.



### COMMENT

- This case teaches us that an early melanoma can easily be misdiagnosed as a nevus and the first time a lesion is noted, it should be imaged with fundus photography or UWF (ultra-Widefield) Imaging
- B-scan, OCT and even FA should be obtained in questionable cases and **a re-eval in 3 months** should be considered.
- Without any evidence of growth at **3 months**, then a **6 month re-eval** should be arranged and then **yearly** exams.
- Choroidal melanomas begin as **small lesions** and a timely diagnosis and treatment is arguably associated with reduced morbidity and mortality.



## Next Case

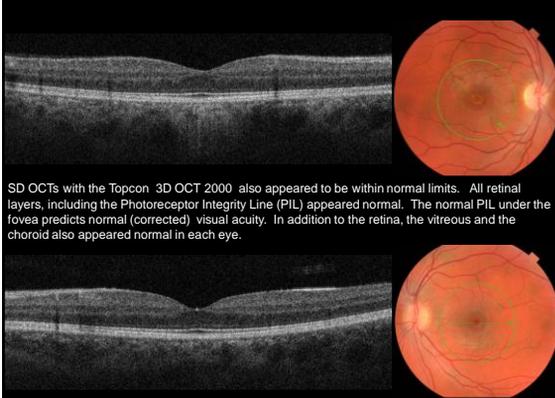


Case 1: Topcon 3D OCT Fundus Image OD



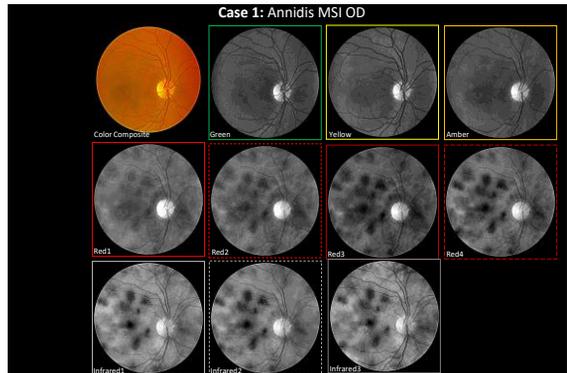
A 25 year old female presented with blurred vision in her right eye. She was concerned about her eyes because she has a family history of melanoma. Her initial ophthalmologic diagnosis was choroidal nevus and with indirect ophthalmoscopy with a 78D lens and with a 30D fundus photography was also judged to be a choroidal nevus in both the right and left eye. Her best corrected visual acuities were 20/20 in her right eye and 20/20 and a -0.50 in her left eye also resulted in 20/20. The slit lamp exam revealed several iris spots which were perhaps small Lisch nodules or just commonplac iris freckles.

Case 1: Topcon 3D OCT Image OU



SD OCTs with the Topcon 3D OCT 2000 also appeared to be within normal limits. All retinal layers, including the Photoreceptor Integrity Line (PIL) appeared normal. The normal PIL under the fovea predicts normal (corrected) visual acuity. In addition to the retina, the vitreous and the choroid also appeared normal in each eye.

Case 1: Annidis MSI OD



The Annidis Multi-Spectral Imaging, of our patient with NF, uses 10 different LEDs, each of a different color and somewhat different penetration range. The Green, Yellow and Amber LEDs reveal detailed information about the shallow retinal structures. The Red and Infrared LEDs penetrate deeper into the retina and choroid and reveal abnormalities not visualized with the Green, Yellow and Amber LEDs.





**Case 10: Elevations vs. Excavations** Page 31

Left Eye

unilateral congenital optic nerve abnormality detected five days after birth and enlarged blind spot in the left eye. Patient reports vision in both eyes is excellent. BCVA measured 20/15+2 OD and 20/15-1 OS.

Fundus photo of the anomalous disc and of the macula, as well as a 6mm x 6mm scan box. The horizontal section through the macula reveals that the PIL is normal temporally, becomes mildly attenuated under the fovea and eventually disappears towards the optic nerve head. Note the optic disc excavation nasal in this scan.

For the full case study go to: [Retina Revealed Case #8 - "Morning Glory" Disc Coloboma](#)

**DGH B-Scan Scanmate** Page 8

The DGH B-scan Scanmate below is a vertical slice through the optic nerve head and the retinoschisis inferior to the optic nerve head.

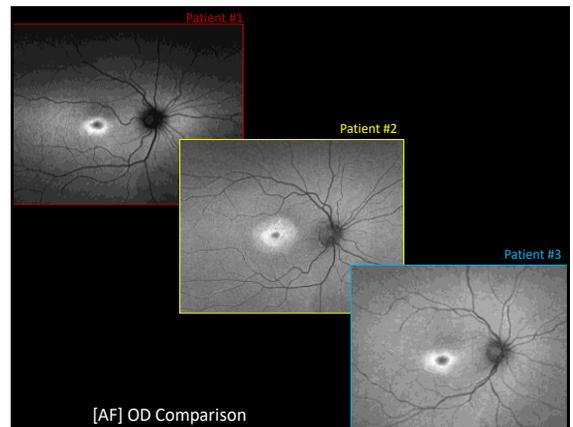
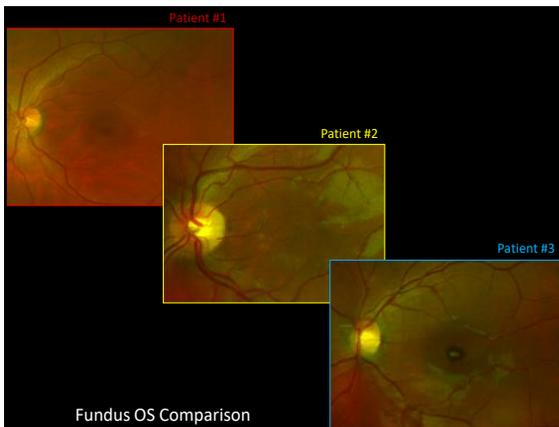
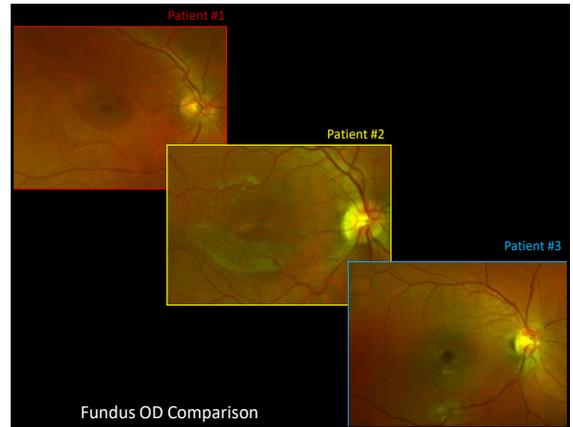
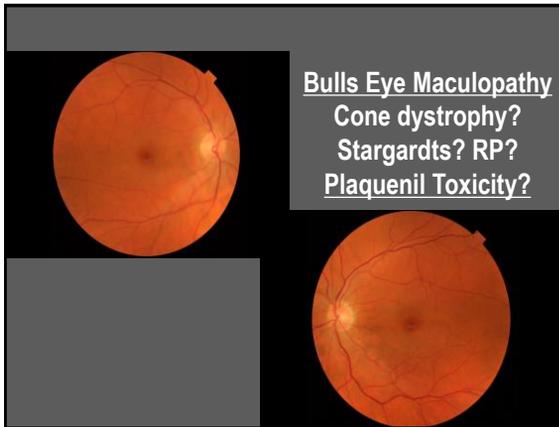
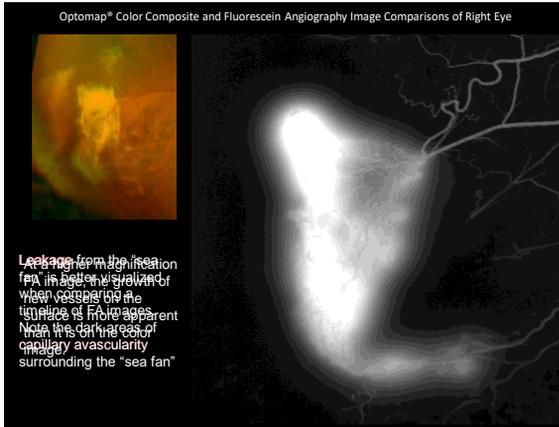
Disc excavation

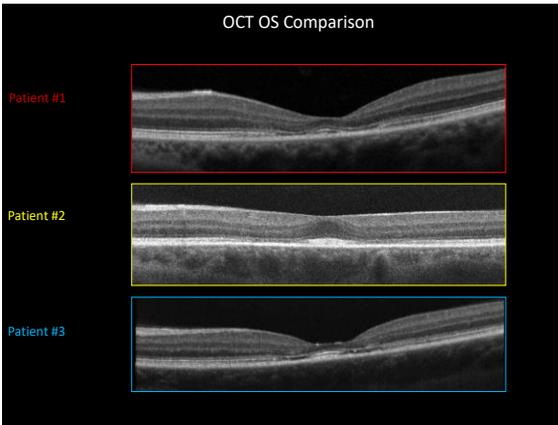
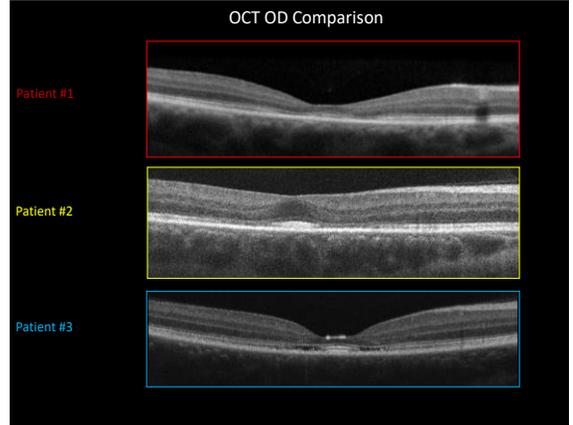
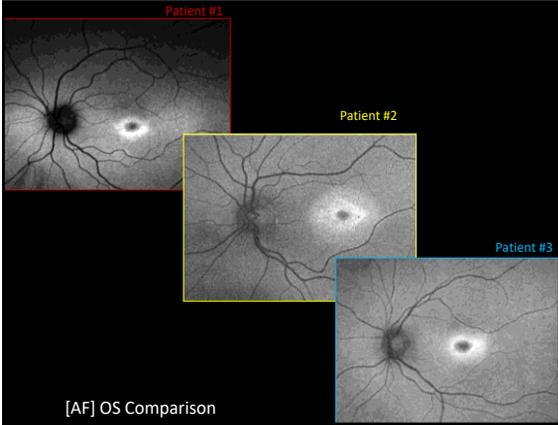
Retinoschisis

Optomap® Color Fundus Image of Right Eye

Optomap® Red Separation Fundus Image of Right Eye

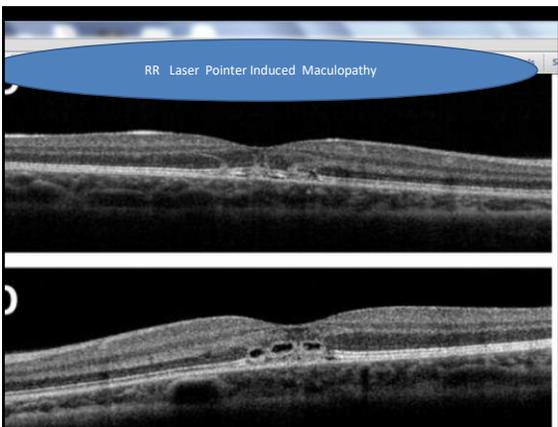
Typical retinal vascular changes in **Sickle Cell Retinopathy** have been presented in detail in RR #29. (RR29 link). See RR #29 for full details.





# Next Case

[www.retinarevealed.com](http://www.retinarevealed.com)  
#53



# Next Case

[www.retinarevealed.com](http://www.retinarevealed.com)  
#15

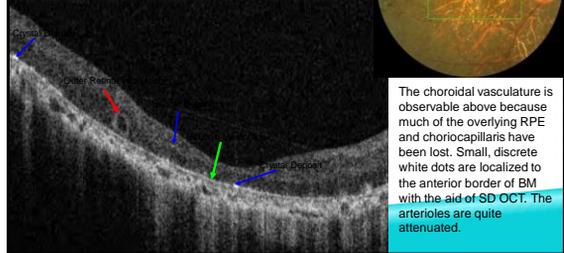
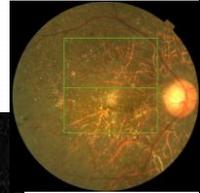


## See RR #15

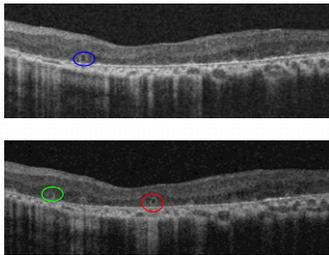
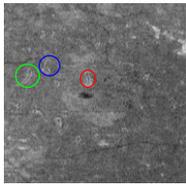
- Bietti's Crystalline Dystrophy
- Crystals in both cornea and retina
- Exemplary case of ORTs- outer retinal tubulations
- ORTs are likely Muller cells providing a Regenerative role
- In non-mammalian vertebrates, Muller cells dedifferentiate to a progenitor state and then can regenerate into retinal tissue
- Various growth factors, transcription factors and excitatory amino acids can stimulate regeneration

## Outer Retinal Tubulations (ORTs)

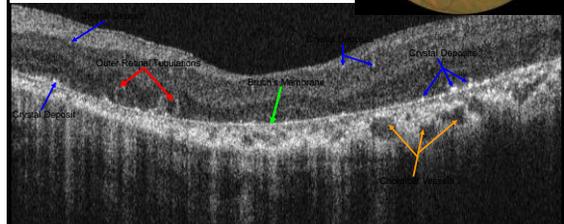
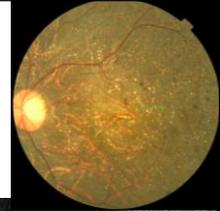
Green arrow depicts a well defined Bruch's Membrane (BM). Note the extreme thinning of the overlying RPE and absence of the PIL. BM is masked in normal eyes because of the presence of a normal RPE.



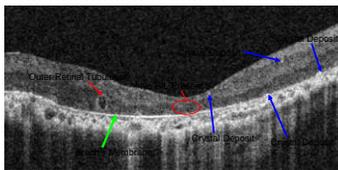
The en face image below is color-coded as to locations of the ORTs in the cross sectional images on the right.



In addition to the white dots on BM, multiple hollow circular bodies are found in the SD OCT cross sectional images. Large choroidal vessels are also visualized and are unmasked because of the loss of overlying tissue.

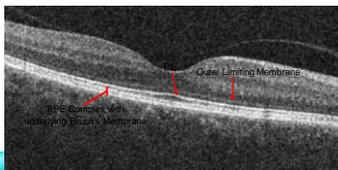


**Patient**



The PIL is present in every normal eye of the first 1000 or so imaged and abnormal in all eyes with outer retinal disease imaged to date.

**Normal Control**



## Next Case

