

**STATE BOARD OF OPTOMETRY**

2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
P (916) 575-7170 F (916) 575-7292 www.optometry .ca.gov



Continuing Education Course Approval Checklist

Title:

Provider Name:

☒ Completed Application

Open to all Optometrists? ☒ Yes ☐ No

Maintain Record Agreement? ☒ Yes ☐ No

☒ Correct Application Fee

☒ Detailed Course Summary

☒ Detailed Course Outline

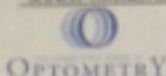
☒ PowerPoint and/or other Presentation Materials

☐ Advertising (optional)

☒ CV for EACH Course Instructor

☒ License Verification for Each Course Instructor

Disciplinary History? ☐ Yes ☒ No



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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 15306, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 15306(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Retina Symposium Okularfest 2016</u>	Course Presentation Date <u>10/02/2016</u>
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Course Provider Contact Information

Provider Name <u>Enka</u> <u>Aragon</u> (First) (Last) (Middle)	
Provider Mailing Address Street <u>3357 Skyview Ln.</u> City <u>Corona</u> State <u>CA</u> Zip <u>92882</u>	
Provider Email Address <u>earagon@retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

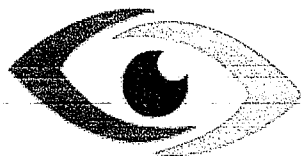
Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>see attached for the rest</u> <u>Michael</u> <u>DAVIS</u> (First) (Last) (Middle)	
License Number <u>A111866</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>mdavis@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Enka Aragon 8/11/16
Signature of Course Provider Date



Retina Research Foundation
of California Inc.

RETINA SYMPOSIUM OKULARFEST 2016 AGENDA

Registration/breakfast	7:00 – 8:00 am	
Welcome/Introduction	8:00 – 8:10 am	Erika Aragón
The Pupil: A Gateway to the Brain ✓	8:10 – 8:30 am	Wolfgang Fink, PhD
You Have Some Nerve: Pediatric Ophthalmology ✓	8:30 – 8:50 am	Kweku Grant-Acquah, MD
Save That Globe! Ocular Oncology Update	8:50 – 9:10 am	Sharon Theodore, MD
Zika Virus: An Emerging Retinopathy	9:10 – 9:30 am	Jennifer Spiegel, MD
AB-Interno Approaches to Glaucoma Surgery	9:30 – 9:50 am	Morgan Renner, MD
Obamacare: What to Expect for 2016	9:50 – 10:20 am	Tom Chang, MD
BREAK	10:20 – 10:40 am	
Complications of Glaucoma Filtering Surgery	10:40 – 11:10 am	Brian Chen, MD
Inferring Diagnosis and Trajectory of Wet AMD From OCT Imagery of Retina	11:10 – 11:30 am	John Irvine, PhD
Digital Eye Strain & eyeBrain Technology	11:30 – 11:50 am	Gary Lovcik, OD
Around The Orbit With Madhu Agarwal, MD	11:50 – 12:20 pm	Madhu Agarwal, MD
LUNCH	12:20 – 1:20 pm	
Diabetic Retinopathy	1:20 – 1:50 pm	Sara Haji, MD
New Concepts in Pediatric Retina	1:50 – 2:20 pm	Michael Samuel, MD
Retinal Emergencies	2:20 – 2:50 pm	Michael Davis, MD
R.I.P. Blepharoplasty	2:50 – 3:10 pm	Lily Lee, MD
Preparing the Ocular Surface for Cataract And Refractive Eye Surgery	3:10 – 3:40 pm	Mitch Shultz, MD
OCT-Tung Baby! <i>Part Deux</i>	3:40 – 4:10 pm	Kristie Lin, MD
Minimally Invasive Glaucoma Surgery	4:10 – 4:30 pm	Gerald Schultz, MD
Closing/Final Remarks	4:30 – 4:35 pm	Erika Aragón



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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Continuing Education and Board Use Only			
Receipt #	Payor ID	Beneficiary ID	Amount
1-3000	6457207	647215	50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>The Pupil: A gateway to the Brain</u>	Course Presentation Date <u>10/02/2016</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Wolfgang</u> (First) <u>Fink</u> (Last) _____ (Middle)	
License Number <u>NIA</u>	License Type <u>PhD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>WFink@autonomy.camech.edu</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

The Pupil: A Gateway to the Brain

This lecture focused on the continued refinement of PupilQuest. Pupillometry has the potential for the detection of: brain damage, sleep disorders (e.g., sleep apnea) and other ophthalmic conditions. In addition, I discussed that pupillometry is non-invasive and can be performed in a mobile setting. Case studies were also presented to support the PupilQuest information .

Wolfgang Fink, Ph.D.

The Pupil: A Gateway to the Brain

- Motivation for Pupillometry:
- The purpose of the pupil is to regulate how much light enters the eye and to protect the eye from too much light exposure
- Monitoring both pupils of a person, merely with a flashlight (so-called “swinging-flashlight” test), will tell first responders or (emergency) doctors whether the person has suffered critical brain damage.
- Monitoring the pupillary movement in darkness has the potential to reveal whether a person is suffering from sleep disorders (so-called sleep apnea).
 - Pupillometry is non-invasive.
- PupilQuest Clinical Case Studies • ClinicalCaseStudy#1: *Unilateral Amaurosis*
 - No anisocoria expected o Amaurotic fixed pupil expected
 - ClinicalCaseStudy#2: *Unilateral Tractus Lesion*
 - No anisocoria expected
 - RAPD contralaterally to lesion expected
 - ClinicalCaseStudy#3: *Unilateral Pretectum Lesion*
 - No anisocoria expected
 - RAPD expected
 - Summary & Outlook:
 - o Continued refinement of *PupilQuest*
 - o *Pupillometry* has the potential for the detection of:
 - Brain damage
 - Sleep disorders (e.g., sleep apnea)
 - Other ophthalmic conditions.
 - *Pupillometry* is non-invasive.
 - o *Pupillometry* can be performed in a mobile setting.



Okularfest, October 2, 2016

Organized by Retina Institute at California Institute of Technology



The Pupil: A Gateway to the Brain

Prof. Wolfgang Fink, Ph.D.

Associate Professor and Edward & Maria Keonjian Endowed Chair at the University of Arizona

AIMBE Fellow, da Vinci Fellow, IEEE Senior Member

**Visual and Autonomous Exploration Systems Research Laboratory
Depts. of Electrical & Computer Engineering, Biomedical Engineering,
Systems & Industrial Engineering, Aerospace & Mechanical Engineering, and Ophthalmology & Vision Science
University of Arizona, Tucson, AZ**



Acknowledgements



Retina Institute:

Tom Chang, M.D.

Kristie Lin, M.D.

Erika Aragon, Marketing Director



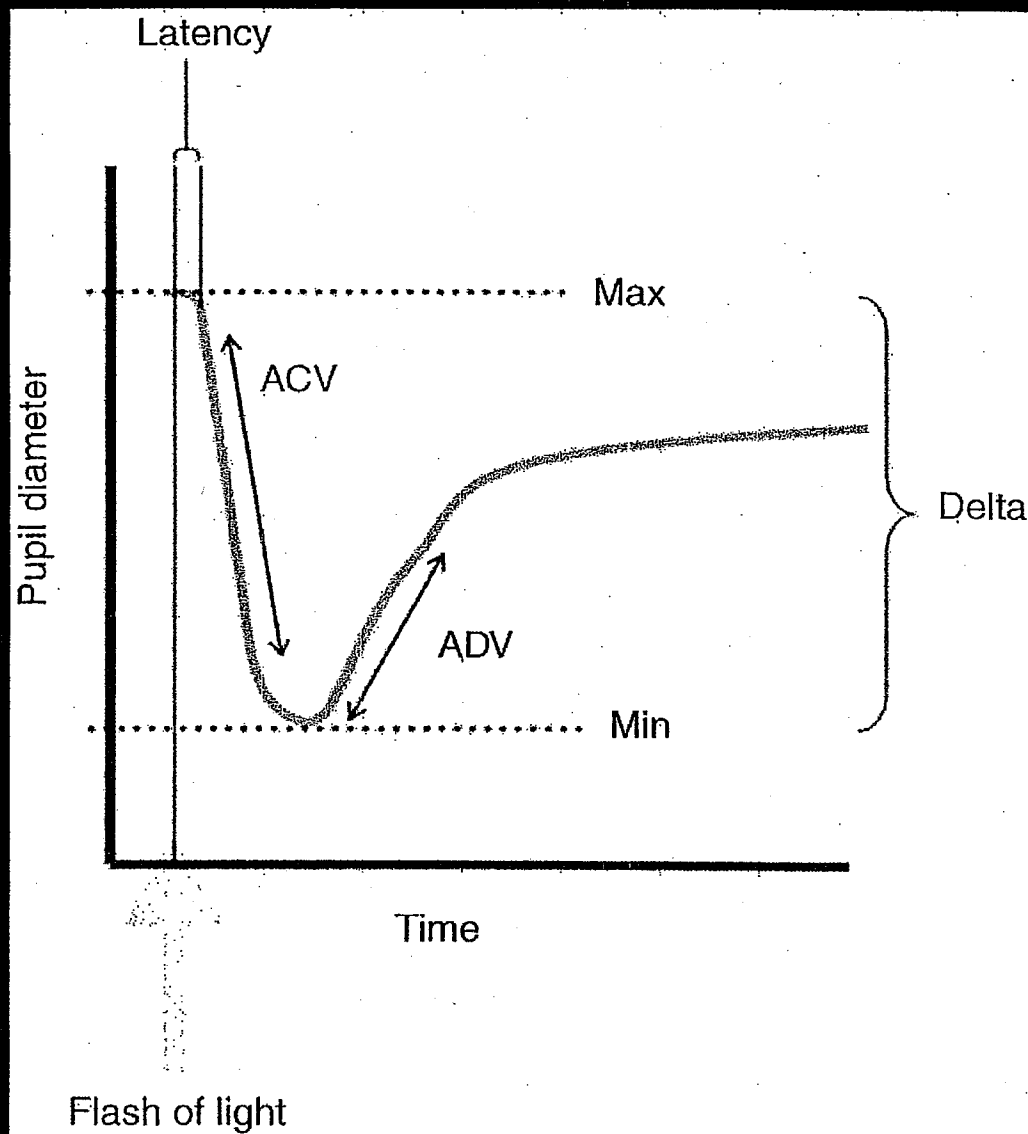
Motivation for *Pupillometry*



- The purpose of the pupil is to regulate how much light enters the eye and to protect the eye from too much light exposure
- The pupil is a gateway to the brain.
- Monitoring both pupils of a person, merely with a flashlight (so-called “swinging-flashlight” test), will tell first responders or (emergency) doctors whether the person has suffered critical brain damage.
- Monitoring the pupillary movement in darkness has the potential to reveal whether a person is suffering from sleep disorders (so-called sleep apnea).
- Pupillometry is non-invasive.



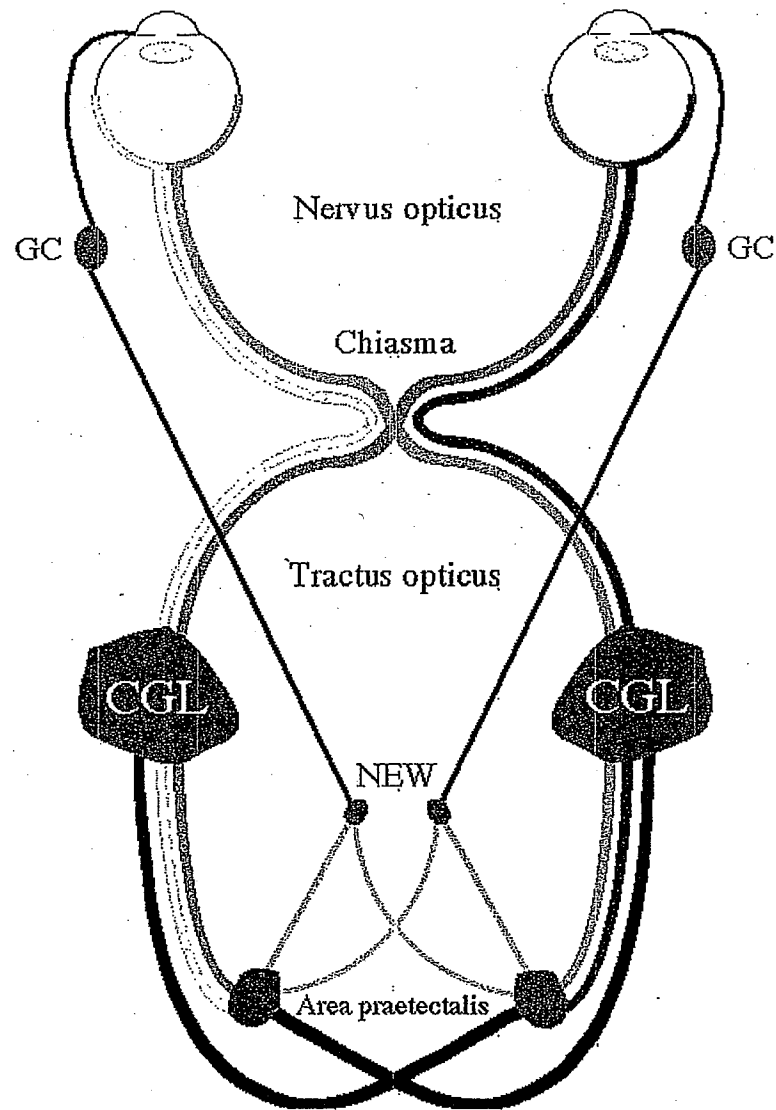
Introduction: *Pupillary Light Reflex (PLR)*



[Courtesy www.nature.com]



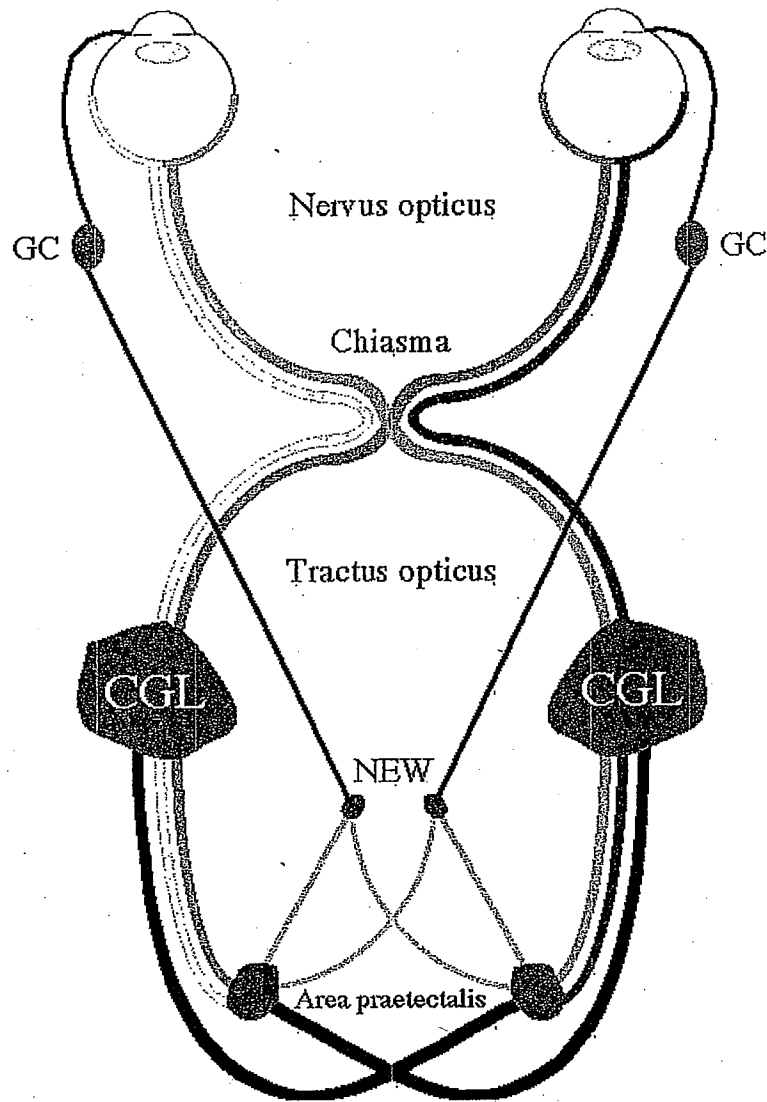
Neural Modeling of *Pupillary Pathway*



Fink et al., Ger J Ophthalmol 1996

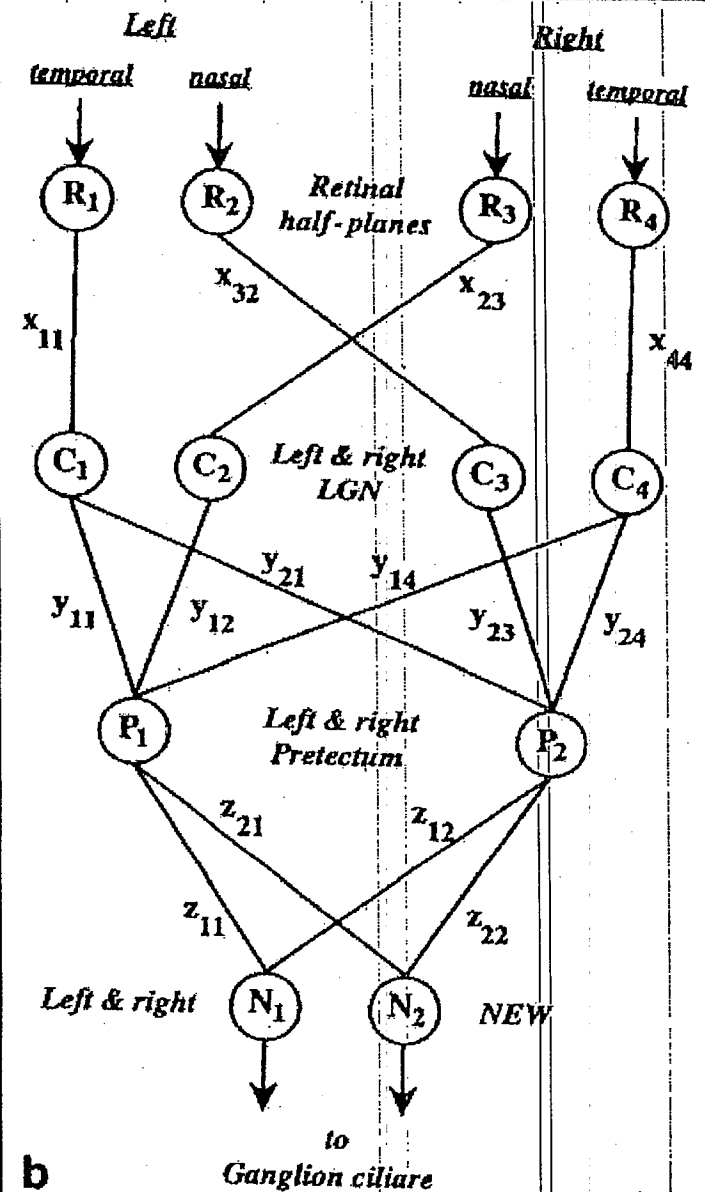


Neural Modeling of *Pupillary Pathway*

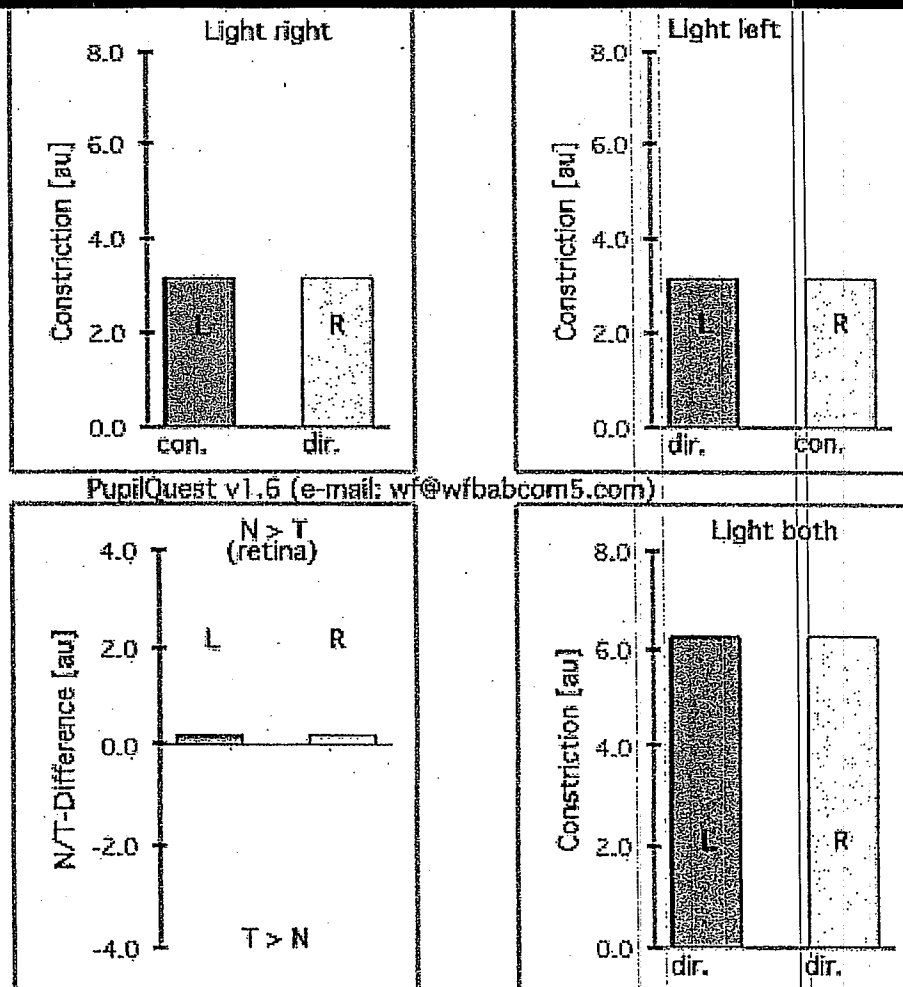


Fink et al., Ger J Ophthalmol 1996

Fink et al.,
Ger J Ophthalmol
1996



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© 1995 by Wolfgang Fink, Institute for Theoretical Physics, University of Tübingen, Germany

Fink et al., Ger J Ophthalmol 1996

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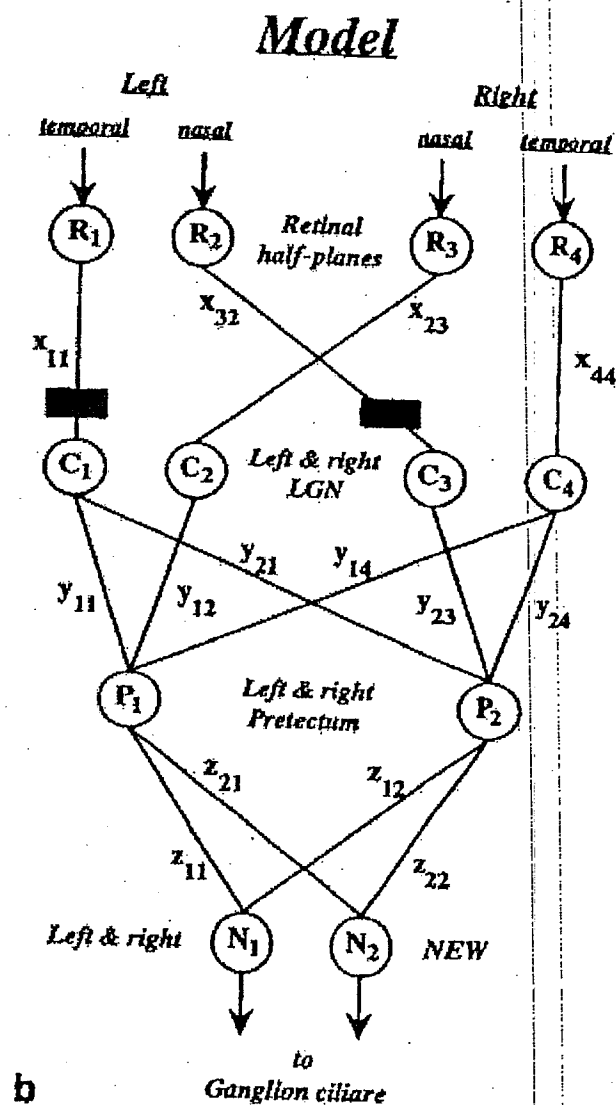
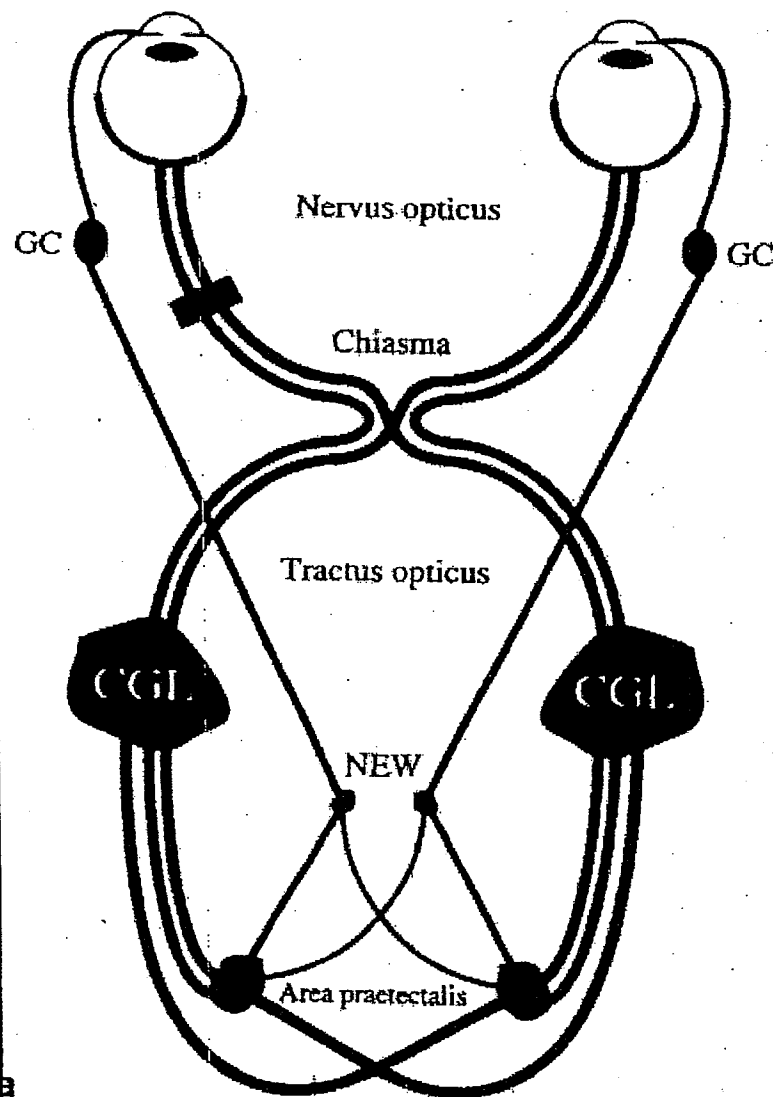
PupilQuest® Clinical Case Studies



- **Clinical Case Study #1: *Unilateral Amaurosis***
 - No anisocoria expected
 - Amaurotic fixed pupil expected
- **Clinical Case Study #2: *Unilateral Tractus Lesion***
 - No anisocoria expected
 - RAPD contralaterally to lesion expected
- **Clinical Case Study #3: *Unilateral Pretectum Lesion***
 - No anisocoria expected
 - RAPD expected



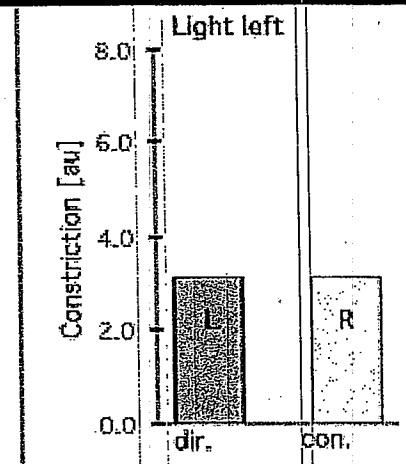
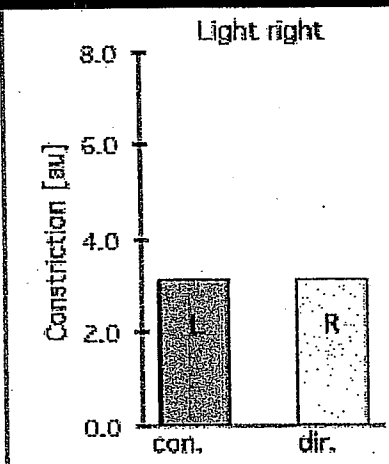
Case Study #1: Unilateral Amaurosis



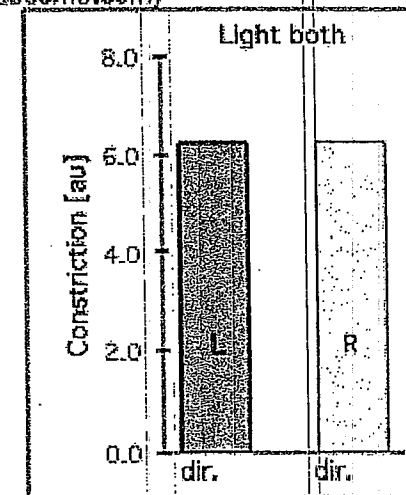
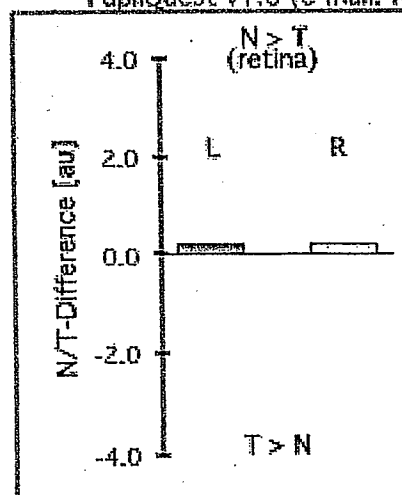
Fink et al., Ger J Ophthalmol 1996



PupilQuest®



PupilQuest v1.6 (e-mail: wf@wfbabcom5.com)



© 1995 by Wolfgang Fink, Institute for Theoretical Physics, University of Tübingen, Germany

Fink et al., Ger J Ophthalmol 1996

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[illegible]

Model

Left

temporal → R₁

nasal → R₂

Right

nasal → R₃

temporal → R₄

Retinal half-planes

x₁₁ x₃₂ x₂₃ x₄₄

C₁ C₂ C₃ C₄

Left & right LGN

y₁₁ y₁₂ y₂₁ y₁₄ y₂₃ y₂₄

P₁ P₂

Left & right Prefectum

z₁₁ z₁₂ z₂₁ z₂₂

N₁ N₂ **NEW**

Left & right

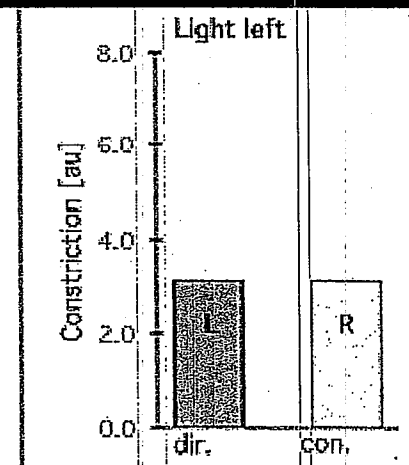
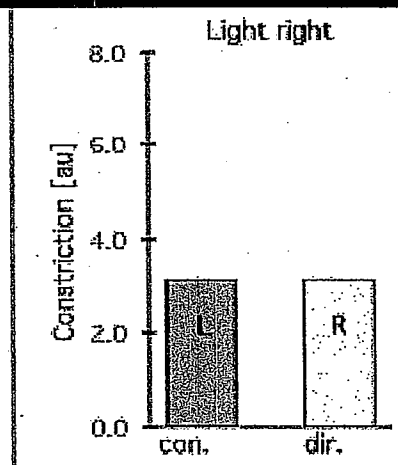
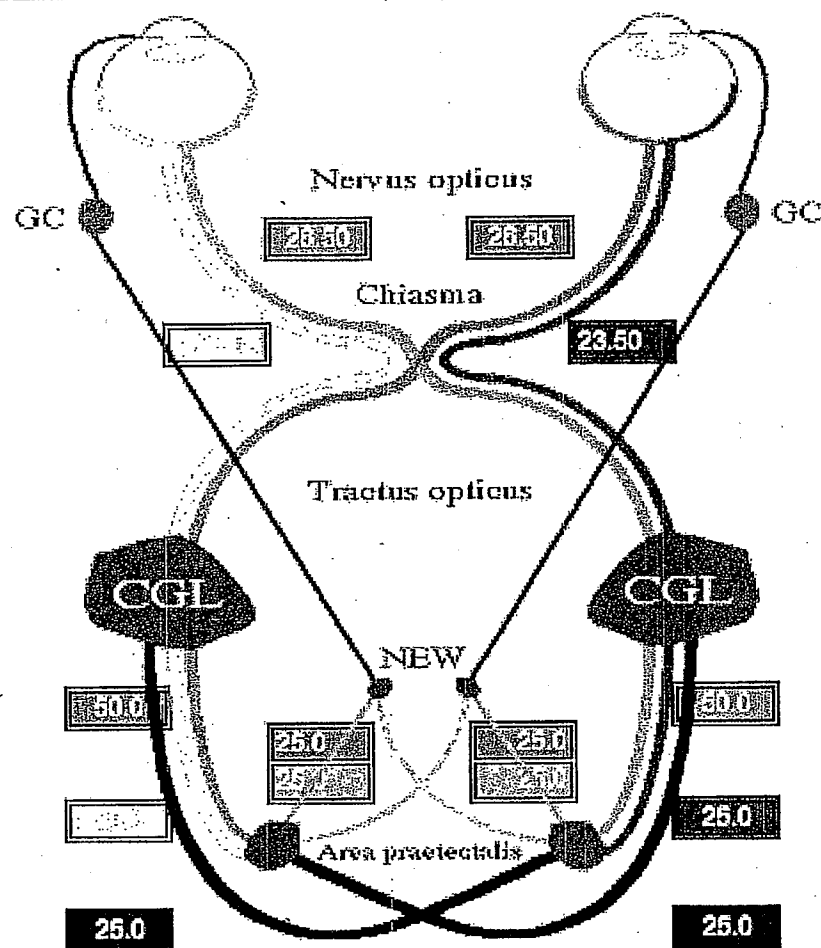
to
Ganglion ciliare



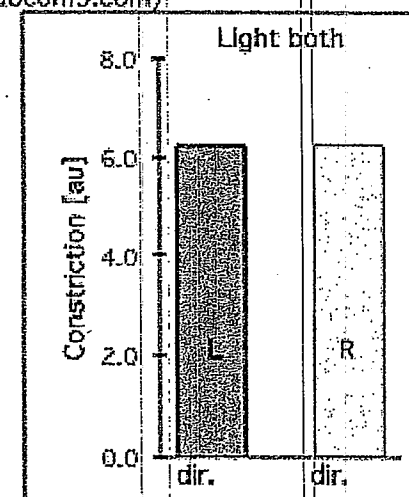
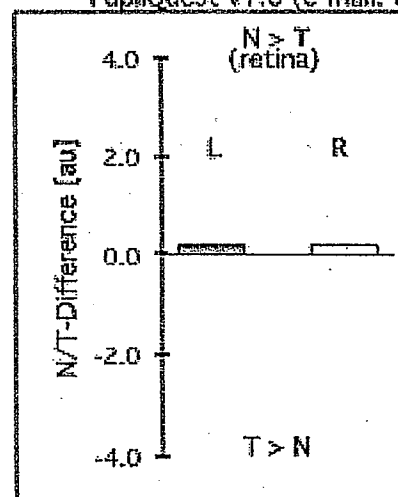
PupilQuest® Simulation: Unilateral Tractus Lesion



PupilQuest®



PupilQuest v1.6 (e-mail: wf@wfbabcom5.com)



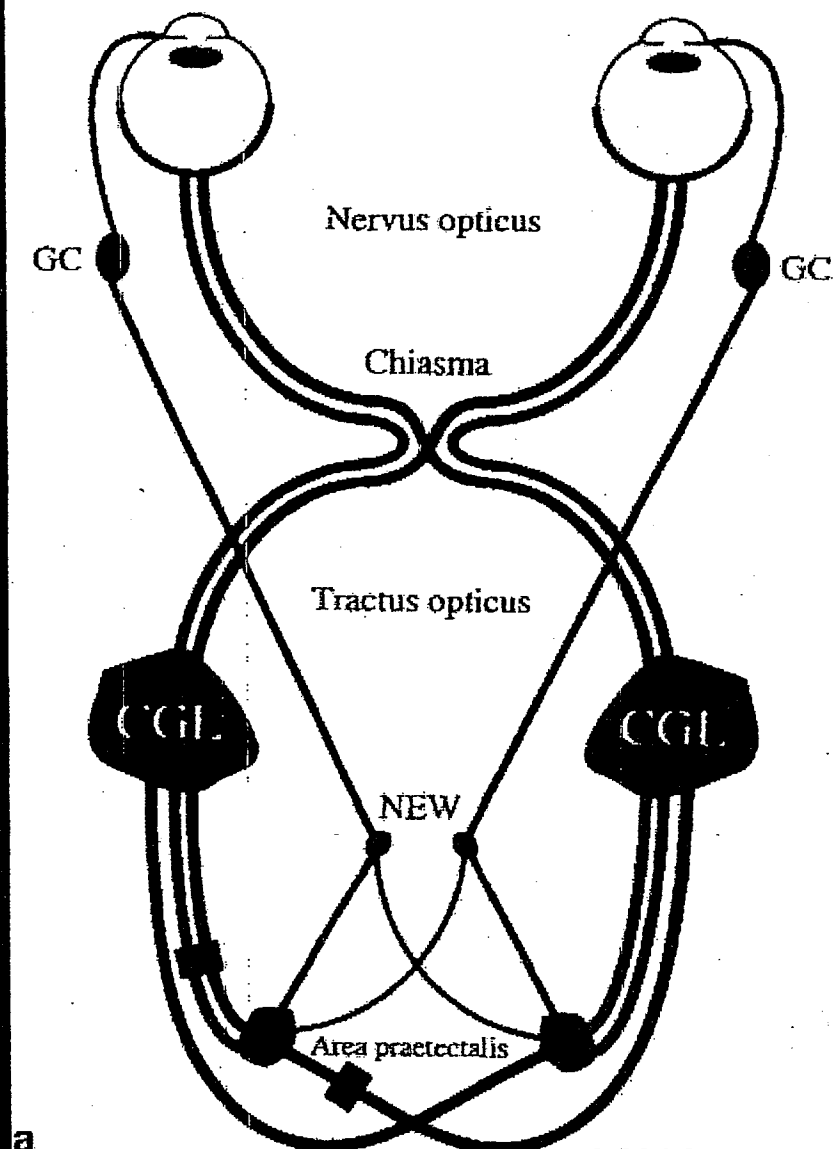
© 1995 by Wolfgang Fink, Institute for Theoretical Physics, University of Tübingen, Germany

Fink et al., Ger J Ophthalmol 1996

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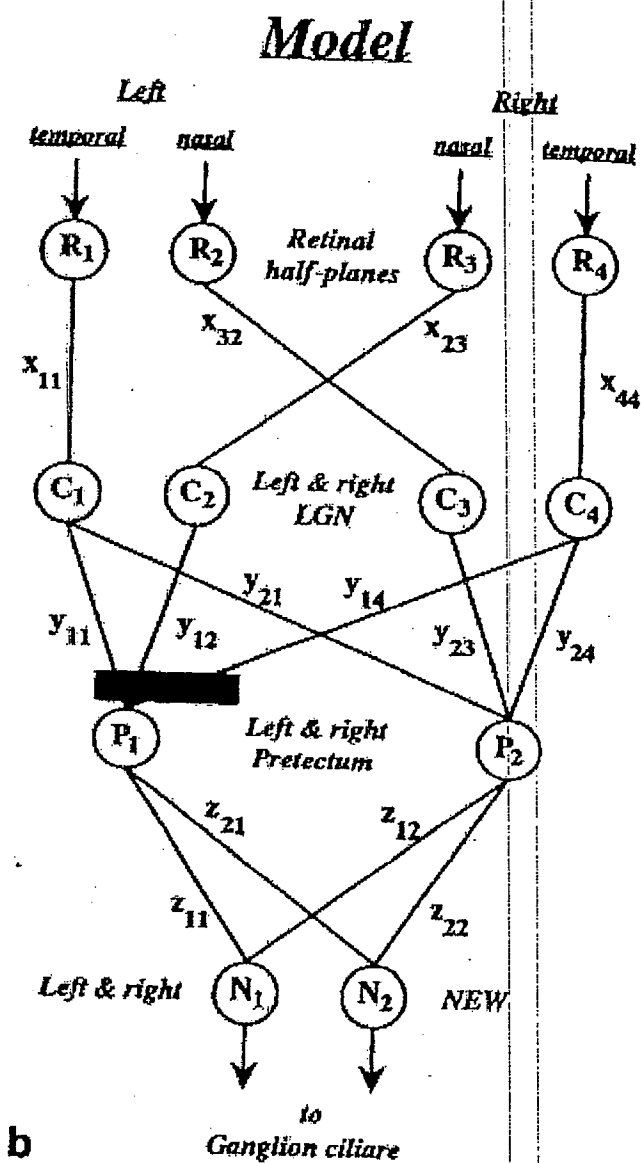


Case Study #3: Unilateral Pretectum Lesion



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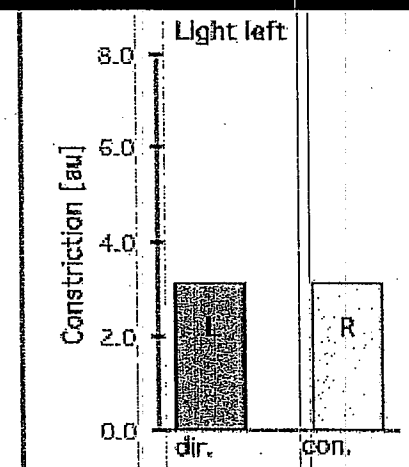
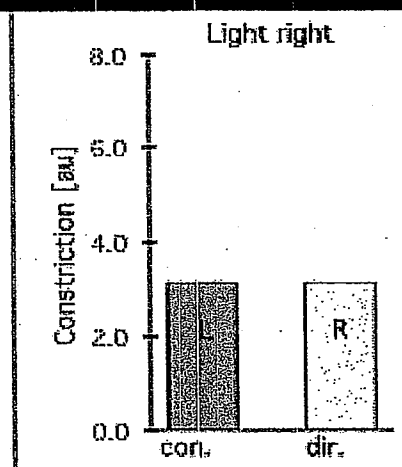
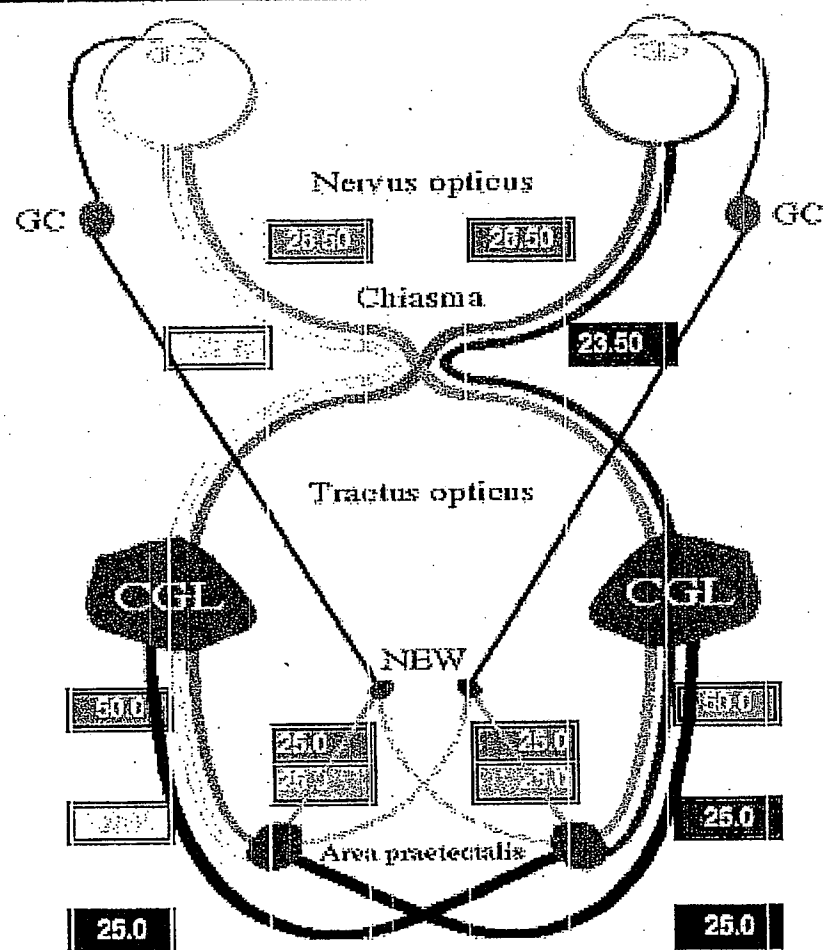
Fink et al., Ger J Ophthalmol 1996



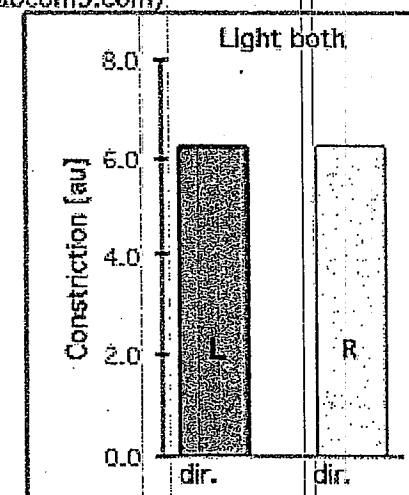
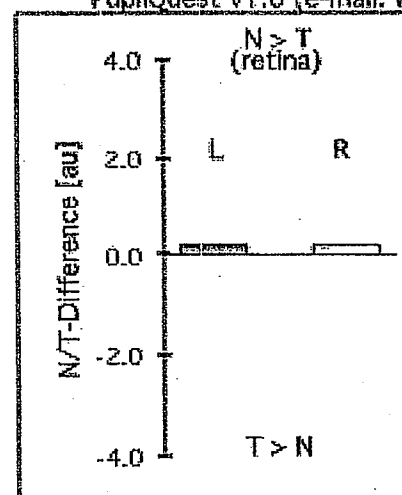
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***PupilQuest*®**



PupilQuest v1.6 (e-mail: wf@wfbabcom5.com)



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Fink et al., Ger J Ophthalmol 1996

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Summary & Outlook



- Continued refinement of *PupilQuest*®
- *Pupillometry* has the potential for the detection of:
 - Brain damage
 - Sleep disorders (e.g., sleep apnea)
 - Other ophthalmic conditions.
- *Pupillometry* is non-invasive.
- *Pupillometry* can be performed in a mobile setting.



Contact Information



Prof. Wolfgang Fink, Ph.D.

***Visual and Autonomous Exploration Systems
Research Laboratory***

Depts. of Electrical & Computer Engineering and Biomedical Engineering
University of Arizona

wfink@email.arizona.edu

<http://autonomy.caltech.edu> and <http://autonomy.arizona.edu>

Curriculum Vitae of Prof. Dr. Wolfgang Fink

July 2015

Contact Information

University of Arizona: Wolfgang Fink, Ph.D.
Visual and Autonomous Exploration Systems Research Laboratory
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Tucson, AZ 857210104
Phone/Fax: (520)-621-8734
E-mail: wfink@email.arizona.edu

Caltech: Wolfgang Fink, Ph.D.
Visual and Autonomous Exploration Systems Research Laboratory
Division of Physics, Mathematics and Astronomy
California Institute of Technology
1200 E California Blvd
Mail Stop 103-33
Pasadena, CA 91125
Phone/Fax: (626)-395-4587
E-mail: wfink@autonomy.caltech.edu

Research Experience

- **Associate Professor (tenured) at University of Arizona** **2009 – Present**
Inaugural Edward & Maria Keonjian Endowed Chair in Microelectronics with joint appointments in the Departments of Electrical & Computer Engineering, Biomedical Engineering, Systems & Industrial Engineering, Aerospace & Mechanical Engineering, and Ophthalmology & Vision Science; Director of the *Visual and Autonomous Exploration Systems Research Laboratory* (<http://autonomy.arizona.edu>)
- **Senior Researcher at NASA's Jet Propulsion Laboratory** **2001 – 2009**
Nano and Micro Systems (NAMS) Group at the Jet Propulsion Laboratory (JPL), Microdevices Laboratory, and Center for Evolutionary Computation and Automated Design (CECAD)
- **Visiting Associate in Physics at Caltech** **2001 – Present**
Division of Physics, Mathematics, and Astronomy at the California Institute of Technology. Founder and Director of the *Visual and Autonomous Exploration Systems Research Laboratory* (<http://autonomy.caltech.edu>)
- **Visiting Research Associate Professor of Ophthalmology at USC** **2005 – Present**
- **Visiting Research Assistant Professor of Ophthalmology at USC** **2001 – 2005**
Department of Ophthalmology, Keck School of Medicine at the University of Southern California

Curriculum Vitae of Prof. Dr. Wolfgang Fink

July 2015

- **Visiting Research Associate Professor of Neurological Surgery at USC** 2005 – Present
- **Visiting Research Assistant Professor of Neurological Surgery at USC** 2004 – 2005
Department of Neurological Surgery, Keck School of Medicine at the University of Southern California and Los Angeles County General Hospital
- **Postdoctoral Scholar in Physics at Caltech** 1998 – 2001
Division of Physics, Mathematics & Astronomy at the California Institute of Technology
Adviser: Prof. Dr. S. E. Koonin, former Vice President and Provost of Caltech and Professor of Theoretical Physics, former Chief Scientist of British Petroleum, former Undersecretary of Department of Energy (DOE), currently Director of NYU's Center for Urban Science and Progress (CUSP)
- **Postdoctoral Scholar in Physics at the University of Tübingen** 1997 – 1998
Institute for Theoretical Physics, University of Tübingen, Germany
Advisers: Prof. Dr. E. W. Schmid (Institute for Theoretical Physics, Founding Director of Center for Data Processing (ZDV) Tübingen) and Prof. Dr. med. E. Zrenner (Director of University Eye Hospital Tübingen, Head of German Retinal Implant Project at Retina AG)

Education

- **Ph.D. in Theoretical Physics** with highest honors (*summa cum laude*) 1997
Institute for Theoretical Physics, Eberhard-Karls-University of Tübingen, Germany
Ph.D.-thesis: "Application of Methods of Theoretical Physics to Ophthalmology"
Advisers: Prof. Dr. E. W. Schmid (Institute for Theoretical Physics, Founding Director of Center for Data Processing (ZDV) Tübingen) and Prof. Dr. med. E. Zrenner (Director of University Eye Hospital Tübingen, Head of German Retinal Implant Project at Retina AG)
- **Diploma in Theoretical Physics (M.S.)** 1993
in: Theoretical Physics, Experimental Physics, Astronomy & Astrophysics, and Physical Chemistry
Institute for Theoretical Physics, Georg-August-University of Göttingen, Germany
Diploma-thesis: "Phase space analysis in models of neural networks"
Advisers: Prof. Dr. A. Zippelius (Leibniz-Laureate 1998) and Prof. Dr. A. Engel
- **Vordiploma in Physics (B.S.)** 1990
in: Theoretical Physics, Experimental Physics, Mathematics, and Chemistry
Georg-August-University of Göttingen, Germany

Professional Memberships

- Fellow (2012) of the American Institute for Medical and Biological Engineering (AIMBE)
- Senior Member of the IEEE Engineering in Medicine and Biology Society
- Member of the SPIE
- Member of the Association for Research in Vision and Ophthalmology (ARVO)
- Member of the German Physical Society

Research Interests

- **(Bio-)Medical Sciences/Engineering**

- **Artificial Vision Prostheses (Brain-Machine Interface)**

This effort aims to enable and optimize the visual perception afforded by a wide variety of electric stimulation based visual prostheses through the development of: (1) real-time image processing hardware/software systems; (2) multivariate optimization algorithms that allow the blind subject via tactile feedback devices to modify the stimulation patterns, to optimize the resulting visual perception; and (3) novel electrical stimulation strategies to improve the resolution of vision afforded by visual prostheses.

- **Biomedical Sensor Development for Glaucoma Treatment**

This effort aims to assess the actual intraocular pressure inside the eye via implantable devices. This is crucial in the management of glaucoma to prevent blindness.

- **Worldwide Accessible Visual Field Test & Diagnosis System**

This effort aims to establish a comprehensive visual field test and diagnosis system that enables screening and examination of people worldwide via the Internet, assisting physicians with an independent second opinion, and offering a promising perspective towards modern computer-assisted diagnosis in both medicine and telemedicine.

- **Smart Telemedicine Platforms**

This effort aims to establish mobile healthcare data acquisition devices and software applications that enable true tele-medical analysis and diagnosis capabilities.

- **Smart Service Systems, Autonomous Robotics and Reasoning Systems**

- **Tier-Scalable Reconnaissance: Paradigm Shift in Autonomous Planetary Exploration**

This effort investigates multi-tiered, multi-agent architectures for the exploration of planetary bodies and hazardous environments on Earth from space, air, ground, and subsurface.

- **Autonomous C⁴ISR Systems**

This effort aims to establish aerial, ground-based, and water-based robotic platforms that are equipped with sensors and synthetic reasoning capabilities for autonomous operations.

- **Computational Field Geology for Autonomous Planetary (Sub-)Surface Exploration**

This effort aims to equip an autonomous craft with abductive/inductive inference schemes and the ability to generate “working hypotheses” akin to a field geologist through automatic feature extraction, anomaly identification, target prioritization, and science data interpretation.

- **Astrobiology: Chemical reaction networks and instrument development for life detection**

This effort investigates the possibility for chemical concentration profiles of oxidants or reductants within porous media to be used to unambiguously define biologically mediated reactions – signatures of life – both on Earth (e.g., Lake Vostok, Antarctica) and on other planetary bodies (e.g., putative subsurface oceans on Europa and Ganymede).

- **Evolutionary Computing and Optimization, Automated Design**
 - **Stochastic Optimization Framework (SOF) for Computer-Optimized Design, Engineering, and Performance of Multi-Dimensional Systems and Processes**

This effort aims to develop and implement highly efficient multivariate stochastic optimization algorithms. These algorithms can be applied to high-dimensional problems in science, medicine, and engineering that escape deterministic, gradient-descent-based optimization schemes due to the existence of multiple or infinite local minima.

Research Support To Date

- **(Bio-)Medical Sciences**

Secured funding from DOE, DOD, NSF, NASA, and corporations (directed research) in excess of \$3.26 Million as a PI, contributed significantly as Caltech's founding Co-I to a 10 year NSF-ERC grant (USC lead institution) with funding in excess of \$37 Million, and contributed as a PI to the DOE-funded CRADA-based effort "Artificial Retina" with funding in excess of \$63 Million.
- **Smart Service Systems, Autonomous Robotics and Reasoning Systems**

Secured funding from NASA in excess of \$1.038 Million as a PI.
- **Evolutionary Computing and Optimization, Automated Design**

Task Leader in the *Center for Evolutionary Computation and Automated Design (CECAD)* at JPL. CECAD secured funding from NASA in excess of \$2.355 Million.

Professional Service

- Peer Reviewer for *NSF-EPSCoR Program 2014*
- Peer Reviewer for *IEEE Journal of Biomedical and Health Informatics*
- Peer Reviewer for *Journal of Investigative Ophthalmology & Visual Science*
- Peer Reviewer for *Journal of Field Robotics*
- Peer Reviewer for *IEEE Aerospace Conference*
- Peer Reviewer for *Austrian Science Fund (FWF)*
- Peer Reviewer for *Journal of Biomedical Optics*
- Peer Reviewer for *Journal Neural Computation*
- Peer Reviewer for *IEEE Sensors Journal*
- Peer Reviewer for *IEEE Transactions on Neural Systems & Rehabilitation Engineering*
- Peer Reviewer for *Journal of Computer Methods and Programs in Biomedicine*
- Peer Reviewer for *Journal of Ophthalmic and Physiological Optics*
- Peer Reviewer for *Journal Expert Review of Ophthalmology*
- Peer Reviewer for *John Wiley & Sons, Inc*
- Peer Reviewer for *NASA SBIR Program, 2002*
- Peer Reviewer for *NASA Exobiology Program, 1998*

- Program Committee Member and Peer Reviewer for *22nd Annual ACM Symposium on Applied Computing, Seoul, Korea, 2007, Computer Applications in Health Care track*
- Session Chair and Peer Reviewer for *Astrobiology Science Conference (AbSciCon), Santa Clara, California, 2008, Approaches and Technologies to Detect Life on Mars (S3)*
- Session Chair and Peer Reviewer for *SPIE Defense & Security Symposium, Orlando, Florida, 2007, MICRO (MEMS) AND NANOTECHNOLOGIES FOR SPACE APPLICATIONS II (DS17)*
- Conference Chair and Peer Reviewer for *SPIE Defense & Security Symposium, Orlando, Florida, 2008, SPACE EXPLORATION TECHNOLOGIES FOR DEFENSE AND SECURITY*
- Conference Chair and Peer Reviewer for *SPIE Defense, Security and Sensing Symposium, Orlando, Florida, 2009, Space Exploration Technologies Conference II*
- Conference Co-Chair and Peer Reviewer for *SPIE Defense, Security and Sensing Symposium, Orlando, Florida, 2010, Space Exploration Technologies Conference III*
- Invitation-only participant at *"New Frontiers in Characterizing Biological Systems"* DOE workshop, May 13-14, 2009, Bethesda, MD
- Invitation-only participant at *"Opportunities in Biology at the Extreme Scale of Computing"* international DOE workshop, August 17-19, 2009, Chicago, IL
- U.S. Army Medical Research and Materiel Command (USAMRMC) scientific peer review of proposals submitted to the Vision Research Program in Washington, DC, Dec. 9-11, 2009
- Program Committee Member for Session on *"Emerging trends in Fuzzy Cognitive Maps"* at the 2012 IEEE International Conference on Fuzzy Systems as part of the 2012 IEEE World Congress on Computational Intelligence, Brisbane, Australia
- IEEE Aerospace Conference 2013-present Session Co-Chair of *"PHM for Astronauts and Pilots"* Session
- IEEE Aerospace Conference 2013-2015 Session Chair/Co-Chair of *"PHM for Autonomous Systems"* Session
- IEEE Aerospace Conference 2015-present Session Chair of *"PHM for Helicopters, UAVs, and Autonomous Systems"* Session
- IEEE Aerospace Conference 2013-present Track Co-Chair of *"Diagnostics, Prognostics and Health Management (PHM)"* Track

Honors & Awards

- **2015:** Elevated to IEEE Senior Member grade.
- **2014/2015:** Named DaVinci Fellow for *"innovative, productive and highly recognized engineering research"* at the College of Engineering, University of Arizona – the most prestigious award of the College
- **2014:** Led University of Arizona NSBE (National Society of Black Engineers) Chapter to take 1st place at NSBE Undergraduate Technical Research Competition in March at the NSBE 40th Annual Convention in Nashville, TN
- **2012:** Inducted as Fellow of the American Institute for Medical and Biological Engineering (AIMBE) *"for outstanding contributions in the field of ophthalmology and vision sciences with particular focus on diagnostics and artificial vision systems."*

- **2010:** NASA patent award for “Inverse Tomographic Approach to Create Arbitrary Sidewall Geometries in 3D using LiGA Technologies”
- **2010:** NASA patent award “Optically powered and optically data-transmitting wireless intraocular pressure sensor device”
- **2010:** NASA patent award for “Automated objective characterization of visual field defects in 3D”
- **2010:** NASA patent award for “Multi-agent autonomous system and method (3/3)”
- **2010:** NASA patent award for “Multi-agent autonomous system (2/3)”
- **2009:** NASA Board Award for “Field-Deployable Integrated Air-Ground Multi-Agent Autonomous Remote Planetary Surface Exploration”
- **2009:** Co-recipient of R&D Magazine’s R&D 100 Editors’ Choice award 2009 for the DOE-funded Artificial Retina Project
- **2009:** Co-recipient of R&D Magazine’s R&D 100 award 2009 for the DOE-funded Artificial Retina Project
- **2009:** NASA patent award for “Multi-agent autonomous system (1/3)”
- **2006:** 1st place (World Champion) of the IEEE Congress on Evolutionary Computation (CEC) 2006 International “Huygens Probe” Optimization Competition, held at the IEEE World Congress on Computational Intelligence (WCCI) 2006 in Vancouver, BC, Canada
- **2006:** NASA Techbrief Award for “Spectral retrieval and degeneracy analysis by means of Evolutionary Computational Methods (ECM)”, Terrile, Fink et al.
- **2006:** NASA Techbrief Award for “Stochastic Evolutionary Algorithms (Simulated Annealing) for Deployment Path Planning & Optimization for Joint-based Robotic Limbs”, Fink et al.
- **2006:** NASA Techbrief Award for “Efficient Optimization of Low-Thrust Spacecraft Trajectories”, Lee, Fink et al.
- **2006:** NASA Techbrief Award for “Evolutionary Computing Methods for Retrieving Spectral Data”, Terrile, Fink et al.
- **2005:** Silver Award, awarded to the Evolutionary Computation Group at JPL, for demonstrating Human Competitive Performance (*Humie Award*) for “Evolutionary Computational Techniques for the Automated Design of Space Systems” from the Genetic and Evolutionary Computation Conference (GECCO) held in Washington DC.
- **2004:** NASA Techbrief Award for “Field-Deployable Integrated Air-Ground Multi-Agent Autonomous Remote Planetary Surface Exploration”, Fink et al.
- **2002:** NASA Space Flight Awareness (SFA) Launch Honoree Award for work in support of NASA’s human spaceflight program
- **1997:** Ph.D.-degree in Theoretical Physics, *summa cum laude*, Institute for Theoretical Physics, University of Tübingen, Germany
- **2000 – Present:** Media and Press Media Features
(<http://autonomy.caltech.edu/halloffame.html> and <http://autonomy.arizona.edu/media>)

Patents

- **14 patents (including PCT) issued to date** in the areas of autonomous systems, biomedical devices, neural stimulation, MEMS fabrication, and multi-dimensional optimization
- 17 JPL New Technology Reports (NTRs)

Publications

Theses:

1. Fink W (1993) *Phasenraumanalyse von Modellen neuronaler Netzwerke (Coupling space analysis in models of neural networks)*, Diplomarbeit (Master's Thesis), Institute for Theoretical Physics, University of Göttingen
2. Fink W (1997) *Anwendung theoretisch-physikalischer Methoden in der Ophthalmologie (Application of Methods of Theoretical Physics to Ophthalmology)*, Ph.D.-Dissertation, Institute for Theoretical Physics, University of Tübingen

Publications Related to Biomedicine and Ophthalmology

Contributions in Refereed Journals:

1. Fink W, Frohn A, Schiefer U, Schmid EW, Wendelstein N (1996) *A ray tracer for ophthalmological applications*, Ger J Ophthalmol 5 118
2. Fink W, Frohn A, Schiefer U, Schmid EW, Wendelstein N, Zrenner E (1996) *Visuelle Wahrnehmung bei hohen Ametropien - Computergestützte Simulation mittels strahlenoptischer Rechnungen*, Klin Monatsbl Augenheilkd 208 472
3. Fink W, Wilhelm H, Wilhelm B, Schmid EW (1996) *Multi-layered Perceptron as a Model for the Pupillary Pathway*, Ger J Ophthalmol 5 160
4. Fink W, Schiefer U, Schmid EW (1997) *Effect of dislocated and tilted correction glasses on perimetric outcome - A simulation using ray-tracing*, Perimetry Update 1996/1997 pp 201, Proceedings of the XIIth International Perimetric Society Meeting Würzburg, Germany, June 4-8, 1996, Wall M, Heijl A, Eds., Kugler Publications bv, Amsterdam/New York
5. Frohn A, Fink W, Thiel HJ (1997) *Strahldeflektionsmethode bei der Diagnostik unklarer Sehstörungen*, Proceedings 486, 11. Kongreß der DGII in Frankfurt, Germany, 1997, Ohrloff C et al., Eds., Springer Verlag Berlin Heidelberg 1998
6. Frohn A, Fink W, Thiel HJ (1998) *Axiale Linsenverschiebung als Differentialdiagnose bei Visusstörungen nach Kapselruptur - Axial displacement of IOL and visual impairment*, Klin Monatsbl Augenheilkd 213 309
7. Huebscher HJ, Fink W, Steinbrück D, Seiler T (1999) *Scheimpflug Records without Distortion - A Mythos?*, Ophthalmic Research 31:2 134
8. Fink W, Schiefer U, Schmid EW (1999) *Neural attractor-network classification of visual field data*, Perimetry Update 1998/1999 pp 283-288, Proceedings of the XIIIth International Perimetric Society Meeting Gardone Riviera, Italy, October, 1998, Wall M, Heijl A, Eds., Kugler Publications bv, Amsterdam/New York
9. Burth R, Fink W, Hölper E, Mayer S, Schiefer U (1999) *Development of the Tübingen neuro-ophthalmological perimetric database*, Perimetry Update 1998/1999 pp 533-538, Proceedings of the XIIIth International Perimetric Society Meeting Gardone Riviera, Italy, October, 1998, Wall M, Heijl A, Eds., Kugler Publications bv, Amsterdam/New York
10. Frohn A, Fink W, Burkhard Dick H, Thiel HJ (2001) *Beam Deflection Method in Diagnosis of Impaired Vision*, Journal of Cataract and Refractive Surgery 27 994
11. Fink W, Sadun A (2003) *Novel 3D Computerized Threshold Amsler Grid Test*, Perimetry Update 2002/2003 pp 207-212, Proceedings of the XVth International Perimetric Society

- Meeting in Stratford Upon Avon, England, June, 2002, Kugler Publications bv, Amsterdam/New York
12. Fink W, Sadun A (2004) *3D Computer-automated Threshold Amsler Grid Test*, Journal for Biomedical Optics 2004 Jan;9(1):149-53
 13. Fink W (2004) *Neural attractor network for application in visual field data classification*, Journal of Physics in Medicine and Biology 49 (7 July 2004) 2799-2809
 14. Nazemi PP, Fink W, Lim JI, Sadun AA (2004) *Scotomas of age-related macular degeneration detected and characterized by means of a novel computer-automated 3D visual field test*; Journal Retina, Jun;25(4):446-53
 15. Fink W (2005) *Refractive correction method for digital charge-coupled device-recorded Scheimpflug photographs by means of ray tracing*, Journal for Biomedical Optics 2005 Mar-Apr;10(2):024003
 16. Liu W, Fink W, Tarbell M, Sivaprakasam M (2005) *Image Processing and Interface for Retinal Visual Prostheses*; ISCAS 2005 Conference Proceedings (invited), Kobe, Japan, 2927-2930 Vol. 3
 17. Weiland JD, Fink W, Humayun M, Liu W, Rodger DC, Tai YC, Tarbell M (2005) *Progress Towards a High-Resolution Retinal Prosthesis*; Conf Proc IEEE Eng Med Biol Soc. 2005;7: 7373-5.
 18. Fink W, Micol D (2006) *simEye: Computer-based Simulation Of Visual Perception Under Various Eye Defects Using Zernike Polynomials*, Journal for Biomedical Optics 2006 Sep-Oct;11(5):054011
 19. Johnson WR, Wilson DW, Fink W, Humayun M, Bearman G (2007) *Snapshot hyperspectral imaging in ophthalmology*; Journal for Biomedical Optics 2007 Jan-Feb;12(1):014036
 20. Nazemi PP, Fink W, Sadun AA, Francis B, Minckler D (2007) *Early Detection of Glaucoma by Means of a Novel 3-D Computer-automated Visual Field Test*; B J Ophthalmol, 91: 1331-1336; doi:10.1136/bjo.2007.116103
 21. Kim JK, Fahimi A, Fink W, Nazemi PP, Nguyen D, Sadun AA (2008) *Characterizing Ethambutol-induced Optic Neuropathy with a 3D Computer-automated Threshold Amsler Grid Test*; Clin Experiment Ophthalmol 36(5):484-8
 22. Jivrajka RV, Kim JK, Fink W, Sadun AA, Sebag J (2008) *Quantitative analysis of central visual field defects in macular edema using three-dimensional computer-automated threshold Amsler grid testing*; Graefes Arch Clin Exp Ophthalmol; DOI: 10.1007/s00417-008-0971-8
 23. Weiland JD, Fink W, Humayun MS, Liu W, Li W, Sivaprakasam M, Tai YC, Tarbell MA (2008) *System Design of a High Resolution Retinal Prosthesis*; Conf Proc IEEE IEDM 2008; doi:10.1109/IEDM.2008.4796682
 24. Nguyen D, Fahimi A, Fink W, Nazemi PP, Kim JK, Sadun AA (2009) *Novel 3-D computer-automated threshold Amsler grid visual field testing of scotomas in glaucoma patients*; Eur J Ophthalmol; 19(5): 776-782
 25. Fink W, Tarbell MA (2009) *CYCLOPS: A Mobile Robotic Platform for Testing and Validating Image Processing and Autonomous Navigation Algorithms in Support of Artificial Vision Prostheses*; Comput. Methods Programs Biomed.; 96(3):226-33; DOI:10.1016/j.cmpb.2009.06.009
 26. Fink W, You CX, Tarbell MA (2010) μ AVS²: Microcomputer-based Artificial Vision Support System for Real-Time Image Processing for Camera-Driven Visual Prostheses; J. Biomed. Opt., Vol. 15, 016013 (2010); doi:10.1117/1.3292012

27. Fink W, You CX, Sadun AA, Tarbell MA (2010) Comprehensive Visual Field Test and Diagnosis System for Visual Performance Assessment in Military Settings; Conf Proc 27th Army Science Conference 2010, Orlando, Florida
28. Robison CD, Jivrajka RV, Bababeygy SR, Fink W, Sadun AA, Sebag J (2011) Distinguishing wet from dry age-related macular degeneration using three-dimensional computer-automated threshold Amsler grid testing; B J Ophthalmol; 95(10): 1419-1423; doi: 10.1136/bjo.2010.194886
29. Tozer KR, Fink W, Sadun AA, Sebag J (2013) Prospective Three-Dimensional Analysis of Structure and Function in VitroMacular Adhesion Cured by Pharmacologic Vitreolysis; Retinal Cases & Brief Reports 7:57-61
30. Fink W, Clark JB, Reisman GE, Tarbell MA (2013) Comprehensive Visual Field Test & Diagnosis System in Support of Astronaut Health and Performance; IEEE Aerospace Conference Proceedings, paper #2675, Big Sky, Montana
31. Schmid EW, Fink W, Wilke R (2013) Simultaneous vs. Sequential and Unipolar vs. Multipolar Stimulation in Retinal Prostheses; IEEE EMBS Conf Proc, pp. 190-193
32. Schmid EW, Fink W, Wilke R (2013) Electric Stimulation of Neurons and Neural Networks in Retinal Prostheses; IEEE EMBS Conf Proc, pp. 1108-1111
33. Rao A, Hong M, Shankaran A, Fink W, Rozenblit J (2014) Performance Assessment and Optimization of Motion Planning in a Surgical Trainer for Potential Space Applications; IEEE Aerospace Conference Proceedings, paper #2511, Big Sky, Montana
34. Fink W, Hilmers DC, Tarbell MA (2014) Portable System to Monitor Astronaut Ocular Health and the Development of the VIIP Syndrome; IEEE Aerospace Conference Proceedings, paper #2657, Big Sky, Montana
35. Michalska AM, You CX, Nicolini AM, Ippolito VJ, Fink W (2014) Accessible Webpage Design for the Visually Impaired – A Case Study; International Journal of Human-Computer Interaction, 30:12, 995-1002, DOI: 10.1080/10447318.2014.925771
36. Fink W, Tarbell M (2014) Artificial Vision Support System (AVS²) for Improved Prosthetic Vision; Journal of Medical Engineering & Technology; 38(8):385-95; DOI: 10.3109/03091902.2014.957869
37. Schmid EW, Fink W, Wilke R (2014) Operational Challenges of Retinal Prostheses; Journal of Medical Engineering & Physics; 36: 1644-1655

Conference Contributions:

1. Wilhelm H, Wilhelm B, Klier R, Fink W (1995) *Contralateral relative afferent pupillary defect without visual impairment in a thalamic lesion - considerations about the pupillary pathways*, EUNOS-Conference 1995 (European Neuro-Ophthalmological Society), Antwerpen, abstract and lecture
2. Fink W, Wilhelm H, Wilhelm B (1995) *A model for the pupillary pathway based on neural network theory*, 21st International Pupil Colloquium 1995, Haigerloch, abstract and lecture
3. Wilhelm H, Wilhelm B, Fink W (1995) *Unerklärte Pupillenbefunde - Überlegungen zur Organisation der Pupillenbahn*, DOG-Conference 1995 (Deutsche Ophthalmologische Gesellschaft), Mannheim, Der Ophthalmologe 92 Suppl 33, abstract and lecture
4. Wilhelm H, Wilhelm B, Fink W (1996) *Unexplained pupillary findings and considerations about the pupillary pathways*, abstract, DOG-Conference 1995, Mannheim, Ger J Ophthalmol

5. Fink W, Wilhelm H, Wilhelm B (1995) *Mehrschichtiges Perzeptron als Modell für die Pupillenbahn*, DOG-Conference 1995 (Deutsche Ophthalmologische Gesellschaft), Mannheim, Der Ophthalmologe 92 Suppl 34, abstract and lecture
6. Fink W, Wilhelm H, Wilhelm B (1996) *Multi-layered Perceptron as a Model for the Pupillary Pathway*, abstract, DOG-Conference 1995, Mannheim, Ger J Ophthalmol
7. Fink W, Schiefer U, Schmid EW (1996) *Einfluß dislozierter bzw. -verkippter Korrektionsgläser auf perimetrische Befunde, simuliert mittels Ray Tracing*, WAV-Conference 1996 (Württembergische Augenärztliche Vereinigung), Tübingen, Klin Monatsbl Augenheilkd, abstract and lecture
8. Fink W, Schiefer U, Schmid EW (1996) *Effect of dislocated and tilted correction glasses on perimetric outcome - a simulation using Ray Tracing*, IPS-Meeting 1996 (International Perimetric Society), Würzburg, Germany, abstract, lecture and poster
9. Fink W, Frohn A, Schmid EW (1996) *Dislocation of intraocular lens analysed by means of ray tracing*, ARVO 1996 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1996 37 (3) 770, abstract and poster
10. Bräuning J, Fink W, Schüller S, Thiel HJ (1996) *Development of a video based eye tracking system*, ARVO 1996 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1996 37 (3) 274, abstract and poster
11. Schüller S, Bräuning J, Fink W, Frohn A, Thiel HJ (1996) *Digital video eye tracking in perimetry*, ARVO 1996 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1996 37 (3) 275, abstract and poster
12. Fink W, Frohn A, Schmid EW (1996) *Ray-Tracing analysis of transversally dislocated IOL*, ASCRS 1996 (American Society of Cataract and Refractive Surgery), Seattle, Washington, J Cataract Refract Surg, abstract and poster
13. Bräuning J, Schüller S, Fink W, Thiel HJ (1996) *Miniaturisiertes Kampimetriesystem mittels Datenbrille*, DOG-Conference 1996 (Deutsche Ophthalmologische Gesellschaft), Mannheim, Der Ophthalmologe 93 Suppl 150, abstract and lecture
14. Bräuning J, Schüller S, Fink W, Thiel HJ (1996) *Videogestützte Blickrichtungsmessung für das Automatische TAP 2000 Perimeter*, DOG-Conference 1996 (Deutsche Ophthalmologische Gesellschaft), Mannheim, Der Ophthalmologe 93 Suppl 151, abstract, lecture and poster
15. Schüller S, Bräuning J, Fink W, Thiel HJ (1996) *Digitale Video-Fixationskontrolle in der Perimetrie*, DOG-Conference 1996 (Deutsche Ophthalmologische Gesellschaft), Mannheim, Der Ophthalmologe 93 Suppl 151, abstract and lecture
16. Frohn A, Fink W, Schmid EW (1997) *Lichtbrechung in Kataraktlinsen bei der Diagnostik unklarer Sehstörungen*, DGII 1997 (Deutschsprachige Gesellschaft für Intraokularlinsenimplantation), Frankfurt, lecture
17. Frohn A, Fink W, Schmid EW (1997) *Axial Displacement of IOL by Vitreous String*, ASCRS 1997 (American Society of Cataract and Refractive Surgery), Boston, J Cataract Refract Surg, abstract and poster
18. Frohn A, Fink W (1997) *Light scattering in cataract as diagnostic tool*, ASCRS 1997 (American Society of Cataract and Refractive Surgery), Boston, J Cataract Refract Surg, abstract and lecture
19. Frohn A, Fink W, Schmid EW (1997) *Axiale Linsenverschiebung als Folge eines Glaskörper-Stranges*, DOC 1997 (Deutsche Ophthalmochirurgen), Nürnberg, poster

20. Bräuning J, Schüller S, Fink W (1997) *Digitale Video-Fixationskontrolle in einem "Head Mounted Campimetric System" (HMCS)*, DOG-Conference 1997 (Deutsche Ophthalmologische Gesellschaft), Berlin, Der Ophthalmologe 94 Suppl 32, abstract and lecture
21. Schüller S, Bräuning J, Fink W (1997) *Blickrichtungsmessung mit Infrarotvideotechnik in einer Datenbrille*, DOG-Conference 1997 (Deutsche Ophthalmologische Gesellschaft), Berlin, Der Ophthalmologe 94 Suppl 106, abstract and lecture
22. Frohn A, Fink W (1998) *Light-ray-deflection in lenses for early cataract detection*, ARVO 1998 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1998 39 (4) 314, abstract and poster
23. Fink W, Huebscher HJ, Seiler T (1998) *Correction of biometric data derived from digital Scheimpflug records*, ARVO 1998 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1998 39 (4) 1033, abstract and poster
24. Burth R, Fink W, Hölper E, Mayer S, Schiefer U (1998) *Development of the Tübingen neuro-ophthalmological perimetric database*, IPS-Meeting 1998 (International Perimetric Society), Gardone Riviera, Italy, abstract, lecture and poster
25. Fink W, Schiefer U, Schmid EW (1998) *Neural attractor-network classification of visual field data*, IPS-Meeting 1998 (International Perimetric Society), Gardone Riviera, Italy, abstract and lecture
26. Fink W (1999) *Internet-based neural network classification of visual field data*, ARVO 1999 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 1999 40 (4) 657, abstract and poster
27. Fink W, Hsieh AK, Sadun AA (2000) *Computer-automated 3-D visual field testing in distinguishing paracentral scotomas of Optic Neuritis vs. AION*, ARVO 2000 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, abstract and poster
28. Fink W, Sadun AA (2001) *Prospects for Autonomous Visual Field Testing on Space Missions*, abstract, lecture and poster, NanoSpace 2001, Exploring Interdisciplinary Frontiers, The International Conference on Integrated Nano/Microtechnology for Space and Biomedical Applications, March 13-16, 2001, Houston, Texas
29. Fahimi A, Sadun AA, Fink W (2001) *Computer automated 3D visual field testing of scotomas in glaucoma*, ARVO 2001 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2001 42 (4) 149, abstract and poster
30. Nazemi PP, Fink W, Lim JJ, Sadun AA (2001) *Paracentral scotomas of age-related macular degeneration detected by means of a novel computer-automated 3-D visual field test*, ARVO 2001 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2001 42 (4) 705, abstract and poster
31. Fink W (2001) *Project Eyemovie: Motion visualization of eye defects*, ARVO 2001 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2001 42 (4) 854, abstract and poster
32. Nazemi PP, Fink W, Sadun AA, Minckler D, Francis B (2001) *Early detection of glaucoma by means of a novel computer-automated 3-D visual field test*, abstract, American Academy of Ophthalmology Meeting 2001, New Orleans, Louisiana, Proceedings 159, abstract and poster

33. Fink W, Castano R (2002) *Automated Objective Characterization of Visual Field Defects in 3D*, ARVO 2002 (Association for Research in Vision and Ophthalmology), Fort Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2002 43: E-Abstract 240, abstract and poster
34. Fink W (2002) *Autonomous Visual Field Test & Diagnosis System in Space and on Earth*, abstract and lecture at the JPL IT Symposium 2002
35. Fink W (2003) *Autonomous Visual Field Test and Diagnosis System*, abstract and lecture at the NASA Medical Technology Summit: Forging Partnerships to Commercialize Emerging Medical Technologies
36. Fink W (2003) *Wireless Intraocular Pressure Sensor*, abstract and lecture at the NASA Medical Technology Summit: Forging Partnerships to Commercialize Emerging Medical Technologies
37. Fink W, Humayun M (2003) *Blind Patient-in-the-loop Optimization Algorithm for Electrical Stimulation Patterns for Retinal Implant Electrode Arrays*, First DOE International Symposium on Artificial Sight, Ft. Lauderdale, FL, abstract and poster
38. Fink W, Sadun AA, Clark JB (2003) *Worldwide Accessible Comprehensive Visual Field Test & Diagnosis System*, ARVO (Association for Research in Vision and Ophthalmology) 2003 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2003 44: E-Abstract 55, abstract and poster
39. Fink W, Tarbell M, Weiland J, Humayun M (2004) *DORA: Digital Object Recognition Audio-Assistant For The Visually Impaired*, ARVO (Association for Research in Vision and Ophthalmology) 2004 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2004 45: E-Abstract 4201, abstract and poster
40. Fink W, Clark JB, Manuel K, Sadun AA (2004) *Automated Visual Field Test & Diagnosis System in Space and on Earth*, 75th AsMA (Aerospace Medical Association) Annual Scientific Meeting: Frontiers in Aerospace Medicine, Anchorage, Alaska, abstract and lecture; Conference Volume B121
41. Fink W, Tarbell M (2005) *Artificial Vision Simulator (AVS) for Enhancing and Optimizing Visual Perception of Retinal Implant Carriers*, ARVO (Association for Research in Vision and Ophthalmology) 2005 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2005 46: E-Abstract 1145, abstract and lecture
42. Fink W, Levenson H, Sadun A (2005) *Visual Fields with the Amsler 3-D Grid Vision Software*, 3rd Annual Symposium of Neural Hydrodynamics "Focus on Integration of Biomedical Engineering and Clinicians in Basic Neural Hydrodynamics Research", May 12-14, 2005, The University Plaza Hotel & Conference Center, Columbus, Ohio
43. Micol D, Fink W (2006) *SIMEYE: Computer-based Simulation Of Visual Perception Under Various Eye Defects*, ARVO (Association for Research in Vision and Ophthalmology) 2006 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2006 47: E-Abstract 578, abstract and poster
44. Bearman GH, Fink W, Wilson DW, Johnson WR, Humayun M (2007) *Retinal oximetry mapping with a snapshot imaging spectroscopy*, Proceedings of the SPIE, Vol: #6426A-52
45. Jivrajka RV, Younessi D, Fink W, Sadun AA, Sebag J (2007) *Quantitative Analysis of Central Visual Field Defects Using 3D Threshold Amsler Grid Test in Patients with Macular Edema*, ARVO (Association for Research in Vision and Ophthalmology) 2007 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2007 48: E-Abstract 5522, abstract and poster

46. Michalska AM, Fink W (2007) *Accessible Webpage Design For The General Public, Domain Experts, And Visually Impaired*; ARVO (Association for Research in Vision and Ophthalmology) 2007 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2007 48: E-Abstract 3564, abstract and poster
47. Tarbell MA, Fink W (2008) Ocular Sensor Reader Systems for Treatment and Management of Glaucoma; ARVO (Association for Research in Vision and Ophthalmology) 2008 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2008 49: E-Abstract 4227, abstract and poster
48. Robison CD, Jivrajka RV, Bababeygy SR, Fink W, Sadun AA, Sebag J (2009) Distinguishing Dry vs. Wet AMD with 3-D Computer-automated Threshold Amsler Grid Test; ARVO (Association for Research in Vision and Ophthalmology) 2009 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2009 50: E-Abstract 257, abstract and poster
49. Fink W, Tarbell MA (2009) μ AVS²: Microcomputer-Based Artificial Vision Support System for Real-Time Image Processing for Camera-Driven Visual Prostheses; ARVO (Association for Research in Vision and Ophthalmology) 2009 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2009 50: E-Abstract 4748, abstract and paper
50. Tarbell MA, Fink W (2009) CYCLOPS: A Mobile Robotic Platform for Testing and Validating Image Processing Algorithms in Support of Visual Prostheses; ARVO (Association for Research in Vision and Ophthalmology) 2009 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2009 50: E-Abstract 4218, abstract and poster
51. Wang MY, Cuzzo LM, Robison CD, Niemeyer M, Nguyen DT, Fink W, Sadun AA, Sebag J (2010) Quantifying the Effects of Macular Pucker Vitrectomy Surgery on Macular Structure and Function; ARVO (Association for Research in Vision and Ophthalmology) 2010 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2010 51: E-Abstract 6318, abstract and poster
52. Robison CD, Wang MY, Cuzzo LM, Niemeyer M, Fink W, Sadun AA, Sebag J (2010) Quantitative Correlation of Macular Structure by OCT-SLO With Function Using 3-D Computerized Threshold Amsler Grid in Age-Related Macular Degeneration and Macular Pucker; ARVO (Association for Research in Vision and Ophthalmology) 2010 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2010 51: E-Abstract 6319, abstract and poster
53. You C, Fink W (2010) Automated and Integrated Analysis and Characterization System for Visual Field Defects in 3D; ARVO (Association for Research in Vision and Ophthalmology) 2010 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2010 51: E-Abstract 2335, abstract and poster
54. Fink W, You CX, Sadun AA, Tarbell MA (2010) Comprehensive Visual Field Test and Diagnosis System for Visual Performance Assessment in Military Settings; 27th Army Science Conference 2010, Orlando, Florida, abstract and poster
55. Ahmed KA, Tozer KR, Robison CD, Wang MY, Fink W, Sadun AA, Sebag J (2011) Macular Dysfunction and Structure in Macular Pucker with Good Visual Acuity; ARVO (Association for Research in Vision and Ophthalmology) 2011 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2011 52: E-Abstract 6627, abstract and paper
56. Tozer KR, Yee K, Fink W, Sadun AA, Sebag J (2011) 3D Computerized Threshold Amsler Grid Testing Predicts IS/OS Junction Disruption in Macular Pucker, American Academy of Ophthalmology Meeting, Orlando, Florida, October 22-25, 2011, abstract and poster

57. Fink W, You CX, Tarbell MA (2012) Web-accessible Visual Field Test and Analysis System for Multi-Center Studies and Touchpad Device Access; ARVO (Association for Research in Vision and Ophthalmology) 2012 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2012 53: E-Abstract 4838, abstract and poster
58. Fink W, Schmid EW (2013) Electric Field Shaping Via Separatrices For Focused Electric Retinal Stimulation Via Retinal Implants; ARVO (Association for Research in Vision and Ophthalmology) 2013 Conference, abstract and talk
59. Lin K, Fink W, Kamjoo S, Davis M, Chang T (2013) 3-D Computer-Automated Threshold Amsler Grid to Quantify Retinal Deficits Before and After Standard Treatment of Wet Age-related Macular Degeneration; ARVO (Association for Research in Vision and Ophthalmology) 2013 Conference, abstract and poster presentation
60. Milyutkina S, Fink W, Kovalevskaya M (2014) Method for comparative evaluation of therapeutic efficacy in dry AMD patients using 3D-CTAG; EVER (European Association for Vision and Eye Research) 2014 Conference, abstract and poster presentation
61. Milyutkina S, Fink W, Kovalevskaya M (2014) Detecting recurrence of macular edema in patients with wet AMD after anti-VEGF treatment using 3D-CTAG test; EVER (European Association for Vision and Eye Research) 2014 Conference, abstract and poster presentation
62. Nguyen J, Yee K, Wa C, Fink W, Sadun AA, Sebag J (2014) 3D-Threshold Amsler Grid Quantification of Distortions in Macular Pucker & Vitreo-Macular Traction; AAO (American Academy of Ophthalmology) 2014 Conference, abstract and poster presentation
63. Fink W, Tarbell MA (2015) Smart Ophthalmics: A Smart Service Platform for Tele-Ophthalmology; ARVO (Association for Research in Vision and Ophthalmology) 2015 Conference, abstract and poster presentation
64. Fink W, Adams, C, Cerwin J (2015) Portable, Comprehensive, Tele-medical Assessment of Visual Performance in Warfighters, Veterans, and Civilians; 2015 Military Health System Research Symposium (MHSRS), accepted as abstract and poster presentation

Invited Lectures, Seminars and Colloquia (since 1997):

1. Fink W (Oct 1997) *Application of theoretical-physical methods in ophthalmology*, invited talk, Department of Physics, University of Lund, Sweden
2. Fink W (22 May 1998) *Applications of Theoretical Physics in Ophthalmology*, Kellogg Seminar, Division of Physics, Mathematics & Astronomy at the California Institute of Technology
3. Fink W (02 Dec 1998) *Applications of Theoretical Physics in Investigative Ophthalmology and Visual Sciences*, Physics and Astronomy Colloquium (invited talk), Department of Physics and Astronomy at the California State University Northridge
4. Fink W (07 Apr 1999) *Applications of Theoretical Physics in Investigative Ophthalmology and Visual Sciences*, invited talk, Department of Physics and Astronomy at the California State University Los Angeles
5. Fink W (25 June 1999) *Applications of Theoretical Physics in Investigative Ophthalmology and Visual Sciences - Possible Clinical Applications*, invited talk at Grand Rounds, Doheny Eye Institute at the University of Southern California (USC)
6. Fink W (19 Nov 1999) *On the Human Eye, the Origin of Life, and finding THE Sequence in the Universe*, invited talk, Center for Integrated Space Microsystems (CISM) at the Jet Propulsion Laboratory (JPL)

7. Fink W (3 Nov 2000) *Project "Eyemovie": Motion Visualization of Eye Defects*, invited talk at the Dr. Isaac Bekhor Seminar Series, Doheny Eye Institute at the University of Southern California (USC)
8. Fink W (1 Dec 2000) *Novel 3D Visual Field Test and Project "Eyemovie": Motion Visualization of Eye Defects*, invited guest at the Live-TV-Show CU@USC on Trojan Vision Television, a service of the USC Annenberg Center, University of Southern California (USC)
9. Fink W (4 Dec 2000) *Project "Eyemovie": Motion Visualization of Eye Defects and 3D Computer-based Threshold Amsler Grid Test*, invited talk at the Medical Technology Program Group at the Lawrence Livermore National Laboratory
10. Fink W (2 Feb 2001) *3D Computer-based Threshold Amsler Grid Test*, invited talk at the Dr. Isaac Bekhor Seminar Series, Doheny Eye Institute at the University of Southern California (USC)
11. Fink W (19 Jul 2002) *Project "Eyemovie": Motion Visualization of Eye Defects and 3D Computer-automated Threshold Amsler Grid Test*, invited talk at the Department of Ophthalmology at the Loma Linda University
12. Fink W (14 Jan 2003) *To See or Not to See...Tools for Early Detection, Diagnosis and Prevention of Eye Disorders*, invited all-Lab Lecture at JPL
13. Fink W (2 March, 2003) *To See or Not to See...Tools for Early Detection, Diagnosis and Prevention of Eye Disorders*, invited talk at the Mardi Gras Conference in Baton Rouge, Louisiana
14. Fink W (7 Apr 2003) *To See or Not to See...Tools for Early Detection, Diagnosis and Prevention of Eye Disorders*, invited Lecture at the Caltech Bioengineering Seminar (Dr. Mory Gharib)
15. Fink W (11 Apr 2003) *To See or Not to See...Tools for Early Detection, Diagnosis and Prevention of Eye Disorders*, invited Lecture at the Bioengineering Seminar at the University of Southern California (Dr. Aluisio Prata)
16. Fink W (17 Jan 2004) *Robotic Eyes!*, invited Lecture at the Reuben H. Fleet Science Center, San Diego
17. Fink W (12 May 2004) *To See or Not to See..., Tools for Early Detection, Diagnosis and Prevention of Eye Disorders in Space and on Earth*, invited Lecture at the Tri County Eye Society, March Airfield Museum, Inland Empire
18. Fink W (20 August 2004) *To See or Not to See... Tools for Early Detection, Diagnosis and Prevention of Eye Disorders in Space and on Earth*, invited lecture at the Baskin School of Engineering at the University of California Santa Cruz
19. Fink W (2 November 2004) *To See or Not to See...*, invited lecture at the School of Biomedical Engineering at the University of Southern California
20. Fink W (18 Nov 2004) *To See or Not to See..., Tools for Early Detection, Diagnosis and Prevention of Eye Disorders in Space and on Earth*, JPL's von Karman Lecture Series and Webcast
21. Fink W (19 Nov 2004) *To See or Not to See..., Tools for Early Detection, Diagnosis and Prevention of Eye Disorders in Space and on Earth*, JPL's von Karman Lecture Series at Pasadena Community College, Pasadena, CA
22. Liu W, Fink W, Tarbell M, Sivaprakasam M (May 2005) *Image Processing and Interface for Retinal Visual Prostheses*; invited lecture at ISCAS 2005 Conference

23. Fink W (15 Sep 2005) *Introduction to Biomimetic Neural Engineering: Biomimetic Image Processing*; invited guest lecture for BME-452 class at the School of Biomedical Engineering at the University of Southern California
24. Fink W (3 October 2005) *Introduction to Biomimetic Neural Engineering*; invited guest lecture for BE-167 bioengineering class at the California Institute of Technology
25. Fink W (16 Feb 2006) *To See or Not to See..., Tools for Early Detection, Diagnosis and Prevention of Eye Disorders in Space and on Earth*, Distinguished Speaker, The IEEE San Fernando Valley Section of the Engineering in Medicine and Biology Society
26. Fink W (26 May 2006) *Project simEye: Motion Visualization of Eye Defects*, invited talk at the Dr. Isaac Bekhor Seminar Series, Doheny Eye Institute at the University of Southern California (USC)
27. Fink W (21 Sep 2006) *Biomimetic Image Processing*; invited guest lecture for BME-452 class at the School of Biomedical Engineering at the University of Southern California
28. Fink W (22 March 2007) *To See or Not to See...*; invited guest lecture for the GATE Program at the Newport-Mesa Unified School District, Costa Mesa Neighborhood Community Center
29. Fink W (27 Sep 2007) *Biomimetic Image Processing*; invited guest lecture for BME-452 class at the School of Biomedical Engineering at the University of Southern California
30. Fink W, Kornfield JA, Grubbs RH (11 Feb 2008) *To See or Not to See...Detection, Diagnosis, and Remedies for Eye Disorders*, Expert Panel Presentation at the Executive Forum, California Institute of Technology
31. Fink W (2 Mar 2008) *To See or Not to See...*; invited Plenary Speaker at the IEEE Aerospace Conference, Big Sky, Montana
32. Fink W (12 Mar 2008) *To See or Not to See... Detection, Diagnosis, and Remedies for Eye Disorders*; invited guest lecture at the Health Science Center at the University of Texas at Houston
33. Fink W (17 Sep 2008) *Biomimetic Image Processing*; invited guest lecture for BME-452 class at the School of Biomedical Engineering at the University of Southern California
34. Fink W (30 Sep 2009) *Biomimetic Image Processing*; invited guest lecture for BME-452 class at the School of Biomedical Engineering at the University of Southern California
35. Fink W (13 Aug 2009) *To See or Not to See: Detection, Diagnosis, and Remedies for Eye Disorders*, Neuromorphic Engineering Student Society (NESS), California Institute of Technology
36. Fink W (21 May 2012) *To See or Not to See: Detection, Diagnosis, and Remedies for Eye Disorders*, invited seminar Dept. of Bioengineering, Henry Samueli School of Engineering and Applied Science, UCLA
37. Fink W (7 Oct 2012) *Worldwide Accessible Comprehensive Visual Field Testing*; invited speaker at the "Okularfest 2012" at Caltech, Pasadena, CA
38. Fink W (20 Dec 2012) *To See or Not to See... Detection, Diagnosis, and Remedies for Eye Disorders*; invited talk at Carl Zeiss, Jena, Germany
39. Fink W (15 Jul 2013) *Comprehensive Visual Field Test & Diagnosis System in Support of Astronaut Health and Performance*; invited talk at NASA/Wyle, Houston, TX
40. Fink W (16 Jul 2013) *Comprehensive Visual Field Test & Diagnosis System in Support of Astronaut Health and Performance*; invited talk at NSBRI, Houston, TX
41. Fink W (28 Aug 2013) *From Artificial Vision to Autonomous Missions*; invited talk at the ECE Department, Rice University, Houston, TX
42. Fink W (29 Aug 2013) *Comprehensive Visual Field Test & Diagnosis System in Support of*

Curriculum Vitae of Prof. Dr. Wolfgang Fink

July 2015

- Astronaut Health and Performance; invited talk at NSBRI Sensorimotor Workshop on "Towards Integrated Countermeasures", Houston, TX
43. Fink W (6 Oct 2013) Artificial Vision; invited speaker at the "Okularfest 2013" at Caltech, Pasadena, CA
 44. Fink W (5 Oct 2014) Visualization of Optical Eye Defects; invited speaker at the "Okularfest 2014" at Caltech, Pasadena, CA
 45. Fink W (18 Nov 2014) Worldwide-accessible Comprehensive Visual Field Test & Diagnosis System & Smartphone-based Ophthalmic Examination Devices; invited talk and participation on the Telemedicine Pioneers Panel at the Western Pennsylvania Healthcare Summit, Cranberry Township, PA
 46. Fink W (21 Nov 2014) Making Full Use of the High-Resolution Image Capability of Smartphones to Collect Data through Ophthalmic Devices for Smart Mobile- and Tele-Health; invited poster presentation at the invitation-only MIT-NSF Workshop: "Smarter Service Systems through Innovation Partnerships and Transdisciplinary Research," Cambridge, MA
 47. Fink W (6 Mar 2015) 3D Visual Field Test as a Prime Example of Tele-Ophthalmology on Earth and in Space; invited speaker at the 12th Annual World Congress of the Society for Brain Mapping and Therapeutics, Los Angeles

Publications Related to Autonomous Robotics and Reasoning Systems

Contributions in Refereed Journals:

1. Fink W, Dohm JM, Tarbell MA, Hare TM, Baker VR (2005) *Next-Generation Robotic Planetary Reconnaissance Missions: A Paradigm Shift*; Planetary and Space Science, 53, 1419-1426
2. Schulze-Makuch D, Dohm JM, Fairén AG, Baker VR, Fink W, Strom RG (2005) *Venus, Mars, and the Ices on Mercury and the Moon: Astrobiological Implications and Proposed Mission Designs*; Astrobiology, 5, 778-795
3. Fink W, Dohm JM, Tarbell MA, Hare TM, Baker VR, Schulze-Makuch D, Furfaro R, Fairén AG, Ferré TPA, Miyamoto H, Komatsu G, Mahaney WC (2006) *Autonomous Tier-Scalable Reconnaissance Missions For Remote Planetary Exploration*; Proceedings of the 4th International Planetary Probe Workshop 2006, Pasadena
4. Fink W (2006) *Generic Prioritization Framework for Target Selection and Instrument Usage for Reconnaissance Mission Autonomy*, Proceedings of IEEE World Congress on Computational Intelligence (WCCI) 2006, Vancouver, Canada, 11116-11119
5. Schulze-Makuch, Dohm JM, Fan C, Fairén AG, Rodriguez JAP, Baker VR, Fink W (2007) *Exploration of Hydrothermal Targets on Mars*; Icarus; DOI:10.1016/j.icarus.2007.02.007
6. Fink W, Dohm JM, Tarbell MA, Hare TM, Baker VR, Schulze-Makuch D, Furfaro R, Fairén AG, Ferré TPA, Miyamoto H, Komatsu G, Mahaney WC (2007) *Tier-Scalable Reconnaissance Missions For The Autonomous Exploration Of Planetary Bodies*; IEEE Aerospace Conference Proceedings, paper #1199; DOI: 10.1109/AERO.2007.352715
7. Fink W, George T, Tarbell MA (2007) *Tier-Scalable Reconnaissance: The Challenge of Sensor Optimization, Sensor Deployment, Sensor Fusion, and Sensor Interoperability*; Proc. SPIE, Vol. 6556, 655611 (2007); DOI:10.1117/12.721486 (invited paper)
8. Schulze-Makuch, D., Houtkooper, J.M., Knoblauch M., Furfaro, R., Fink, W., Fairén, A.G., Vali, H., Head, J.N., Lim, D.S.S., Dohm, J., Irwin, L.N., Daly, M., and Andersen, D. (2007) *The Biological Oxidant and Life Detection (BOLD) Mission: An outline for a new mission to Mars*. Proc. SPIE, Vol. 6694, 669400 (2007); DOI:10.1117/12.732155
9. Furfaro R, Dohm JM, Fink W, Kargel JS, Schulze-Makuch D, Fairén AG, Ferré PT, Palmero-Rodriguez A, Baker VR, Hare TM, Tarbell M, Miyamoto HH, Komatsu G (2007) *The Search for Life Beyond Earth Through Fuzzy Expert Systems*; Planetary and Space Science, 56, 448-472
10. Fink W, Datta A, Dohm JM, Tarbell MA, Jobling FM, Furfaro R, Kargel JS, Schulze-Makuch D, Baker VR (2008) *Automated Global Feature Analyzer (AGFA) – A Driver for Tier-Scalable Reconnaissance*; IEEE Aerospace Conference Proceedings, paper #1273; DOI: 10.1109/AERO.2008.4526422
11. Furfaro R, Lunine JJ, Kargel JS, Fink W (2008) *Intelligent systems for the autonomous exploration of Titan and Enceladus*; Proc. SPIE, Vol. 6960, 69600A (2008); DOI:10.1117/12.777643 (invited paper)
12. Kargel JS, Fink W, Furfaro R (2008) *Robotic resource exploration is a key to human expansion through the cosmos*; Proc. SPIE, Vol. 6960, 69600F (2008); DOI:10.1117/12.784643 (invited paper)
13. Miyamoto H, Kargel JS, Fink W, Furfaro R (2008) *Granular processes on Itokawa, a small near-Earth asteroid: Implications for resource utilization*; Proc. SPIE, Vol. 6960, 69600I (2008); DOI:10.1117/12.784634 (invited paper)

14. Fairén AG, Schulze-Makuch D, Rodríguez AP, Fink W, Davila AF, Furfaro R, Uceda ER, Amils R (2008) *Evidence for Amazonian Acidic Liquid Water on Mars – A Review of MER Mission Results*; Planetary and Space Science, Volume 57, Issue 3, p. 276-287.
15. Bassi D, Fink W (2009) *Optimal Attitude Control Parameters via Stochastic Optimization Framework for Autonomous Aircraft*; IEEE Aerospace Conference Proceedings, paper #1753, Big Sky, Montana
16. Fink W, Tarbell MA (2009) *Multi-Rover Test Bed for Tele-Conducted and Autonomous Surveillance, Reconnaissance, and Exploration*; Proc. SPIE, Vol. 7331, 73310B (2009); DOI: 10.1117/12.819991
17. Furfaro R, Kargel JS, Lunine JJ, Fink W, Bishop MP (2010), Identification of cryovolcanism on Titan using fuzzy cognitive maps. Planet. Space Sci., Volume 58, Issue 5, p. 761-779, doi:10.1016/j.pss.2009.12.003
18. Dohm, J. M., H. Miyamoto, G. G. Ori, A. G. Fairén, A. F. Davila, G. Komatsu, W. C. Mahaney, J.-P. Williams, S. B. Joye, G. Di Achille, D. Oehler, G. Marzo, D. Schulze-Makuch, V. Acocella, M. Glamoclija, M. Pondrelli, P. Boston, C. R. Allen, R. C. Anderson, V. R. Baker, W. Fink, A. R. Frazer, R. Furfaro, C. H. Gross, T. M. Hare, K. M. Hart, F. Ip, B. P. Kelleher, K. J. Kim, S. Maruyama, P. C. McGuire, D. Netoff, J. Parnell, L. Wendt, S. Wheelock, and A. Steele (2011) An inventory of potentially habitable environments on Mars: geological and biological perspectives, in *Analogues for Planetary Exploration*, B. Gerry and J. Bleacher, eds., Special Paper, Geological Society of America, pp. 317-347, Boulder, Colorado
19. Fink W, Tarbell MA, Furfaro R, Powers L, Kargel JS, Baker VR, Lunine J (2011) *Robotic Test Bed for Autonomous Surface Exploration of Titan, Mars, and Other Planetary Bodies*; IEEE Aerospace Conference Proceedings, paper #1770, Big Sky, Montana
20. Furfaro R, Kargel JS, Fink W (2011) Autonomous Real-Time Site Selection for Venus and Titan Landing Using Evolutionary Fuzzy Cognitive Maps; ICAI Conference Proceedings, paper #ICA5183, Las Vegas, Nevada
21. Fink W, Tuller M, Jacobs A, Kulkarni R, Tarbell MA, Furfaro R, Baker VR (2012) *Robotic Lake Lander Test Bed for Autonomous Surface and Subsurface Exploration of Titan Lakes*; IEEE Aerospace Conference Proceedings, paper #1285, Big Sky, Montana
22. Schulze-Makuch D, Head JN, Houtkooper JM, Knoblauch M, Furfaro R, Fink W, Fairén AG, Vali H, Sears SK, Daly M, Deamer D, Schmidt H, Hawkins AR, Sun HJ, Lim DSS, Dohm J, Irwin LN, Davila AF, Mendez A, Andersen D (2012) *The Biological Oxidant and Life Detection (BOLD) mission: A proposal for a mission to Mars*; Planet. Space Sci., 67, 57-69
23. Furfaro R, Fink W, Kargel JS (2012) Autonomous Real-Time Site Selection for Venus and Titan Landing Using Evolutionary Fuzzy Cognitive Maps; Applied Soft Computing, Volume 12, Issue 12, December 2012, Pages 3825–3839, <http://dx.doi.org/10.1016/j.asoc.2012.01.014>
24. Fink W, Sun HJ, Mahaney WC, Kuhlman KR, Schulze-Makuch D (2013) Planetary Imaging In Powers Of Ten: A Multi-scale, Multi-purpose Astrobiological Imager; Astrobiology, Volume 13, Number 11, pp. 1005-1010 (made Journal Cover)
25. Fink W, Baker VR, Schulze-Makuch D, Hamilton CW, Tarbell MA (2015) *Autonomous Exploration of Planetary Lava Tubes Using a Multi-Rover Framework*; IEEE Aerospace Conference Proceedings, paper #2723, Big Sky, Montana
26. J.M. Dohm, T.M. Hare, S.J. Robbins, J.-P. Williams, R.J. Soare, M.R. El-Maarry, S.J. Conway, D.L. Buczkowski, J.S. Kargel, M.E. Banks, A.G. Fairén, D. Schulze-Makuch, G.

Komatsu, H. Miyamoto, R.C. Anderson, A.F. Davila, W.C. Mahaney, W. Fink, H.J. Cleaves, J. Yan, B. Hynek, S. Maruyama (2015) Geological and hydrological histories of the Argyre province, Mars, *Icarus*, Volume 253, June 2015, Pages 66-98, ISSN 0019-1035, <http://dx.doi.org/10.1016/j.icarus.2015.02.017>.

Book Contributions:

1. Schulze-Makuch D, Dohm JM, Fairén AG, Baker VR, Fink W, Strom RG (2006) *Geology of the Terrestrial Planets with Implications to Astrobiology and Mission Design*; Chapter 1 in "Space Science: New Research", Ed. N. S. Maravell. Nova Science Publishers, Hauppauge, NY. ISBN: 1-60021-005-8
2. Schulze-Makuch D, Dohm JM, Fairén AG, Baker VR, Fink W, Strom RG (2006) *Geology of the Terrestrial Planets with Implications to Astrobiology and Mission Design*; Chapter 3 in *Journal of Magnetohydrodynamics, Plasma and Space Research*, Volume 14 Issue 1/2, Nova Science Publishers, Hauppauge, NY.
3. Fink W, Tarbell MA, Jobling FM (2008) *Tier-Scalable Reconnaissance - A Paradigm Shift in Autonomous Remote Planetary Exploration of Mars and Beyond*; Chapter 1 in "Planet Mars Research Focus", Ed. L. A. Costas. Nova Science Publishers, Hauppauge, NY. ISBN: 1-60021-826-1
4. Kargel J, Furfaro R, Kaser G, Leonard G, Fink W, Huggel C, Käab A, Raup B, Reynolds J, Wolfe D, and Zapata M (2011) *ASTER Imaging and Analysis of Glacier Hazards*; Chapter 15 in *Land Remote Sensing and Global Environmental Change: NASA's Earth Observing System and the Science of Terra and Aqua*, B. Ramachandran, Christopher O. Justice, and M.J. Abrams (Eds.), pp 325-373, Springer, New York.

Conference Contributions:

1. Mjolsness E, Davies AG, Castano R, Lou J, Fink W (2000) *Autonomous Rover-Based Scientific Investigation Using Invertible Mathematical Models*, abstract and poster, American Geophysical Union (AGU) Meeting, Fall 2000, San Francisco, California
2. Davies AG, Fink W, Castano R, Barrett A, Mjolsness E, Burl M (2001) *Observing Active Volcanism on Earth and Beyond With an Autonomous Science Investigation Capability*, abstract and poster, American Geophysical Union (AGU) Meeting, Fall 2001, San Francisco, California
3. Fink W, Castano R, Davies A, Mjolsness E (2001) *Clustering Algorithm for Mutually Constraining Heterogeneous Features*, Technical Report JPL-ICTR-01-5
4. Castano R, Anderson RC, Fox J, Dohm JM, Haldemann AFC, Fink W (2002) *Automating Shape Analysis of Rocks on Mars*, abstract and poster, Lunar and Planetary Science Conference (LPSC) 2002, March 2002, Houston, Texas
5. Fink W, Dohm JM, Tarbell MA, Hare TM, Baker VR (2005) *Next-Generation Robotic Planetary Surface/Subsurface Reconnaissance Missions: A Paradigm Shift* [abstract 1977]. In 36th *Lunar and Planetary Science Conference Abstracts* [CD-ROM], Lunar and Planetary Institute, Houston; abstract and poster
6. Fink W, Dohm J, Tarbell M, Hare T, Baker V (2005) *Next-Generation Robotic Planetary Reconnaissance Missions: A Paradigm Shift*, Symposium SS-56: "New results from the robotic exploration of Mars and Titan and their implications on planetary environmental conditions and cosmochemistry". In *Abstracts of the 15th Annual V.M. Goldschmidt*

- Conference, Moscow, Idaho. Geochimica et Cosmochimica Acta*, Volume 69, Number 10S, A533; abstract and invited lecture
7. Fink W, Datta A, Baker V (2005) *AGFA: (Airborne) Automated Geologic Field Analyzer*, Symposium SS-56: "New results from the robotic exploration of Mars and Titan and their implications on planetary environmental conditions and cosmochemistry". In *Abstracts of the 15th Annual V.M. Goldschmidt Conference, Moscow, Idaho. Geochimica et Cosmochimica Acta*, Volume 69, Number 10S, A535; abstract and poster
 8. Fink W, Dohm JM, Tarbell MA, Hare TM, Baker VR, Schulze-Makuch D, Furfaro R, Fairén AG, Ferré TPA, Miyamoto H, Komatsu G, Mahaney WC (2006) *Multi-tier Multi-agent Autonomous Robotic Planetary Surface/Subsurface Reconnaissance For Life* [abstract 1433]. In 37th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 9. Schulze-Makuch D, Dohm JM, Fairén AG, Baker VR, Fink W, Strom RG (2006) *Sample Return Missions to Mars, Venus, and the Ices on Mercury and the Moon* [abstract 1324]. In 37th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 10. Furfaro R, Dohm JM, Fink W, Schulze-Makuch D, Fairén AG, Tarbell MA, Hare TM, Baker VR (2006) *Multi-Layer Fuzzy Logic-based Expert System for Conducting Tier-scalable Planetary Reconnaissance* [abstract 1257]. In 37th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 11. Furfaro R, Dohm JM, Fink W (2006) *Fuzzy Logic Expert System for Tier-scalable Planetary Reconnaissance*, 9th International Conference on Space Operations, AIAA, Rome, Italy, June 19-23, 2006
 12. Dohm JM, Fink W, Tarbell MA, Hare TM, Schulze-Makuch D, Furfaro R, Baker VR (2006) *Tier-scalable Reconnaissance To Test Overarching Geological Theories and Locate Prime Targets on Mars*; abstract at the 25th International Space Development Conference 2006, Los Angeles
 13. Fink W, Dohm JM, Schulze-Makuch D, Fairén AG, Baker VR, Furfaro R, Tarbell MA, Hare TM (2006) *Tier-Scalable Reconnaissance for Remote Planetary Exploration*; abstract at the 25th International Space Development Conference 2006, Los Angeles
 14. Furfaro R, Dohm JM, Fink W (2006) *Autonomy in Planetary Exploration: Fuzzy Expert System for Tier-Scalable Reconnaissance*; abstract at the 25th International Space Development Conference 2006, Los Angeles
 15. Fink W, Mahaney WC, Kuhlman KR (2007) *Adapter-based Microscopic and Wide-angle Imaging Capability For Digital Cameras For Planetary Exploration and Astrobiology* [abstract 2397]. In 38th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 16. Fink W and Tarbell MA (2007) *Tier-scalable Reconnaissance Mission Test Bed: Implementation of Ground-Tier* [abstract 2410]. In 38th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 17. Schulze-Makuch D, Dohm JM, Fairén AG, Fink W, Fan C, Rodriguez JAP, Baker VR (2007) *Prioritizing Putative Hydrothermal Sites on Mars* [abstract 1735]. In 38th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 18. Furfaro R, Dohm JM, Fink W, Kargel JS, Schulze-Makuch D, Fairén AG, Ferré TPA, Tarbell MA, Hare TM, Komatsu G, Palmero-Rodriguez AJ, Baker VR, Miyamoto H (2007) *Searching For Life On Extraterrestrial Bodies: Fuzzy Autonomous Systems For Planetary*

- Reconnaissance* [abstract 1372]. In 38th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
19. Bearman GH, Johnson WR, Fink W, Wilson DW (2007) *An Intelligently Reconfigurable Snapshot Imaging Spectrometer For Planetary Exploration* [abstract 1103]. In 38th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 20. Johnson WR, Fink W, Wilson D, Bearman G (2007) Electronically Reconfigurable Imaging Spectrometer, 7th IAA International Conference on Low-Cost Planetary Missions 2007, Pasadena, CA, abstract and poster
 21. Fink W, Tarbell MA (2007) Tier-Scalable Reconnaissance© - A Paradigm Shift in Autonomous Robotic Planetary Exploration, 7th IAA International Conference on Low-Cost Planetary Missions 2007, Pasadena, CA, abstract and poster
 22. Schulze-Makuch D, Houtkooper JM, Knoblauch M, Furfaro R, Fink W, Head JN, Fairén AG, Vali H, Daly M, Deamer D, Schmidt H, Hawkins AR, Sun HJ, Lim DSS, Dohm J, Irwin LN, Davila A, Andersen D (2008) A Proposal for a New Mission to Mars: The Biological Oxidant and Life Detection (BOLD) Mission; Session 3: Approaches and Technologies to Detect Life on Mars, of the Astrobiology Science Conference (AbSciCon) 2008, Santa Clara, CA, invited abstract and talk
 23. Furfaro R, Dohm JM, Fink W, Kargel JS, Schulze-Makuch D, Fairén AG, Palmero-Rodriguez A, Baker VR, Ferré PT, Hare TM, Tarbell M, Miyamoto HH, Komatsu G (2008) Searching for Life on Mars via Fuzzy Autonomous Systems; Session 3: Approaches and Technologies to Detect Life on Mars, of the Astrobiology Science Conference (AbSciCon) 2008, Santa Clara, CA, abstract and talk
 24. Fink W and Tarbell MA (2008) Multi-Rover Test Bed for Tele-Conducted and Autonomous Surface Operations for the Moon and Mars [abstract 2472]. In 39th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 25. Fink W, Datta A, Dohm JM, Tarbell MA, Jobling FM, Furfaro R, Kargel JS, Schulze-Makuch D, Lunine JJ, Baker VR (2008) Automated Global Feature Analyzer (AGFA) for the Intelligent and Autonomous Robotic Exploration of the Solar System [abstract 1883]. In 39th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 26. Dohm JM, Miyamoto H, Ori GG, Komatsu G, Pondrelli M, Kim KJ, Anderson RC, Fairén AG, Hare TM, Williams P, Ruiz J, Davila AF, McGuire PC, Mahaney WC, Schulze-Makuch D, Fink W, Boston P, Di Achille G, Glamoclija M, Allen C, Oehler D, Baker VR, Maruyama S, Ip F, Wheelock SJ (2010) Linkage among Geology, Hydrology, Climate, and Life on Earth Point to Possible Life-containing Environments on Mars [abstract 2360]. In 41st Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 27. Furfaro R, Kargel JS, Fink W, Bishop MP (2010) Fuzzy Cognitive Maps for Glacier Hazards Assessment: Application to Predicting the Potential for Glacier Lake Outbursts; 2010 AGU Fall Meeting, abstract and poster
 28. Kargel JS, Fink W, Furfaro R, Leonard GJ, Patterson M, Title of Team: GLIMS, GAPHAZ (2010) Hunza Landslide and Monsoon Flooding in Pakistan Call for International Attention to Transboundary Natural Hazards; 2010 AGU Fall Meeting, abstract and talk
 29. Fink W, Tarbell MA, Furfaro R, Kargel JS (2010) Tier-Scalable Reconnaissance Missions for Autonomous Exploration and Spatio-Temporal Monitoring of Climate Change with

- Particular Application to Glaciers and their Environs; 2010 AGU Fall Meeting, abstract and talk
30. Schulze-Makuch D, Fink W, Head JN, Houtkooper JM, Knoblauch M, Furfaro R, Fairén AG, Vali H, Sears SK, Daly M, Deamer D, Schmidt H, Hawkins AR, Sun HJ, Lim DSS, Dohm J, Irwin LN, Davila AF, Mendez A, Andersen D (2012) The Biological Oxidant And Life Detection (BOLD) Mission: A Proposal For A Mission To Mars; NASA Workshop at Lunar and Planetary Institute on "Concepts and Approaches for Mars Exploration", Houston, Texas, abstract and talk
 31. Fink W, Baker VR, Schulze-Makuch D, Hamilton CW, Tarbell MA (2015) Multi-Rover Framework to Autonomously Explore Planetary Lava Tubes [abstract 3011]. In 46th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
 32. J.M. Dohm, H. Miyamoto, A.G. Fairén, V.R. Baker, M., Spagnuolo, R.C. Anderson, G. Komatsu, W. Fink, W.C. Mahaney, D. Schulze-Makuch, T.M. Hare, M.R. El-Maarry, J.-P. Williams, C.E. Viviano-Beck, S. Karunatillake, T. Niihara, S. Maruyama (2015) MARS CHANGING ENVIRONMENT, HABITABILITY, AND PRIME TARGETS; Astrobiology Science Conference (AbSciCon) 2015, Chicago, IL; abstract and oral presentation
 33. Dirk Schulze-Makuch, Dale Andersen, Mike Daly, Alfonso F. Davila, David Deamer, James Dohm, Alberto G. Fairén, Wolfgang Fink, Roberto Furfaro, Aaron R. Hawkins, James N. Head, Joop M. Houtkooper, Louis N. Irwin, Michael Knoblauch, Darlene S.S. Lim, Abel Mendez, Holger Schmidt, S. Kelly Sears, Henry J. Sun, Hojatollah Vali (2015) The Biological Oxidant and Life Detection (BOLD) mission: A proposal for a low-cost mission to Mars; 11th Low-Cost Planetary Missions Conference, LCPM-11, Berlin, Germany; abstract and oral presentation

Invited Lectures, Seminars and Colloquia (since 1997):

1. Fink W (14 Apr 1998) *Laser Control of Chemical Reactions*, Kellogg Journal Club, Division of Physics, Mathematics & Astronomy at the California Institute of Technology
2. Fink W (03 Jul 1998) *Thermodynamical Quantities Accessible Via Electrochemical Measurements - A brief introduction to Electrochemistry*, Astrobiology Seminar, Division of Geological & Planetary Sciences at the California Institute of Technology
3. Fink W, Dohm J, Tarbell M, Hare T, Baker V (May 2005) *Next-Generation Robotic Planetary Reconnaissance Missions: A Paradigm Shift*, invited lecture for Symposium SS-56: "New results from the robotic exploration of Mars and Titan and their implications on planetary environmental conditions and cosmochemistry", of the 15th Annual Goldschmidt Conference: "A Voyage of Discovery", Moscow, Idaho
4. Dohm JM, Fink W, Tarbell MA, Hare TM, Schulze-Makuch D, Furfaro R, Baker VR (6 May 2006) *Tier-scalable Reconnaissance To Test Overarching Geological Theories and Locate Prime Targets on Mars*; invited talk at the 25th International Space Development Conference 2006, Los Angeles
5. Fink W, Dohm JM, Schulze-Makuch D, Fairén AG, Baker VR, Furfaro R, Tarbell MA, Hare TM (6 May 2006) *Tier-Scalable Reconnaissance for Remote Planetary Exploration*; invited talk at the 25th International Space Development Conference 2006, Los Angeles
6. Furfaro R, Dohm JM, Fink W (6 May 2006) *Autonomy in Planetary Exploration: Fuzzy Expert System for Tier-Scalable Reconnaissance*; invited talk at the 25th International Space Development Conference 2006, Los Angeles

7. Fink W (25 January 2007) *Tier-Scalable Reconnaissance: A Paradigm Shift in Autonomous Planetary Exploration*; invited guest speaker at the IEEE - Buena Ventura Section AeroSpace & Electronic Systems Chapter
8. Fink W, George T, Tarbell MA (12 Apr 2007) *Tier-Scalable Reconnaissance: The Challenge of Sensor Optimization, Sensor Deployment, Sensor Fusion, and Sensor Interoperability*; invited talk at the SPIE Defense & Security Symposium, Orlando, Florida
9. Fink W (22 June 2007) *Tier-Scalable Reconnaissance: A Paradigm Shift in Autonomous Planetary Exploration*; invited guest speaker at the Computer Science Software Engineering Seminar at the Concordia University, Montreal, Canada
10. Furfaro R, Lunine JJ, Kargel JS, Fink W (18 Mar 2008) *Intelligent systems for the autonomous exploration of Titan and Enceladus*; invited talk at the SPIE Defense & Security Symposium, Orlando, Florida
11. Kargel JS, Fink W, Furfaro R (18 Mar 2008) *Robotic resource exploration is a key to human expansion through the cosmos*; invited talk at the SPIE Defense & Security Symposium, Orlando, Florida
12. Miyamoto H, Kargel JS, Fink W, Furfaro R (18 Mar 2008) Granular processes on Itokawa, a small near-Earth asteroid: Implications for resource utilization; invited talk at the SPIE Defense & Security Symposium, Orlando, Florida
13. Schulze-Makuch D, Houtkooper JM, Knoblach M, Furfaro R, Fink W, Head JN, Fairén AG, Vali H, Daly M, Deamer D, Schmidt H, Hawkins AR, Sun HJ, Lim DSS, Dohm J, Irwin LN, Davila A, Andersen D (Apr 2008) A Proposal for a New Mission to Mars: The Biological Oxidant and Life Detection (BOLD) Mission; Session 3: Approaches and Technologies to Detect Life on Mars, of the Astrobiology Science Conference (AbSciCon) 2008, Santa Clara, CA, invited abstract and talk
14. Fink W (11 Mar 2010) *Tier-Scalable Reconnaissance: A paradigm shift in next-generation robotic planetary reconnaissance missions*; invited talk at the Department of Systems & Industrial Engineering, University of Arizona
15. Fink W (5 Nov 2010) *Rovers and Vision*; invited talk at the first MacTech Conference 2010, Universal City, CA
16. Fink W (10 Feb 2011) *Robotic test bed for autonomous surface exploration of planetary bodies*; invited talk at the Department of Aerospace and Mechanical Engineering, University of Arizona
17. Fink W (18 Jul 2011) *Autonomous Robotic Space Exploration*; invited talk at Cosmic Musings, Friends of the Observatory lecture cycle, Griffith Observatory, Los Angeles, CA
18. Fink W (26 Sep 2013) *Autonomous Exploration Systems: Research & Development Efforts* at the Visual and Autonomous Exploration Systems Research Laboratory; invited talk at the AUVSI Saguaro Chapter Meeting, University of Arizona
19. Fink W (15 Oct 2013) *Autonomous Robotic Reconnaissance Missions in Extreme Space Environments*; invited Luminary Presentation at the Annual Conference of the Prognostics and Health Management Society 2013, New Orleans, Louisiana
20. Fink W (6 Nov 2013) *Autonomous Robotic Reconnaissance Missions in Extreme Space Environments*; invited talk at the MacTech Conference 2013, Samuel Oschin Air and Space Center, California Science Center, Los Angeles, CA
21. Fink W (6 Dec 2013) *Autonomous Robotic Reconnaissance Missions in Extreme Environments*; invited talk at the Physics Colloquium at the Department of Physics, University of Arizona

Curriculum Vitae of Prof. Dr. Wolfgang Fink

July 2015

22. Fink W (20 Dec 2013) *Autonomous Robotic Exploration for Extreme Space Environments*; invited talk at the Astrophysics Colloquium at the Center of Astronomy and Astrophysics, Technical University Berlin
23. Fink W (30 Sep 2014) *The Challenges of Autonomous Robotic Exploration for Extreme Environments*; invited talk at the Raytheon 2014 Technology Network Symposium "Systems Engineering & Architecture" in Tucson, AZ

Publications Related to Evolutionary Computing Technologies, Computer Optimized Design, and Neural Networks

Contributions in Refereed Journals:

1. Engel A, Fink W (1993) *Statistical mechanics calculation of Vapnik Chervonenkis bounds for perceptrons*, J Phys A: Math Gen 26 6893
2. Nadler W, Fink W (1997) *Finite size scaling in neural networks*, Phys Rev Lett 78 555
3. Terrile RJ, Adami C, Aghazarian H, Chau SN, Dang VT, Ferguson MI, Fink W, Huntsberger TL, Klimeck G, Kordon MA, Lee S, von Allmen P, Xu J (2004) *Evolutionary Computation Technologies for Space Systems*; IEEE Aerospace Conference Proceedings, paper #1257, DOI: 10.1109/AERO.2005.1559733
4. Lee S, von Allmen P, Fink W, Petropoulos AE, Terrile RJ (2004) *Design and Optimization of Low-thrust Orbit Transfers*; IEEE Aerospace Conference Proceedings; DOI: 10.1109/AERO.2005.1559377
5. Keymeulen D, Fink W, Ferguson MI, Peay C, Oks B, Terrile R, Yee K (2004) *Tuning of MEMS Devices using Evolutionary Computation and Open-Loop Frequency Response*; IEEE Aerospace Conference Proceedings, paper #1211; DOI: 10.1109/AERO.2005.1559562
6. Keymeulen D, Fink W, Ferguson MI, Peay C, Oks B, Terrile R, Yee K (2005) *Evolutionary Computation applied to the Tuning of MEMS Gyroscopes*; GECCO 2005 Conference Proceedings, Washington DC
7. Terrile RJ, Aghazarian H, Ferguson MI, Fink W, Huntsberger TL, Keymeulen D, Klimeck G, Kordon MA, Lee S, von Allmen P (2005) *Evolutionary Computation Technologies for the Automated Design of Space Systems*; 2005 NASA/DoD Conference on Evolvable Hardware, IEEE Computer Society, 131-138, DOI: 10.1109/EH.2005.24
8. Lee S, von Allmen P, Fink W, Petropoulos AE, Terrile RJ (2005) *Comparison of Multi-Objective Genetic Algorithms in Optimizing Q-Law Low-Thrust Orbit Transfers*; late-breaking conference paper, GECCO 2005 Conference, Washington DC
9. Keymeulen D, Ferguson MI, Fink W, Oks B, Peay C, Terrile R, Cheng Y, Kim D, MacDonald E, Floor D (2005) *Hardware Platform for MEMS Gyroscopes Tuning based on Evolutionary Computation using Open-Loop and Closed-Loop Frequency Response*; ICES'2005 Conference Proceedings
10. Lee S, Russell RP, Fink W, Terrile RJ, Petropoulos AE, von Allmen P (2006) *Low-Thrust Mission Trade Studies with Parallel, Evolutionary Computing*; IEEE Aerospace Conference Proceedings, paper #1042, DOI: 10.1109/AERO.2006.1656038
11. Terrile RJ, Lee S, Tinetti G, Fink W, Huntsberger TL, von Allmen P (2008) *Evolutionary Computational Methods for the Design of Spectral Instruments*; IEEE Aerospace Conference Proceedings, paper #1194; DOI: 10.1109/AERO.2008.4526675
12. Fink W (2008) *Stochastic Optimization Framework (SOF) for Computer-Optimized Design, Engineering, and Performance of Multi-Dimensional Systems and Processes*; Proc. SPIE, Vol. 6960, 69600N (2008); DOI:10.1117/12.784440 (invited paper)
13. Fink W (2009) *Autonomous Self-Configuration of Artificial Neural Networks for Data Classification or System Control*; Proc. SPIE, Vol. 7331, 733105 (2009); DOI:10.1117/12.821836
14. Fink W, Huntsberger TL, Aghazarian H (2010) *Dynamic Optimization of N-Joint Robotic Limb Deployments*; Journal of Field Robotics, Volume 27, Issue 3, p. 268-280, DOI: 10.1002/rob.20323

15. Kulkarni R, Tuller M, Fink W, Wildenschild D (2012) Three-Dimensional Multiphase Segmentation of X-Ray CT Data of Porous Materials Using a Bayesian Markov Random Field Framework; *Vadose Zone J.* 2012 Vol. 11 No. 1, doi: 10.2136/vzj2011.0082
16. Popov A, Fink W, Hess A (2013) PHM for Astronauts – A New Application; *PHM Conf. Proc.*, pp. 566-572
17. Fink W, Popov A, Hess A (2014) Planning a Pilot Project on the ISS for Crew Health Management & Maintenance Beyond LEO; *IEEE Aerospace Conference Proceedings*, paper #2680, Big Sky, Montana
18. Fink W, Baker VR, Flammia M, Tarbell MA (2015) *Rover Traverse-Optimizing Planner For Multi-Objective Deployment Scenarios*; *IEEE Aerospace Conference Proceedings*, paper #2722, Big Sky, Montana

Book Contributions:

1. Keymeulen D, Ferguson MI, Fink W, Oks B, Peay C, Terrile R, Cheng Y, Kim D, MacDonald E, Floor D (2005) *Hardware Platform for MEMS Gyroscopes Tuning based on Evolutionary Computation using Open-Loop and Closed-Loop Frequency Response*; Chapter 21 in "Evolvable Systems: From Biology to Hardware", Springer Berlin / Heidelberg
2. Keymeulen D, Ferguson MI, Breuer L, Fink W, Oks B, Peay C, Terrile R, Cheng Y, Kim D, MacDonald E, Floor D (2006) *HARDWARE PLATFORMS FOR ELECTROSTATIC TUNING OF MEMS GYROSCOPE USING NATURE INSPIRED COMPUTATION*; Chapter 10 in "Evolvable Hardware", by T. Higuchi, X. Yao, Y. Liu, Eds., Springer Verlag
3. Tuller M, Kulkarni R, Fink W (2013) *Segmentation of X-Ray CT Data of Porous Materials: A Review of Global and Locally Adaptive Algorithms*; Chapter 8 in "Soil-Water-Root Processes: Advances in Tomography and Imaging", by S.H. Anderson and J.W. Hopmans, Eds., SSSA Special Publication 61

Conference Contributions:

1. Fink W (1993) *Numerische Bestimmung der Ordnungsparameter-Verteilung für Mehrschichtnetzwerke*, Workshop: Physik neuronaler Netzwerke III, Universität Oldenburg, 1. - 3. March 1993, poster
2. Nadler W, Fink W (1997) *Finite Size Scaling in Neuronalen Netzen*, DPG-Conference 1997 (Deutsche Physikalische Gesellschaft), Münster, Verh. der DPG 667, abstract and lecture
3. Nadler W, Fink W (1997) *Das Ising Perzeptron: Universalitätsklassen bei der Speicherung binärer Muster*, DPG-Conference 1997 (Deutsche Physikalische Gesellschaft), Münster, Verh. der DPG 672, abstract and poster
4. Mjolsness E, Turmon M, Fink W (2001) *Stochastic Parameterized Grammars for Bayesian Model Composition*, Interface '01, The 33rd Symposium on the Interface of Computing Science and Statistics, Costa Mesa, Orange County, California, abstract and lecture
5. Terrile RJ, Adami C, Chau SN, Ferguson MI, Fink W, Huntsberger TL, Klimeck G, Kordon MA, von Allmen P (2004) *Evolutionary Computation Techniques for the Automated Design of Space Systems*; Division for Planetary Sciences (DPS) 36th Meeting of the American Astronomical Society, Louisville, KY, Bull. Amer. Astron. Soc., 36#4, 14.11
6. Terrile RJ, Fink W, Huntsberger TL, Lee S, Tisdale ER, Tinetti G, von Allmen P (2005) *Retrieval of Extra-Solar Planetary Spectra Using Evolutionary Computation Methods*; Division for Planetary Sciences (DPS) 37th Meeting of the American Astronomical Society, Cambridge, UK, Bull. Amer. Astron. Soc., 37, 31.19

7. Lee S, Fink W, Russell RP, von Allmen P, Petropoulos AE, Terrile RJ (2005) *Evolutionary Computing for Low-Thrust Navigation*. Conference paper, AIAA Space Conference, Long Beach, CA, August 30-September 1, 2005
8. Fink W, Tarbell MA (2008) *Stochastic Optimization Framework for the Optimization of Prosthetic Vision*; ARVO (Association for Research in Vision and Ophthalmology) 2008 Conference, Ft. Lauderdale, Florida, Invest. Ophthalmol. Vis. Sci. 2008 49: E-Abstract 1779, abstract and poster
9. Fink W, Tarbell MA (2010) *Patient-in-the-loop Optimization of Prosthetic Vision*; Neural Interfaces Conference, Long Beach, CA, June 21-23, 2010
10. Tuller M, Kulkarni R, Fink W (2011) *3-D Multiphase Segmentation of X-Ray Micro Computed Tomography Data of Geologic Materials*; 2011 AGU Fall Meeting, abstract and poster
11. Fink W, Baker VR, Flammia M, Tarbell MA (2015) Avoiding Planetary Rover Damage by Multi-Objective Rover Traverse Optimization [abstract 1353]. In 46th Lunar and Planetary Science Conference Abstracts [CD-ROM], Lunar and Planetary Institute, Houston
12. K. Chen, W. Fink, R. Lane, J. Allen, J. Vanuk and J. M. Roveda (2015) Identify Invariant Patterns in ECG and Respiratory Waveforms; Invited talk for Invited Talk for Biomedical Engineering Conference 2015 by Omics International group, April 28-30, Philadelphia, PA; abstract and oral presentation
13. K. Chen, W. Fink, R. Lane, J. Allen, J. Vanuk and J. M. Roveda (2015) Wearable Sensor Based Stress Management Using Integrated Respiratory and ECG Waveforms; IEEE International Conference on Body Sensor Network Conf. Proc., Boston, MA, June 9-11, 2015

Invited Lectures, Seminars and Colloquia (since 1997):

1. Fink W (16 Oct 1998) *De Novo Protein Design: "...finding a sequence in the haystack?!"*, Kellogg Seminar, Division of Physics, Mathematics & Astronomy at the California Institute of Technology
2. Fink W (16 Dec 1999) *On the Origin of Life and finding THE Sequence in the Universe*, invited talk, Machine Learning Systems (MLS) Group at the Jet Propulsion Laboratory (JPL)
3. Fink W (20 Nov 2006) *Research Topics at the Visual and Autonomous Exploration Systems Research Laboratory*, invited guest speaker at the 17ème JOURNÉE EVOLUTIONNAIRE TRIMESTRIELLE (JET) at the Université de Paris V, Paris, France
4. Fink W (18 Mar 2008) *Stochastic Optimization Framework (SOF) for Computer-Optimized Design, Engineering, and Performance of Multi-Dimensional Systems and Processes*; invited talk at the SPIE Defense & Security Symposium, Orlando, Florida



STATE BOARD OF OPTOMETRY
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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

1-3000/6457207/619781/50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title You have some nerve: Pediatric ophthalmology	Course Presentation Date 10/02/2016
---	---

Course Provider Contact Information

Provider Name Christina (First) Seyri (Last) (Middle)		
Provider Mailing Address Street 100 E. California Blvd. City Pasadena State CA Zip 91105		
Provider Email Address KSEYFI@Retina2020.com		
Will the proposed course be open to all California licensed optometrists?		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?		<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name Kweku (First) Grant - Acquah (Last) (Middle)		
License Number A126202	License Type MD	
Phone Number (800) 898-2020	Email Address kgrant-acquah@californiaeyeandear.com	

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider

Date

12/21/16



Retina Research Foundation
of California

Date: 10/02/2016

You Have Some Nerve: Pediatric Ophthalmology

The lecture presented an in depth review of common and uncommon pediatric optic nerve presentations. A few cases were reviewed initially with discussions that followed. After specific cases were presented, a thorough review of other anomalous pediatric optic nerves was presented.

Kweku Grant-Acquah, MD.

You Have Some Nerve: Pediatric Ophthalmology

- Pediatric Optic Nerves:
 - Cupped?
 - Swollen?
 - Pale?
 - Small?
 - Weird?
- Case Study #1:
 - 10 y/o male present for routine exam
 - Normal developmental history
 - No family history of eye disorder
 - VA 20/20 OU
 - IOP 17 OU
 - Glaucoma Suspect
- Pediatric Glaucoma
 - Very, very rare 1:22,000
 - Much more common is wide variation in disc shape and size
 - 1.15 mm² to 4.94 mm disc area (white)
 - 0.90 mm² to 6.28 mm disc area (blacks)
 - 0.40 to 0.50 mm (whites)
 - 0.50-0.70 mm (blacks)
 - Normal tension glaucoma is essentially unheard of
 - Children with glaucoma are typically not subtle
- Work Up
 - IOP Measurement
 - OCT RNFL
 - Visual Field
 - Observe
 - Table 1: Distribution of retinal nerve fiber layer thickness measurements using cirrus optical cohe
- Pediatric Optic Nerves
 - 16 y/o female with history of poor vision OD
 - Been present since birth
 - Non-progressive reportedly
 - Fundus exam OD is significant for...
- What do we know about her?
 - Birth hx: not significant
 - PMHx: None reported
 - POCHx: No Tra/Sur/Las/Amb/Stra as of yet
 - Meds/All: None
 - SocHx: Lives at home with mom/dad
 - FamHx: No significance

- ROS: Unremarkable
- What are the exam findings
 - Pupils: Equal and reactive, + rAPD OD
 - EOM: Grossly intact and full OU
 - External: Inremarkable
 - Vacc: 20/200 OD 20/20 OS
 - IOP (Palp): Symmetric
- More exam details shared: SLE, CRx, DFE OU
- Moring Glory Disc Anomaly (MGDA)
 - Epidemiology: Occurs in 1:1 million births, non hereditary, unilateral in most, more common in females, occurs less commonly in blacks
 - Pathogenesis: Caused by: abnormal closure of the embryonic fissure or abnormal development of the distal optic stalk at its junction with the primitive optic vesicle or mesenchymal dysgenesis
- Clinical Characteristics:
 - Funnel-shaped excavation
 - Central core of white glial
 - Surrounding RPE is elevated
- Reported Ocular Association are many:
 - Aniridia
 - Lens Coloboma
 - Strabismus
 - Congenital Cataract
 - Nystagmus
 - Eyelid Hemangioma
 - Lenticonis
 - Microphthalmia
- Systemic Associations are a few:
 - Encephaloceles
 - Hormonal deficiencies
- MGDA and Moya
 - Progressive steno-occlusion of proximal intracranial arteries and hypertrophy of collateral vessels at the base of the brain
 - As many as 45% of cases have associated intracranial vascular abnormalities
- Differential Diagnosis
 - Peripapillary Staphyloma
 - No vascular anomalies
 - No central glial tuft
 - Optic Nerve Coloboma
 - Typically affects lower part nerve head
 - No central glial tuft
- Treatment
 - Glasses: Correct Anisometropia & any related amblyopia
 - Polycarbonate lenses for protection
- Optic Nerve Coloboma

- On the same spectrum as MGDA
- Usually inferonasal
- Associated with retinal colobomas
- Higher rate of RDs
- May be unilateral or bilateral
- VA variable
- CHARGE Syndrome (Colobomas, Heart, choanal Atresia, GU issues, Ear)
- Myelinated Nerve Fiber Layer (MNFL)
 - "what a weird looking nerve"
 - Myelination of nerve fibers past lamina cribosa
 - Commonly occur at disc margin but can be anywhere in the retina
 - VA loss from macular involvement
 - Absolute Scotoma
- Tilted Disc Syndrome
 - How do we know if that is glaucoma?
 - Fuchs Coloboma
 - Superior pole of disc may appear elevated with posterior displacement of inferior nasal disc
 - Many affected eyes are myopic with astigmatism
- Bergmeister Papilla
- Optic Nerve Hypoplasia
 - Decreased number of optic nerve axons
 - Double ring sign
 - Retinal vascular tortuosity
- Optic Atrophy
 - Bilateral central vision loss
 - VF defects show central or cecocentral scotoma

Pediatric Optic Nerves

Dr. Grant | Acuity

No Financial Disclosures

Agenda

You've Got Some Nerve

Optic Nerves
Cases

Pediatric Optic Nerves

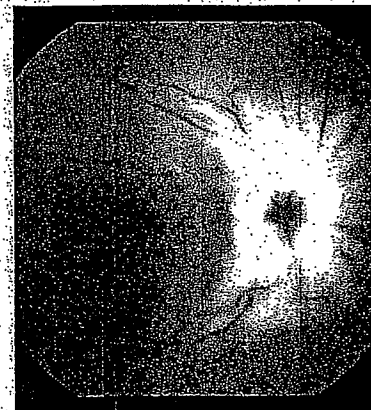
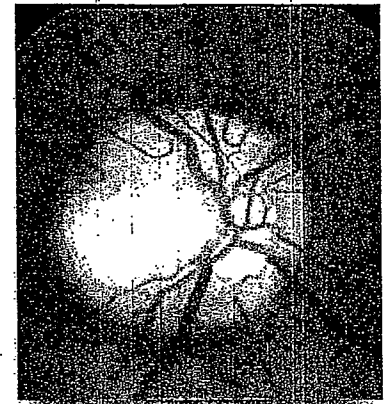
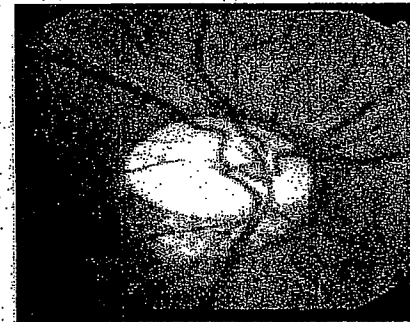
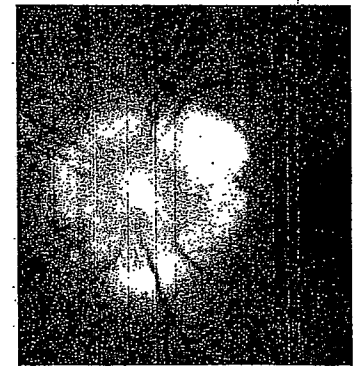
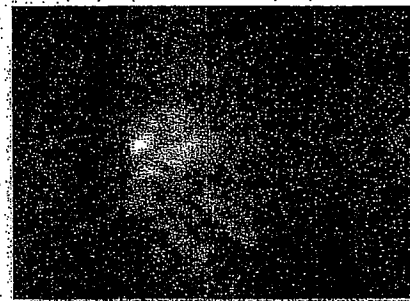
Cupped?

Swollen?

Pale?

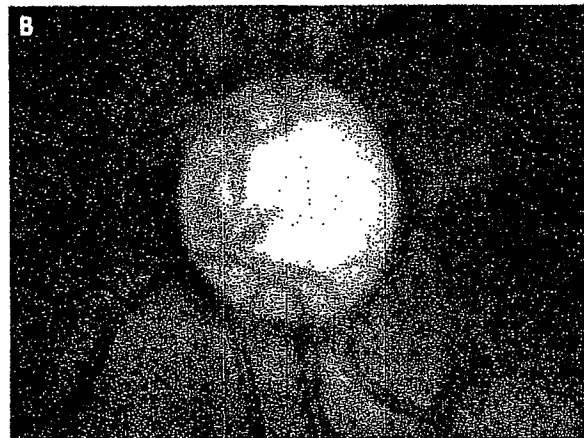
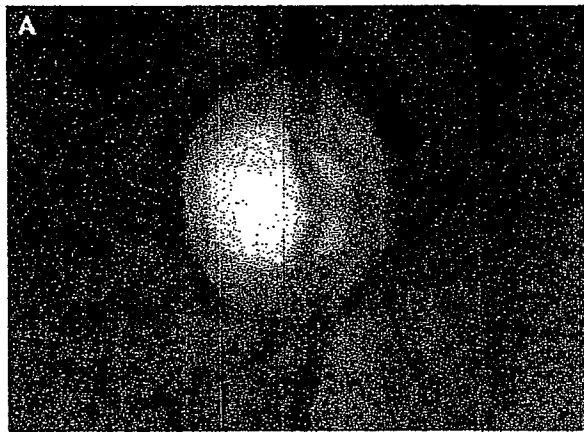
Small?

Weird?



Pediatric Optic Nerves

10 yo M presents for routine exam



Normal developmental hx

No family hx of eye dz

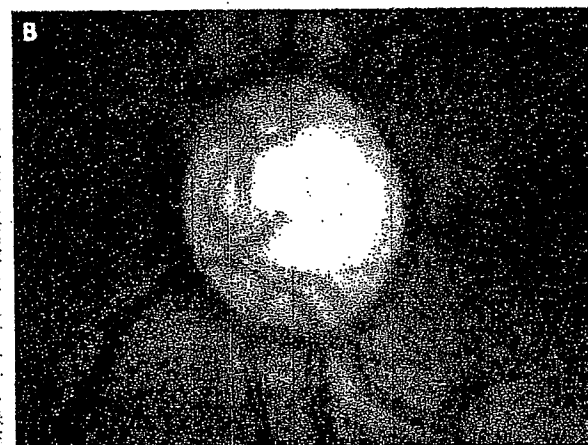
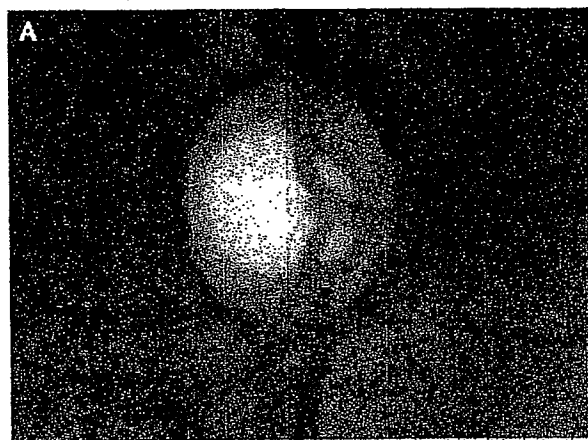
VA 20/20 OU

IOP 17 OU

?

Pediatric Optic Nerves

10 yo M presents for routine exam



Normal developmental hx

No family hx of eye dz

VA 20/20 OU

IOP 17 OU

Glaucoma Suspect

Pediatric Glaucoma

Very very rare

- 1 : 2,000 to 1 : 22,000

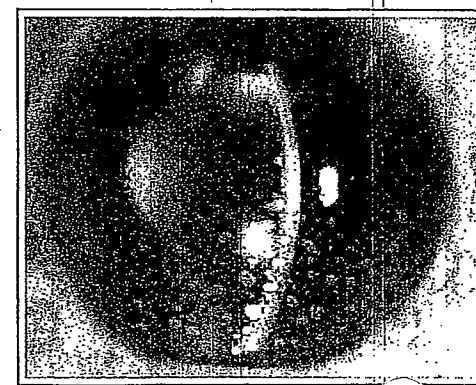
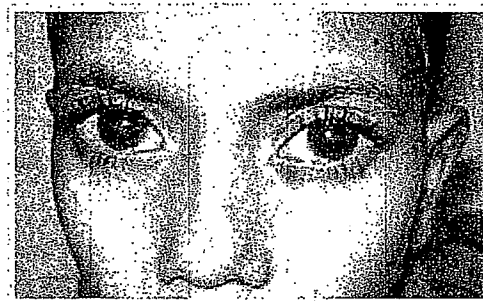
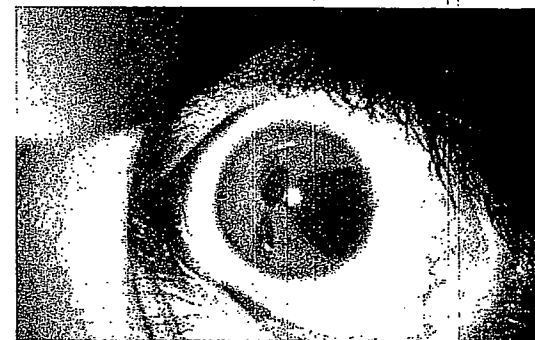
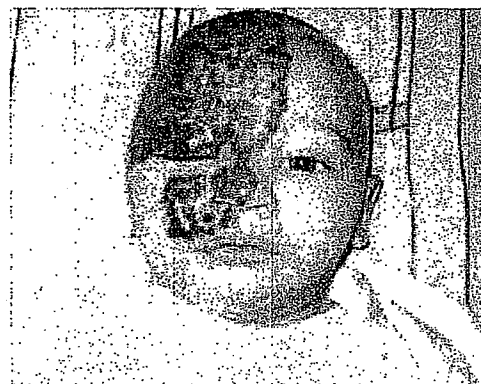
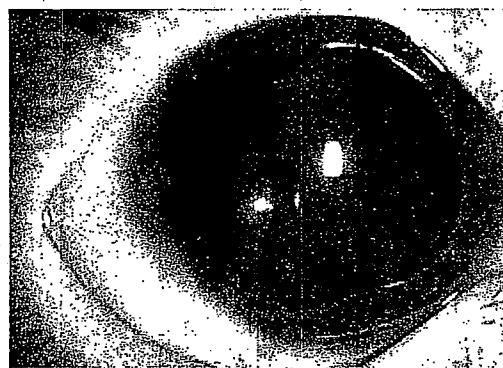
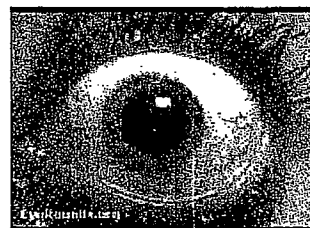
Much more common is wide variation in disc shape and size

- 1.15 mm² to 4.94 mm disc area (white)
- 0.90 mm² to 6.28 mm disc area (blacks)
- 0.40 to 0.50 mm (whites)
- 0.50 - 0.70 mm (blacks)

Normal Tension Glaucoma is essentially unheard of...

Children with glaucoma are typically not subtle...

Pediatric Glaucoma



Pediatric Glaucoma

Work Up

- IOP Measurement
- OCT RNFL
- Visual Field
- Observe

Table 1

Distribution of retinal nerve fiber layer thickness measurements using Cirrus optical coherence tomography

	All ages	6-9 y	9-12 y	12-15 y
Measurements in μm	Mean (5 th -95 th percentile)	Mean (5 th -95 th percentile)	Mean (5 th -95 th percentile)	Mean (5 th -95 th percentile)
Superior	121 (99-145)	123 (99-151)	118 (96-142)	122 (102-144)
Nasal	70 (49-94)	70 (49-89)	71 (51-83)	71 (49-95)
Temporal	66 (54-84)	69 (56-87)	64 (51-83)	68 (57-83)
Inferior	125 (95-159)	129 (91-163)	122 (101-150)	127 (95-160)
Average	96 (80-111)	98 (84-111)	93 (80-106)	98 (82-111)

Pediatric Optic Nerves

16 yo FM w/ hx of a poor vision OD



Been present since birth

Non-progressive reportedly

Fundus exam OD is significant for...

Pediatric Optic Nerves

What do we know about her?



BirthHx: Not significant

PMHx: None reported

POCHx: No Tra/Sur/Las/Amb/Stra as of yet

Meds/All: None

SocHx: Lives at home with mom/dad

FamHx: No sig

ROS: Unremarkable

Pediatric Optic Nerves

What are her exam findings?



Pupils: Equal and reactive, + rAPD OD

EOM: Grossly intact and full OU

External: Unremarkable

Vacc:

20/200 OD

20/20 OS

IOP (palp): Symmetric

Pediatric Optic Nerves

A few more details

SLE

L/L per external

S/C: W/Q OU

Ant Chamber: Deep & symmetric OU

Iris: R/R OU

Lens: Clear OU

CRx: -4.00 OD
plano OS

DFE OU

C/D

OD: **Funnel-shaped, excavated optic disc with central glial tuft surrounded by pigmented ring; radial vessels emanating from edge**

OS: WNL, flat and healthy rims

Macula – Flat OU

Periphery – Attached 360 OU; vascularized

Vessels – Per above OD; WNL OS

Morning Glory Disc Anomaly

MGDA (Morning Glory Disc Anomaly)

Epidemiology

Occurs in 1:1 million births
Non-hereditary
Unilateral in most
More common in females
Occurs less commonly in blacks

Pathogenesis

Caused by

Abnormal closure of the embryonic
fissure

OR

Abnormal development of the distal
optic stalk at its junction with the
primitive optic vesicle

OR

Mesenchymal dysgenesis

MGDA (Morning Glory Disc Anomaly)

Clinical Characteristics



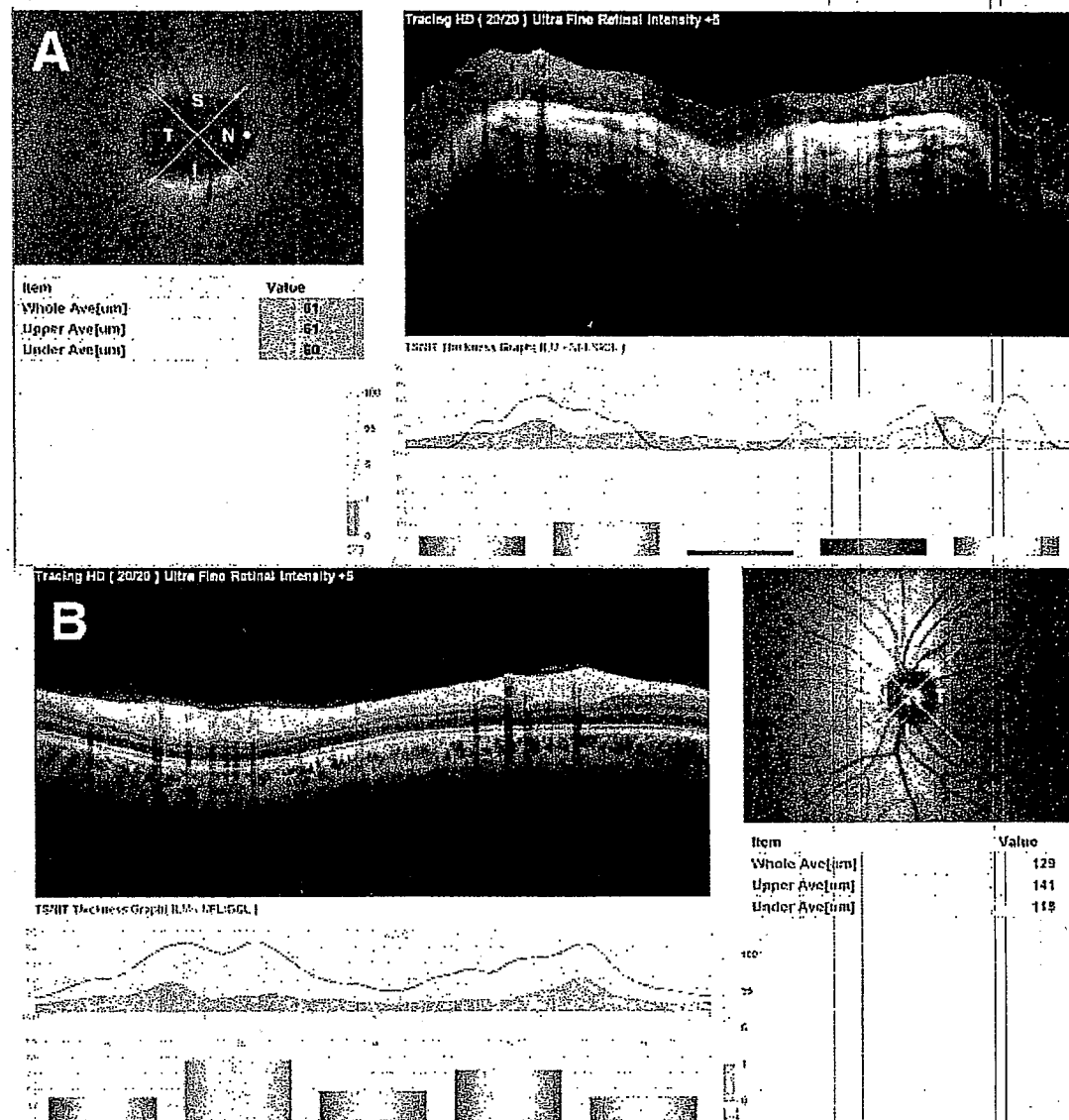
Funnel-shaped excavation of the posterior fundus that incorporates the disc

Central core of white glial tissue that may have contractile elements (the optic cup can be seen to open and close in some)

Surrounding RPE is elevated with an increased number of vessels radiating from the edges of the disc

MGDA (Morning Glory Disc Anomaly)

Visually significant...



MGDA (Morning Glory Disc Anomaly)

Reported ocular associations are many...

Aniridia
Lens Coloboma
Strabismus
Congenital Cataract
Nystagmus
Eyelid Hemangioma
Lenticonus
Microphthalmia

MGDA (Morning Glory Disc Anomaly)

Systemic Associations are a few...

Encephaloceles

Basal, trans-sphenoidal, sphenoethmoidal

Hormonal deficiencies (2/2 to endocrine dysfunction)

Primary agenesis of pituitary or secondary involvement of the pituitary related to an encephalocele

Levels of ADH & GH are the most frequently abnormal

MRI is always indicated because of risk of...?

MGDA (Morning Glory Disc Anomaly)

MGDA and MoyaMoya

MoyaMoya

Progressive steno-occlusion of proximal intracranial arteries & hypertrophy of collateral vessels at the base of the brain

As many as 45% of cases have associated intracranial vascular abnormalities

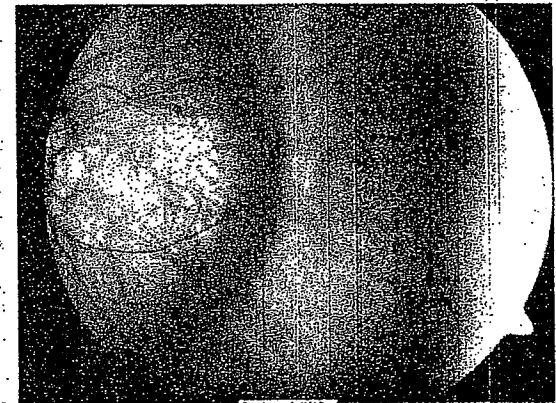


MGDA (Morning Glory Disc Anomaly)

Differential Diagnosis

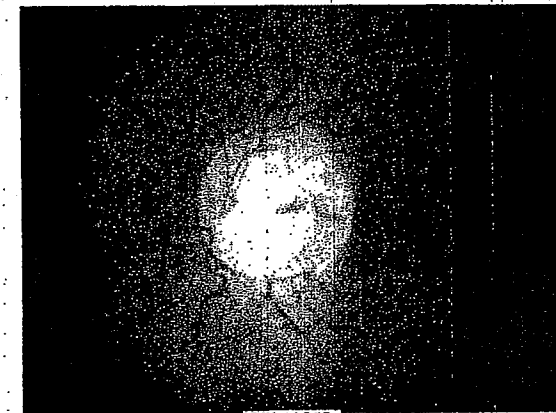
Peripapillary Staphyloma

No vascular anomalies
No central glial tuft



Optic Nerve Coloboma

Typically affects lower part nerve head
No central glial tuft



MGDA (Morning Glory Disc Anomaly)

Treatment

Glasses

Correct Anisometropia & any related amblyopia
Polycarbonate lenses for protection

Optic Nerve Coloboma

Optic Nerve Coloboma

On the same spectrum as MGDA

- May be complete chorioretinal (incomplete embryonic fissure closure during 5th week of gestation) or just ON
- Usually inferonasal
- Associated with retinal colobomas
- Higher rate of RDs
- May be unilateral or bilateral
- VA variable
- CHARGE syndrome
(Colobomas, Heart, choanal Atresia, GU issues, Ear)



Myelinated Nerve Fiber Layer

Myelinated Nerve Fiber Layer (MNFL)

“What a weird looking nerve”

- Myelination of nerve fibers past lamina cribosa
- Most commonly occur at disc margin but can be anywhere in the retina
- VA loss from macular involvement, high myopia or ambylopia
- Absolute Scotoma corresponding with area of myelination



Tilted Disc Syndrome

Tilted Discs

How do we know if that is glaucoma?

Fuchs Coloboma

Superior pole of disc may appear elevated with posterior displacement of inferior nasal disc

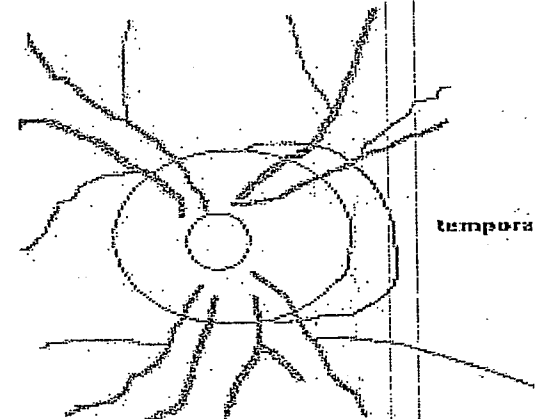
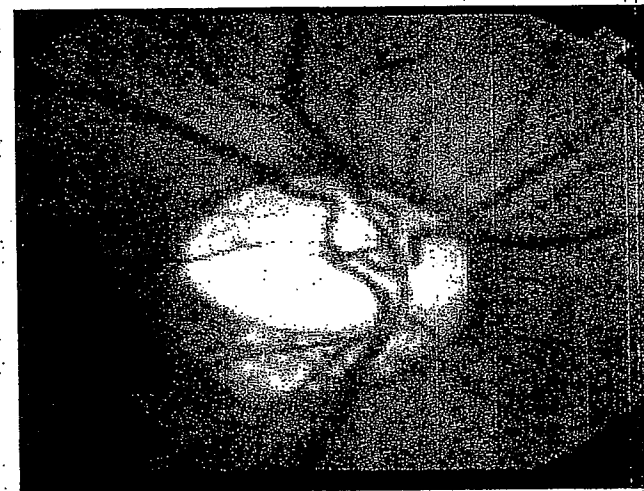
Accompanied by:

Scleral crescent

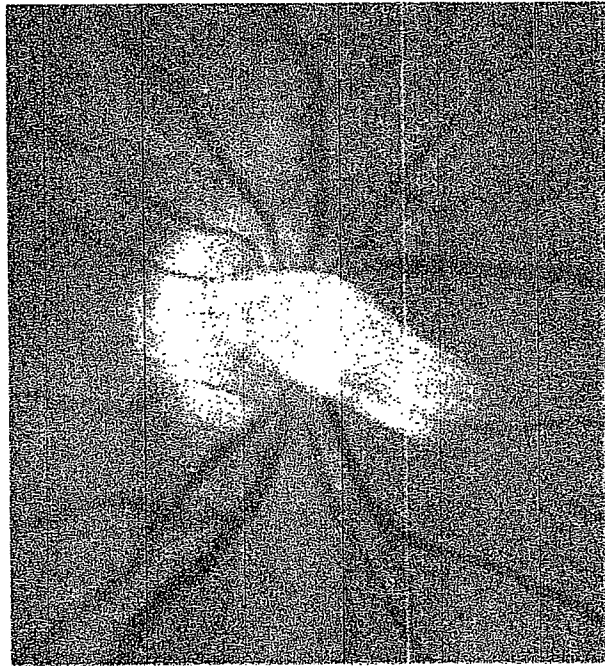
Situs inversus (nasal detour of temporal retinal vessels as emerge from disc)

Many affected eyes are myopic with astigmatism

May be bitemporal VF defects that DO NOT respect vertical midline



Bergmeister Papilla



Remnant of hyaloid artery manifest as glial tissue on the disc

Optic Nerve Hypoplasia

Optic Nerve Hypoplasia (ONH)

a SPECTRUM of disease

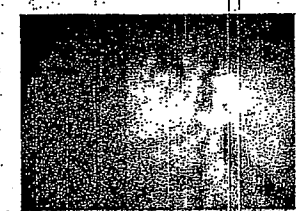
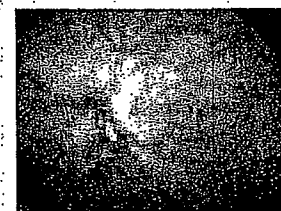
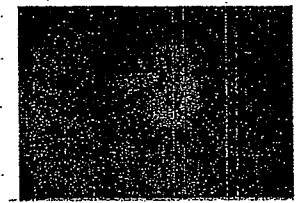
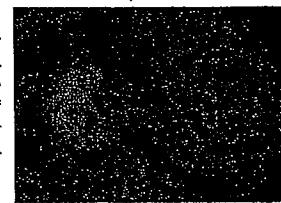
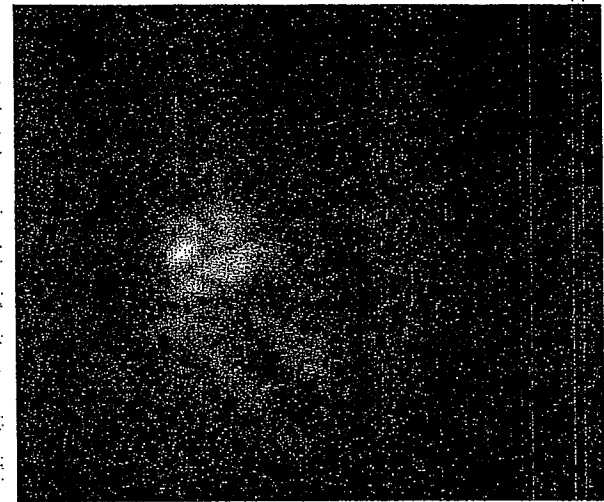
Histologically characterized by
decreased number of optic nerve
axons

Can be unilateral or bilateral and is
often asymmetric

Double ring sign – outer ring is
scleral/lamina cribrosa junction;
inner ring is abnormal extension of
retina/RPE over lamina cribrosa

Retinal vascular tortuosity is often
present

*VA is variable and corresponds with
integrity of macular fibers, not size*



Optic Nerve Hypoplasia (ONH)

Bilateral ONH often presents with congenital sensory nystagmus

Unilateral ONH often presents with sensory strabismus

VA may be improved by patching

Can be associated with **pituitary issues** and cerebral hemisphere abnormalities

Schizencephaly, periventricular leukomalacia, encephalomalacia

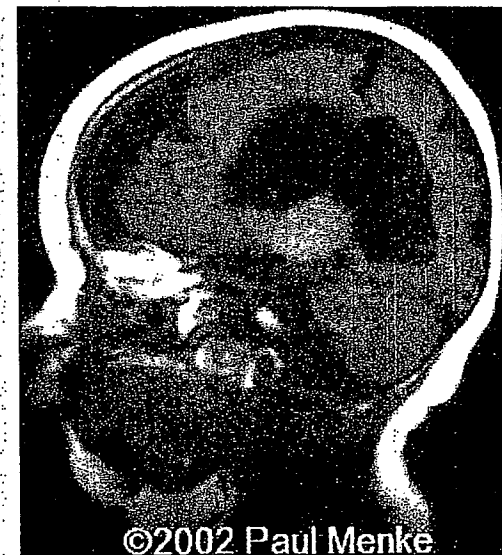
De Morsier syndrome (Septo-optic dysplasia)

Bilateral ONH and midline CNS anomalies

Absence of septum pellucidum

Agenesis of corpus callosum

Alone these are not associated with neurologic delay or endocrine dysfunction

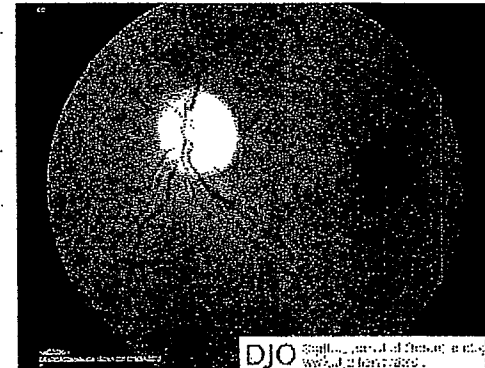
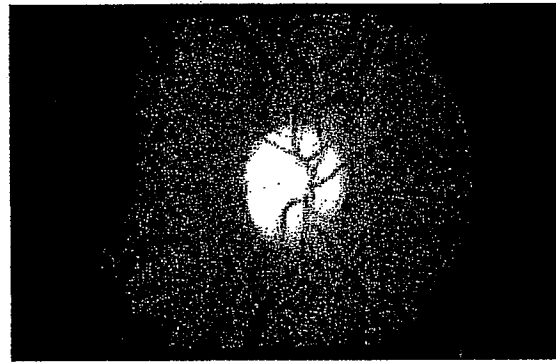


Optic Atrophy

Optic Atrophy



Fig. 2 Atrophic optic nerve.



Dominant Optic Atrophy

Bilateral central vision loss

Begins before age 10

VF defects show central or *cecocentral scotoma*

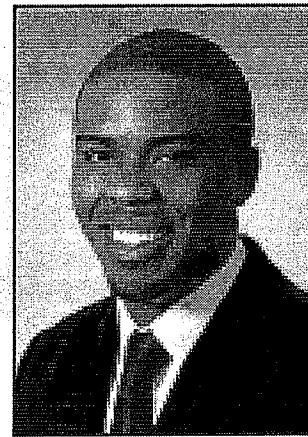
Color vision deficiency is tritan dyschromastopsia

Behr Optic Atrophy

Leber Hereditary Optic Neuropathy

Kweku Grant-Acquah, MD

California Eye & Ear Specialist for
Comprehensive and Pediatric Ophthalmology



Dr. Grant-Acquah is a board-certified ophthalmologist with specialty training in pediatric ophthalmology and adult strabismus (eye alignment). He has authored numerous papers and has presented on various topics relating to eye and nerve health.

Dr. Grant-Acquah is a native of Wisconsin and received his bachelor of science at the University of Wisconsin, Madison. He completed medical school at the University of Chicago Pritzker School of Medicine where he also received a master of business administration (MBA) degree from the Chicago Booth School of Business.

After he completed his internship at Advocate Illinois Masonic Medical Center in Chicago, Dr. Grant-Acquah completed his residency in ophthalmology at the Medical College of Wisconsin Eye Institute. He then completed fellowship training in pediatric ophthalmology and adult strabismus at the University of California, San Diego.

During his free time, the doctor is passionate about community health and works to reduce health disparity in underserved communities. He is formally a nationally-ranked junior tennis player and enjoys living an active lifestyle full of running, biking, hiking and water sports.

While he is very happy to miss the harsh weather of Wisconsin winters, he considers himself to be a proud Wisconsinite and enjoys almost anything Packers or Badgers-related. He enjoyed watching Brett Favre and Aaron Rodgers play at Lambeau Field and considers his time spent at Camp Randall to be amongst his most memorable.

888-884-3805

www.californiaeyeandear.com

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eye & ear

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kgrant-acquah@
californiaeyeandear.com

Ph: 800-884-3805

Education

- 2003 | Bachelor of Science, Biology,
University of Wisconsin, Madison, WI
- 2009 | Master of Business, Booth School of
Business, University of Chicago, Chicago, IL
- 2009 | Doctor of Medicine, Pritzker School of
Medicine, University of Chicago, Chicago, IL

Professional Training

- 2013-2014 | Fellowship, Pediatric Ophthalmology and
Adult Strabismus, University of California,
San Diego
- 2010-2013 | Residency, Ophthalmology, Medical College
of Wisconsin, Eye Institute
- 2009-2010 | Internship, Internal Medicine, Advocate
Illinois Masonic Medical Center

Certification

American Board of Ophthalmology

Professional Affiliations

American Academy of Pediatric
Ophthalmology & Strabismus
American Academy of Ophthalmology
Wisconsin Academy of Ophthalmology (WAO)
Board Member
Cream City Medical Society (Wisconsin)

Awards & Honors

President's Diversity Award,
Medical College of Wisconsin
MVP Award, Advocate Illinois Masonic Medical Center


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CONTINUING EDUCATION COURSE APPROVAL

\$50 Mandatory Fee

APPLICATION

1-3000/6457207/1169246/50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>save that e10be! ocular oncology update</u>	Course Presentation Date <u>10/02/2016</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Sharon</u> (First) <u>Theodore</u> (Last) (Middle)	
License Number <u>A91327</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>stheodore@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Save That Globe! Ocular Oncology Update

Retinoblastoma treatment has evolved markedly over the last ten years with the advent of intravenous-arterial chemotherapy for globe salvage. Intravitreal chemotherapy is also now standard of care. Survival rates are high and globe retention rates are rising.

Melanoma treatment now routinely involves biopsy for molecular mutation analysis, which can provide a personalized prognosis profile. There is a lack of effective treatment for metastatic disease although recent advances in immunotherapy are promising.

Sharon Theodore, MD.

Save That Globe! Ocular Oncology Update

- OCULAR ONCOLOGY UPDATE
- Sharon Theodore, MD
- October 2, 2016
- Disclosures: None

- GLOBE Conservation
- Retinoblastoma
 - 1/35,000 incidence
 - 60% Unilateral
 - 15% actually germline with decreased penetrance
 - 40% Bilateral
 - All germline mutations
 - Tumor Regression
 - Local Chemotherapy in RB
- **EVOLUTION of a REVOLUTION**
 - Periocular
 - Subconjunctival
 - Sub-tenon's
 - Intra-arterial
 - Interventional radiology catheterization of ophthalmic artery
 - Intra-vitreous
 - Adjuvant therapy especially helpful vitreous seeds
- Intra-arterial Chemo
- Dr. David Abramson, MD
 - Pioneer and visionary who has revolutionized Rb care
 - >1600 cases over 10 years
 - No metastatic deaths
 - Some regained vision
 - Decreased enucleation rate to 5%
- Intra-arterial Chemo
- Agents
 - Melphalin
 - Carboplatin
 - Topotecan
 - Average of 3 monthly treatments
 - Longer for vitreous seeds
- Complete Regression: Stage C
- Complete Regression: Stage E
- CRAO Complication

Sharon Theodore, MD

- Intra-vitreous Chemo
 - Melphalin
 - 3mm posterior to limbus
 - 32 gauge needle
 - Cryotherapy to site upon needle removal
 - Intra-vitreous Chemo
 - Intra-vitreous Chemo
 - Challenges
 - Chemo trapped between posterior hyaloid and retina can cause severe toxicity
 - Some cases of catastrophic vision loss
 - Chemo too close to lens can cause cataract
 - May lead to enucleation dilemma
 - Ultrasound difficult with calcified tumors due to shadowing
 - Cannot do cataract surgery with active tumors
 - Leukocoria
 - Further Therapy?
 - GLOBE Conservation
 - Melanoma
- ~13% of us have a nevus
- ONLY 6 in 1,000,000 per year transform into MM
 - COMS showed lack of survival benefit enucleation vs. local control
 - Early hematogenous dissemination threatens life
 - UVEAL MELANOMA: Mortality Risk
 - IMPRESSIVE local control
 - Protons ~97%
 - Brachytherapy ~93%
 - PERSISTENT mortality risk
 - 20 years after proton beam (Mass Eye Ear)
 - Smaller tumors younger patients ~9%
 - Larger tumors older patients ~40%
 - COMS Features Predictive of Growth
 - Larger tumor size
 - Presence of orange pigment
 - Absence of drusen
 - Absence of retinal pigment epithelial alterations
 - Melanoma
 - Nevus or Melanoma?
 - Clip Placement
 - the PROTON
 - **External Beam** vs. Proton Beam
 - FNAB for Tumor Classification
 - Monosomy 3 poor prognosis

- Gain of 6p better
 - Gain of 8q worse
 - BAP1
 - BRCA associated protein 1
 - Implicated in pathogenesis of UM
- Decision Dx-UM
- Class 1: Low Metastatic Risk
 - 1A
 - very low risk
 - 1B
 - low risk (21% chance mets 5 yrs)
- Class 2: High Metastatic Risk
- 72% chance mets over 5 yrs
 - Seeding at Biopsy Site
- Circulating Malignant Cells (CMCs)
- Advanced PCR identify cancer cells in blood
 - Breast, Prostate, Cutaneous Melanoma
 - Evolving technology isolate uveal melanoma cells from serum
 - Correlate clinical disease stage and prognosis
 - Allow for molecular mutational analysis without risk of ocular biopsy

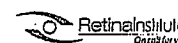
Save That Globe

Sharon Theodore, MD
October 2, 2016



Disclosures

None



I'd Rather Be...

- DEAD
- BLIND

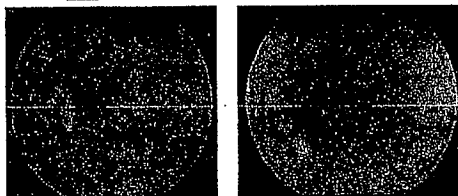


GLOBE Conservation

- Melanoma
 - ~13% of us have a nevus
 - ONLY 6 in 1,000,000 per year transform into MM
- Lack of survival benefit shown COMS study
 - Stellar local control rates radiation



Nevus or MELANOMA?



Courtesy Dr. O'Brien
UCSF Ocular Oncology



COMS Features Predictive of Growth

- Larger tumor size
- Presence of orange pigment
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UVEAL MELANOMA: Mortality Risk

- IMPRESSIVE local control
 - Protons ~97%
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 - Cumulative



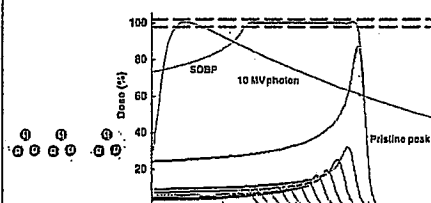
Melanoma



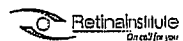
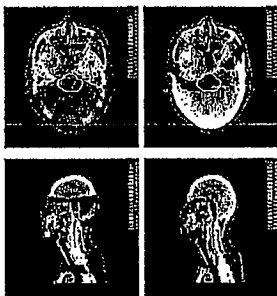
Clip Placement



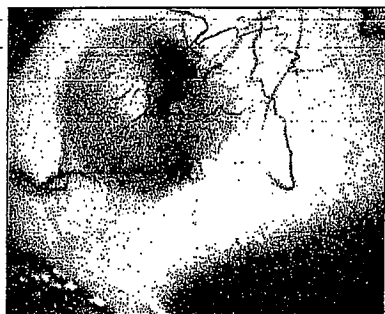
the PROTON



External Beam VS. PROTON BEAM



Seeding at Biopsy Site



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FNAB for Tumor Classification

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 - Gain of 8q worse
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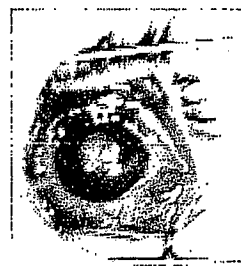
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GLOBE Conservation

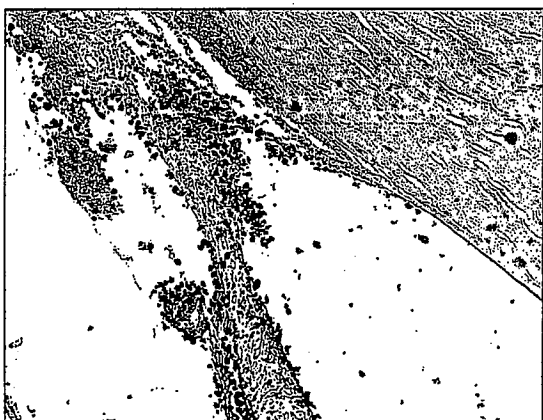
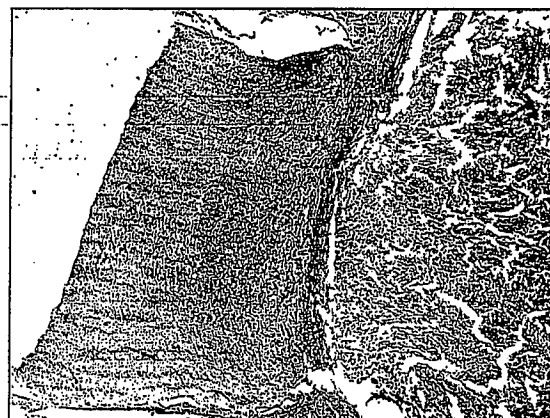
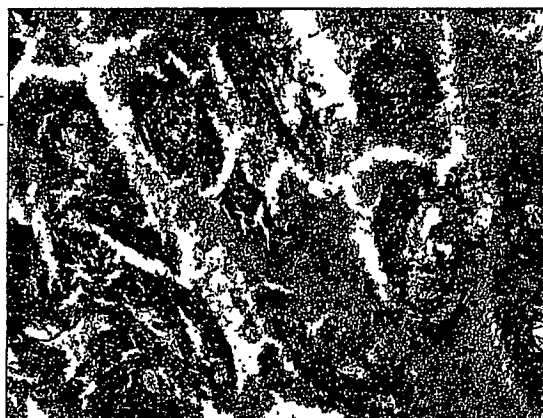
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 - 60% Unilateral
 - 15% actually germline with decreased penetrance
 - 40% Bilateral
 - All germline mutations

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Leukocoria



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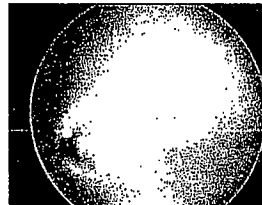
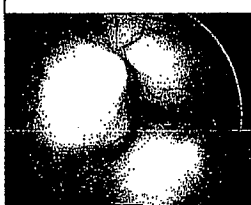
High-Risk Features

6 cycles with 3-agent chemotherapy

Carboplatin
Etoposide (VP-16)
Vincristine



Intra-arterial Chemo



Local Chemotherapy in RB

• EVOLUTION of a REVOLUTION

- Periocular
 - Subconjunctival
 - Sub-tenon's
- Intra-arterial
 - Interventional radiology catheterization of ophthalmic artery
- Intra-vitreous
 - Adjuvant therapy especially helpful vitreous seeds



Intra-arterial Chemo

- Dr. David Abramson, MD
- Pioneer and visionary who has revolutionized Rb care
 - >1600 cases over 10 years
 - No metastatic deaths
 - Some regained vision
 - Decreased enucleation rate to 5%

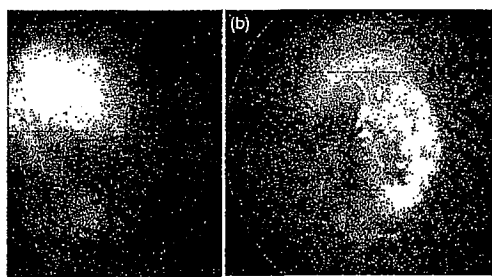


Intra-arterial Chemo

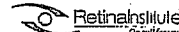
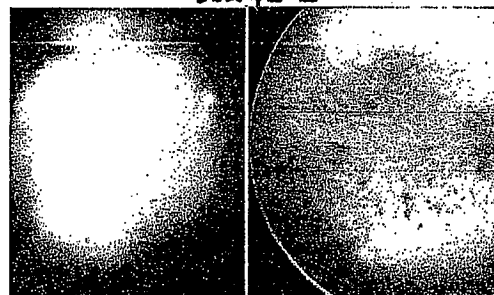
- Agents
 - Melphalin
 - Carboplatin
 - Topotecan
- Average of 3 monthly treatments
 - Longer for vitreous seeds
 - Identified subtypes of vitreous seeds



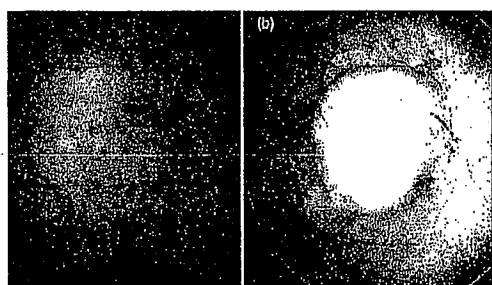
Complete Regression: Stage C



Complete Regression: Stage E



CRAO Complication



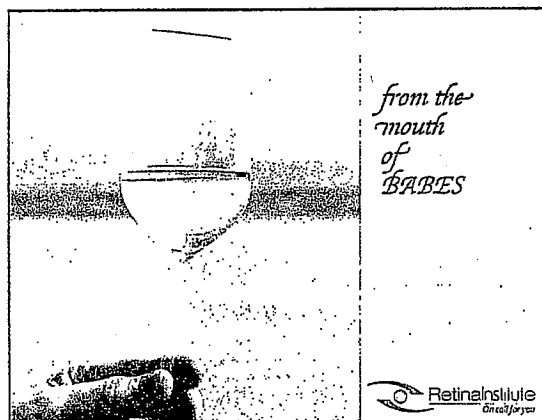
Intra-vitreous Chemo

- Melphalin
 - 3mm posterior to limbus
 - 32 gauge needle
 - Cryotherapy to site upon needle removal



Intra-vitreous Chemo

- Challenging due to formed vitreous
 - Chemo trapped between hyaloid and retina can cause severe toxicity
 - Some cases of catastrophic vision loss
 - Chemo too close to lens can cause cataract
 - May lead to enucleation dilemma
 - Ultrasound difficult with calcified tumors due to shadowing
 - Cannot do cataract surgery with active tumors



Acknowledgments

- Joan O'Brien, MD
 - Ocular Oncology
 - U Penn (formerly UCSF)
- David Abramson, MD
 - Ocular Oncology
 - Memorial Sloan Kettering Cancer Center
- Lilia Loreda, MD
 - Radiation Medicine
 - Loma Linda University



Sharon Theodore, MD
Retina Institute Surgeon

Dr. Theodore is a board-certified ophthalmologist with subspecialties in vitreoretinal surgery and ocular oncology. Dr. Theodore, a native Californian, earned Phi Beta Kappa Honors Society at the University of California in Los Angeles and also attended University of California at Irvine. Dr. Theodore graduated from what is widely considered one of the top five medical schools in the nation, University of California at San Francisco. (UCSF). She went on to complete her residency at the prestigious Washington University in St. Louis for ophthalmology. Theodore later completed an ocular oncology fellowship at UCSF with the globally renowned Dr. Joan O'Brien. She then completed a comprehensive fellowship in retinal disease and surgery at Loma Linda University, one of only two sites on the West Coast with the facilities to treat intraocular tumors using proton beam radiation.



Dr. Theodore is published in numerous peer-reviewed scientific journals for research involving ocular oncology and retinal disease and is a regularly-invited speaker for academic conferences and lectures throughout Southern California. She holds a teaching appointment as Assistant Professor of Ophthalmology at Loma Linda University where she also continues to treat intraocular tumors with proton beam radiotherapy. In addition to intraocular melanoma and retinoblastoma, Dr. Theodore has expertise in the treatment of diabetic retinopathy, macular degeneration, retinopathy of prematurity, and complex retinal detachments.

In addition to her passion for medicine, Dr. Theodore's interests include snow skiing and musical theater. She served for many years as a ski instructor at Mammoth Mountain and was a featured soloist for the king of Jordan by invitation of the Reagan family. In her spare time, she enjoys spending time with her husband and their two children.

800-898-2020



Biography

Sharon Theodore, MD

800-898-2020

stheodore@retina2020.com

Cell: 951-323-9993

EDUCATION

1993 Bachelor of Arts, University of California, Los Angeles, CA
1996 Bachelor of Science, University of California, Irvine, CA
2000 Medical degree, University of California, San Francisco, CA

PROFESSIONAL TRAINING

2001-02 Transitional Internship, Mayo Clinic Hospital, Scottsdale, AZ
2002-05 Ophthalmology Residency, Washington University, St. Louis, MO

FELLOWSHIPS

2000-01 Ocular Oncology Research Fellowship, University of California, San Francisco, CA
2005-07 Ocular Oncology Clinical Fellowship, University of California, San Francisco, CA
2007-10 Vitreoretinal Surgery Fellowship, Loma Linda University

BOARD CERTIFICATION

- › American Board of Ophthalmology
- › California State Medical Board

UNIVERSITY & HOSPITAL POSITIONS

2005-07 Attending Physician, UCSF Medical Center & San Francisco General Hospital
2007-Present Attending Physician, Loma Linda University Medical Center
2010-11 Attending Physician, Desert Regional Medical Center

www.retina2020.com



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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

1-3000/6457207/483807/50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Zika Virus: An Emerging Retinopathy</u>	Course Presentation Date <u>10/02/2016</u>
---	--

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Jennifer</u> (First) <u>Spiegel</u> (Last) (Middle)	
License Number <u>A134733</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>jspiegel@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Zika Virus: An Emerging Retinopathy

Zika virus is causing an emerging retinopathy in endemic areas. It has an established link to microcephaly, but it is now being linked to retinopathy in babies born with microcephaly and presumed Zika virus infection in utero. There are also cases of acute retinopathy in adults with serologically confirmed Zika virus infection. All pregnant women with symptoms or travel to endemic areas must be screening for Zika virus. Also, anyone with viral infection symptoms who have traveled to an endemic area or who has had sexual contact with someone who has traveled to an endemic area should be screened. Contact the local health department for more information about screening.

Jennifer Spiegel, M.D.

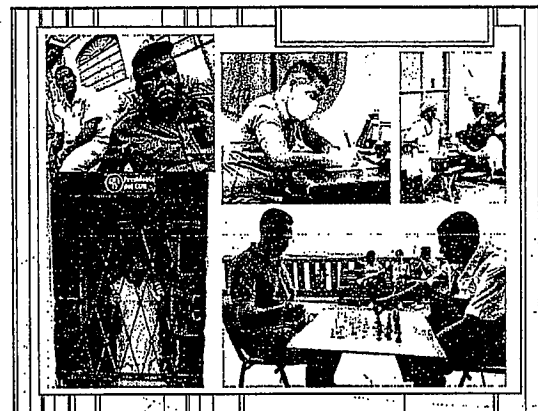
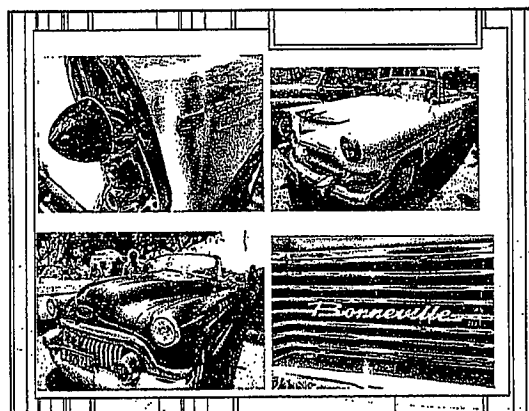
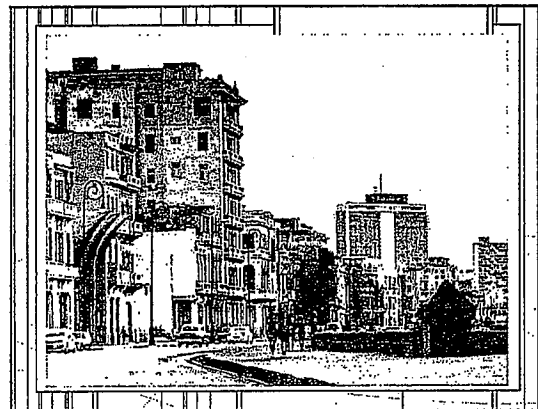
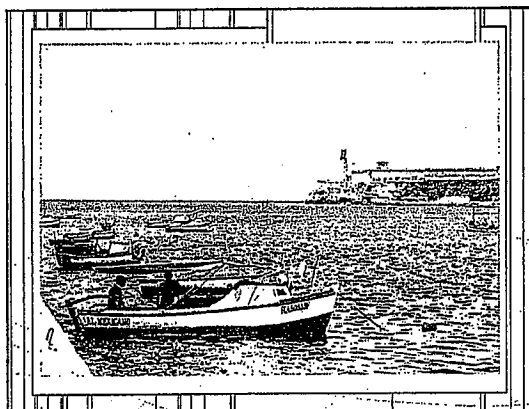
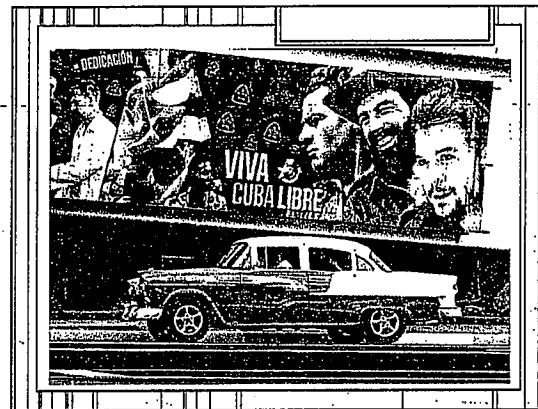
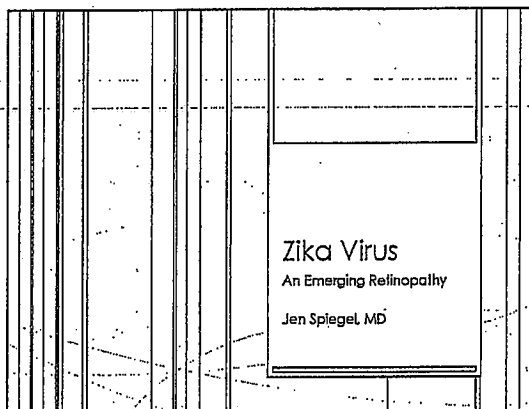
Zika Virus

An Emerging Retinopathy

- Zika Virus: What we know
- Zika virus is a mosquito-borne virus transmitted by *Aedes aegypti* mosquitoes
- These mosquitoes exist throughout the Americas, including parts of the US
- 43 locally acquired cases in Florida
- 19 cases in California, all travel-related
- Zika Virus: What we know
- 80% of people infected with Zika virus do not show symptoms
 - Symptoms may include fever, rash, joint pain, conjunctivitis
- Guillain-Barré syndrome has been reported
 - Condition in which the immune system attacks the nerves
- Fatalities due to Zika virus are rare
- Zika Virus: What we know
- A pregnant mother can transmit Zika virus to her fetus during pregnancy
- Zika has been associated with microcephaly in infants
- Knowledge of sexually transmitted Zika cases is increasing
- There is evidence of transmission through breast milk
- Zika Virus: What we are learning
- Zika virus in the womb can cause damage to the eyes that could lead to severe visual impairment
- Zika Virus in Brazil
- *JAMA Ophthalmology*
- 29 infants with microcephaly due to a likely Zika congenital infection
 - No other history of intrauterine infection
- 10 of the babies had eye findings:
 - Macular pigment mottling
 - Macular chorioretinal atrophy
 - Optic nerve hypoplasia
 - Iris coloboma
 - Lens subluxation
- Zika Virus in Brazil
- 2 month old infant
- Zika Virus in Brazil
- 1 month old infant
- Zika Virus in Brazil
- 1 month old infant
- Zika Virus in Brazil
- 1 month old infant
- Zika Virus in Brazil

- 20 day old infant
- Zika Virus in Brazil
- Case series conclusion:
- In all patients with possible congenital Zika virus, eye examination is recommended, including a retina evaluation, either in the hospital or within one month after birth
- Zika Virus in Brazil
- Case series of 3 infants with microcephaly
- Hemorrhages and abnormal blood vessels
- New findings in relation to the virus
- B: Pigment clumping, ovoid lesion C: Vascular tortuosity, blot hemorrhages D, E: Abnormal vascular termination
- What about adults?
- Zika in Adults
- *Ophthalmology*
- 64 year-old man with decreased central vision OS over 3 days
 - 20/20 OD, 3/200 OS
- Red rash over his upper body
- Knee and shoulder pain for 10 days
- Just returned from Haiti for mission work
- Zika in Adults
- Serologically confirmed Zika virus in 64 year old man
- No treatment
- Improved to 20/20 in 6 weeks
- Zika in Adults
- *New England Journal of Medicine*
- 40 y/o man in Brazil
- 2-day history of rash and bilateral ocular hyperemia
- Serologically confirmed Zika infection
- 7-day course of topical steroid
- Visual acuity returned to baseline and no signs of ongoing uveitis were detected
- CDC Recommendations
- Testing:
- Patients with symptoms:
 - With recent travel to endemic area
 - With sexual contact after partner traveled to endemic area
- Any asymptomatic pregnant patient who has travelled to an area with ongoing transmission
 - CDC Recommendations
- Testing:
- Zika virus testing is performed by the CDC Laboratory and a few health departments

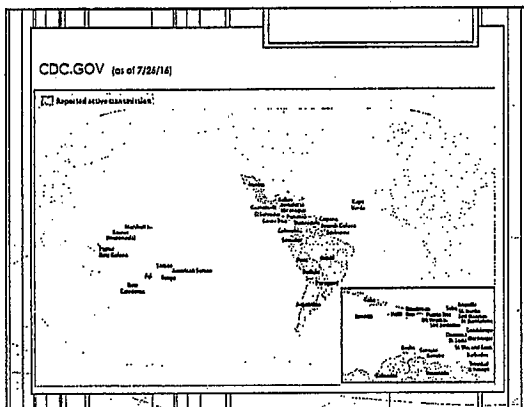
- All healthcare providers should report suspected cases of Zika virus to the state or county health department
- CDC Recommendations
- Prevention in endemic areas:
- Use insect repellents:
 - DEET, picaridin, IR3535, oil of lemon eucalyptus, para-menthane-diol
- Wear long-sleeved shirts and long pants
- Use air conditioning or screens
- Reduce the number of mosquitoes by emptying standing water
- References
- Hennessey M, Fischer M, Staples JE. Zika virus spreads to new areas — Region of the Americas, May 2015–January 2016. *MMWR Morb Mortal Wkly Rep* 2016;65:55–8.
- Schuler-Faccini L, Ribeiro EM, Feitosa IM, et al. Possible association between Zika virus infection and microcephaly — Brazil, 2015. *MMWR Morb Mortal Wkly Rep* 2016;65:59–62.
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- Oduyebo T, Petersen EE, Rasmussen SA, et al. Update: Interim guidelines for health care providers caring for pregnant women and women of reproductive age with possible Zika virus exposure — United States, 2016. *MMWR Morb Mortal Wkly Rep* 2016;65:122–7.
- Expanded Spectrum of Congenital Ocular Findings in Microcephaly with Presumed Zika Infection, de Miranda et al. *Ophthalmology*, article in press, May 2016. DOI: 10.1016/j.ophtha.2016.05.001
- de Paula Freitas B, de Oliveira Dias J, Prazeres J, et al. Ocular Findings in Infants With Microcephaly Associated With Presumed Zika Virus Congenital Infection in Salvador, Brazil. *JAMA Ophthalmol.* 2016;134(5):529-535. doi:10.1001/jamaophthalmol.2016.0267.
- Serologically Confirmed Zika-Related Unilateral Acute Maculopathy in an Adult. Parke, D. Wilkin et al. *Ophthalmology* July 2016. <http://dx.doi.org/10.1016/j.ophtha.2016.06.039>





Zika Virus: What we know

- Zika virus is a mosquito-borne virus transmitted by *Aedes aegypti* mosquitoes.
- These mosquitos exist in North, South, and Central Americas, including some parts of the US



Zika Virus: What we know

- A pregnant mother can transmit Zika virus to her fetus during pregnancy
- Sexual transmission of Zika virus has been reported
- There is evidence of transmission through breast milk

Zika Virus: What we know

- 80% of people infected with Zika virus do not show symptoms
- Fever, rash, joint pain, conjunctivitis possible
- Guillain-Barré syndrome, a condition in which the immune system attacks the nerves, has been reported
- Severe disease and fatalities due to Zika virus are rare

Zika virus: What we are learning

- Zika has been associated with microcephaly in infants
- Zika virus in the womb can cause harm that could lead to severe visual impairment

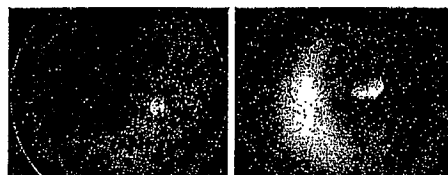


Zika in Brazil

- 29 infants with microencephaly due to a likely Zika congenital infection
- 10 of the babies had eye findings:
 - Macular pigment mottling
 - Macular chorioretinal atrophy
 - Optic nerve hypoplasia
 - Iris coloboma
 - Lens subluxation

Zika in Brazil

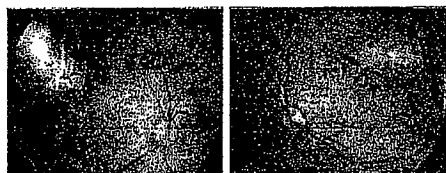
- 2 month old girl



de Paula Freitas L, de Oliveira Dias J, Patience J, et al. Ocular Findings in Infants with Microcephaly Associated with Presumed Zika Virus Congenital Infection in Salvador, Brazil. JAMA Ophthalmol. 2016;134(5):529-535. doi:10.1001/jamaophth.134.5.529.

Zika in Brazil

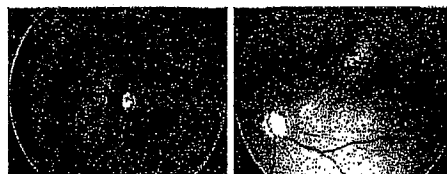
- 1 month old boy



de Paula Freitas L, de Oliveira Dias J, Patience J, et al. Ocular Findings in Infants with Microcephaly Associated with Presumed Zika Virus Congenital Infection in Salvador, Brazil. JAMA Ophthalmol. 2016;134(5):529-535. doi:10.1001/jamaophth.134.5.529.

Zika in Brazil

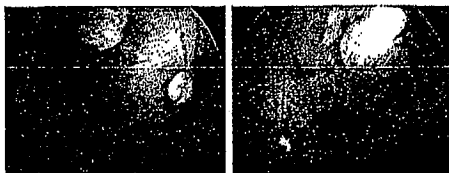
- 1 month old infant



de Paula Freitas L, de Oliveira Dias J, Patience J, et al. Ocular Findings in Infants with Microcephaly Associated with Presumed Zika Virus Congenital Infection in Salvador, Brazil. JAMA Ophthalmol. 2016;134(5):529-535. doi:10.1001/jamaophth.134.5.529.

Zika in Brazil

- 1 month old infant



de Paula Freitas L, de Oliveira Dias J, Patience J, et al. Ocular Findings in Infants with Microcephaly Associated with Presumed Zika Virus Congenital Infection in Salvador, Brazil. JAMA Ophthalmol. 2016;134(5):529-535. doi:10.1001/jamaophth.134.5.529.

Zika in Brazil

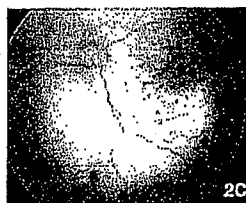
- 20 day old infant



de Paula Freitas L, de Oliveira Dias J, Patience J, et al. Ocular Findings in Infants with Microcephaly Associated with Presumed Zika Virus Congenital Infection in Salvador, Brazil. JAMA Ophthalmol. 2016;134(5):529-535. doi:10.1001/jamaophth.134.5.529.

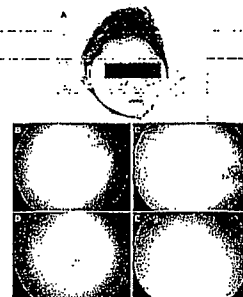
Zika in Brazil

- Case series of 3 infants with microcephaly
- Hemorrhaging and abnormal blood vessel development not noted before in relation to the virus



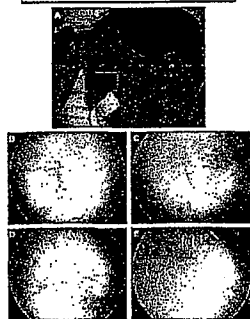
Expanded Spectrum of Congenital Zika Infection in Microcephaly with Presumed Zika Infection, Marinho, Hornum, Augusto de et al. Ophthalmology, Volume 123, Issue 8, 1758-1764

- A: Microcephaly
- B: Vascular tortuosity
- C: Macular ovoid lesions
- D: Early termination of retinal vessels
- E: Superonasal polar bear tracks



Expanded Spectrum of Congenital Zika Infection in Microcephaly with Presumed Zika Infection, Marinho, Hornum, Augusto de et al. Ophthalmology, Volume 123, Issue 8, 1758-1764

- A: Microcephaly
- B, C: Macular pigment clumping
- B: Macular ovoid lesion
- C: Vascular tortuosity and blot hemorrhages
- D, E: Abnormal vascular termination
- E: Focal vascular dilation



Expanded Spectrum of Congenital Zika Infection in Microcephaly with Presumed Zika Infection, Marinho, Hornum, Augusto de et al. Ophthalmology, Volume 123, Issue 8, 1758-1764

- A: Microcephaly
- B, C, D: Macular pigment clumping and ovoid atrophic lesions

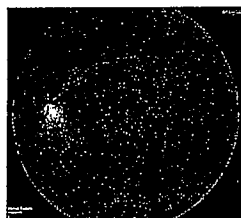


Expanded Spectrum of Congenital Zika Infection in Microcephaly with Presumed Zika Infection, Marinho, Hornum, Augusto de et al. Ophthalmology, Volume 123, Issue 8, 1758-1764

- What about adults?

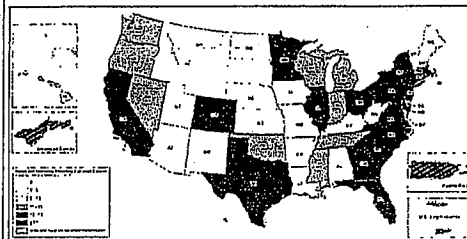
- 64 year-old man with decreased central vision OS over 3 days
- Red rash over his upper body
- Knee and shoulder pain for 10 days
- Just returned from Haiti for mission work

- Serologically confirmed Zika virus in 64 year old man



Serologically Confirmed Zika Virus in a 64-year-old man, N.Y., D.H. Annals of Ophthalmology July 2016, 54(7):e22 (http://dx.doi.org/10.1093/aio/aaw007)

Zika virus disease in the United States, 2015–2016 (as of 7/27/16)



CDC Recommendations

- All healthcare providers should report suspected cases of Zika virus to their state health department
- Zika virus testing is performed by the CDC Laboratory and a few state health departments
- In all patients with possible congenital Zika virus, an eye examination be performed, including a retina evaluation, either in the hospital or within one month after birth

CDC Recommendations

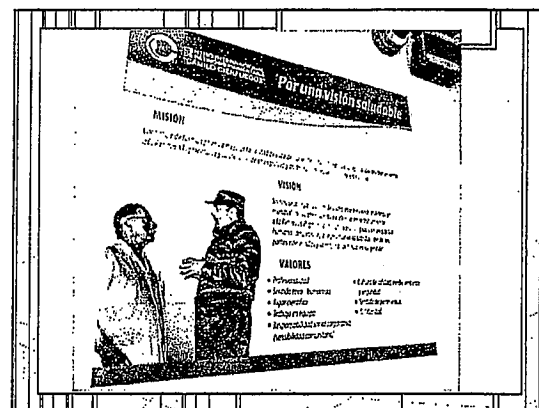
- Any pregnant patients should postpone travel to an area with ongoing Zika virus transmission
- Testing can be offered to any asymptomatic pregnant patients who have travelled to areas with ongoing Zika virus transmission

- Use insect repellents containing DEET, picaridin, IR3535, oil of lemon eucalyptus or para-menthane-diol for long-lasting protection
- Wear long-sleeved shirts and long pants
- Use air conditioning or window and door screens to keep mosquitoes outside
- Reduce the number of mosquitoes by emptying standing water from flowerpots, etc

- Zika cases in Florida
- Zika testing

References

- Hernandez AL, Pacheco AJ, Hargrett-El. The virus spread to new areas — Region of the Americas, May 2014–January 2015. *MMWR Morbidity and Mortality Weekly Report* 2015;64(3):31–34.
- Schuler-Faure C, Paria FA, Fajana DL, et al. Possible association between the virus isolates and macrocephaly — Brazil, 2014. *MMWR Morbidity and Mortality Weekly Report* 2015;64(3):37–42.
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- Varela CV, Smith JA, Everhart V, et al. The virus in fetal and placental autopsy in a child with macrocephaly. *Lancet* 2015;385(9972).
- de Almeida MA, Gouveia MC, Torres MJ, et al. Expanded spectrum of congenital Zika infection in macrocephaly with presumed Zika infection. *Opthalmology* 2015 in press.
- Stagno G, Di Biase G, Pater G, et al. Infant guidelines for the collection and testing of infants with possible congenital Zika infection — United States, 2014. *MMWR Morbidity and Mortality Weekly Report* 2015;64(3):7.
- Guayano J, Fajana DL, Pacheco AJ, et al. Updated interim guidelines for health care providers caring for pregnant women and women of reproductive age with possible Zika virus exposure — United States, 2015. *MMWR Morbidity and Mortality Weekly Report* 2015;64(3):22–27.
- Expanded spectrum of congenital Zika infection in macrocephaly with presumed Zika infection — Brazil, 2014. *MMWR Morbidity and Mortality Weekly Report* 2015;64(3):37–42.
- de Figueiredo J, de Oliveira E, Pacheco AJ, et al. Congenital infection in infants with macrocephaly associated with presumed Zika virus congenital infection in Salvador, Brazil. *JAMA Ophthalmol* 2015; Available at <http://archophth.jama.com/content/early/2015/07/14/ophth.2015.0014>.
- Serogrouping Confirmed the Revised United States Macrocephaly in the Adult. *Paola D, Walsh et al. Ophthalmology* May 2015. <http://www.ophth.net/1046999/2015.05.020>



Jen Spiegel, MD

jenniferaspiegel@hotmail.com

515 Petiwinkle Court ♦ Thousand Oaks, CA 91360 ♦ (913) 244-6014

Fellowship

Ochsner Medical Center Vitreoretinal Surgery Fellowship

New Orleans, LA
July 2013 - June 2015

Residency

University of Kansas
Department of Ophthalmology

Kansas City, KS
July 2010 - June 2013

Internship

University of Kansas
Department of Internal Medicine

Kansas City, KS
July 2009 - June 2010

Education

University of Kansas School of Medicine
Doctor of Medicine

Kansas City, KS
May 2009

University of Kansas
Bachelor of Science in Journalism/Broadcast News
Bachelor of Arts in Spanish

Lawrence, KS
August 1998
August 1998

Honors

Janet M. Glasgow-Rubin Achievement Citation, awarded at Hooding Ceremony, May 2009

- Presented to women graduates in top ten percent of class
- Alpha Omega Alpha Honor Medical Society, elected and inducted May 2008
- Virchow Society, National Pathology Honors Society, inducted May 2007
- University of Kansas School of Medicine Clendening Fellowship, Summer 2006

• Self-designed research in Quito, Ecuador

Myrtle R. & Emmitt Eugene Peterson Memorial Fellowship, 2007-2008 and 2008-2009

- Scholarship awarded by University of Kansas Department of Ophthalmology
- University of Kansas Endowment Scholarships, 2005-2009 (multiple)

Publications and Presentations

- "Atypical Retinal Lesion in Heart Transplant Patient: Investigation and Management"
 - Published in The Ochsner Journal, Summer 2015
 - Presentation at Ochsner Medical Center Research Day, May 2015
- "Central Serous-like Chorioretinopathy with Anterior and Posterior Uveitis in MEK Inhibition for Metastatic Cutaneous Melanoma: A Case Report"
 - Presentation at annual meeting of American Society of Retina Specialists, August 2014
- "New Perspectives on Autoimmune Retinopathy: Cases from a National Cancer Institute Designated Cancer Center"
 - Podium presentation at annual meeting of American Society of Retina Specialists, August 2013
 - Presented at Kansas EyeCon, May 2013
- "Ocular Involvement in Patients with Fungemia: A Meta-Analysis"
 - Presentation, Ochsner Health System Research Day, May 2014
 - Presentation, annual meeting of American Academy of Ophthalmology, November 2013
- "The Efficacy of Steroid Treatment for Diabetic Macular Edema in Cases of Failure of Vascular Endothelial Growth Factor Inhibition"
 - Podium presentation at Table Rock Regional Roundup, September 2012
 - Presented at for American Society of Retina Specialists annual meeting August 2012
 - Presented at Kansas EyeCon, May 2012
- Spiegel, Jen; Symons, R.C. Andrew. "The SD-OCT Revolution is Here." *Retinal Physician*. September 2011: pp 42-45.
- "Three Cases of Viral Retinitis"
 - Presented at Kansas EyeCon, May 2011

Language Skills

Fluency in Spanish (Bachelor of Arts degree)

Extracurricular Activities

Peer reviewer for The Ochsner Journal 2014

Co-chief Ophthalmology Resident 2012-2013

University of Kansas Residents' Council 2010-2013

- Elected and served as council Secretary 2009-2010
 - Initiated secure, University-wide resident online forum
- Graduate Medical Education Committee member 2009-2013
 - Participated in University accreditation site review 2011

Work Experience

National Cancer Institute's Cancer Information Service, March 2003 - August 2005

- Cancer Information Specialist for patients, health care providers, and general public
- Project leader for new e-mail service
- Participated in research to test tailored barriers intervention for cancer pain management

Health Midwest Media Relations, January 2001 - March 2003

- Media Relations Coordinator/Interim Director of Media Relations
- Promoted medical news coverage for 14 Kansas City-area hospitals

KMBC-TV, September 1999 - January 2001

- Television news producer for daily Kansas City newscasts and special projects

KTKA-TV, September 1998 - September 1999

- Television news producer for daily Topeka, Kansas newscasts and special projects

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STATE BOARD OF OPTOMETRY
2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
P (916) 575-7170 F (916) 575-7292 www.optometry.ca.gov



CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

PN 4: 50

1-3000/6457207/6201399/SD

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>AB-Internal Approaches to Glaucoma Surgery</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Keyfi</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Morgan</u> (First) <u>Penner</u> (Last) (Middle)	
License Number <u>142841</u>	License Type <u>MD</u>
Phone Number (800) <u>998-2020</u>	Email Address <u>mrenner@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider

Date

12/21/16



**Retina Research Foundation
of California**

Date: 10/02/2016

AB-Interno Approaches to Glaucoma Surgery

Presented the topic of angle based glaucoma surgery, specifically focusing on gonioscopy-assisted trans luminal trabeculotomy as well as Visco360, a device used to viscodilate Schlemms canal. We discussed good patient candidates for these procedures as well as expected outcomes.

Morgan Renner, MD.

Ab-Interno approaches to glaucoma surgery

Intraocular pressure reduction with minimal tissue destruction

- Enhanced safety profile – potentially less risks of hypotony
- Quick
- Can be performed using incisions used for cataract surgery
- Perhaps less efficacious than traditional surgical methods
- Ab Interno Trabeculotomy
 - Trabectome (NeoMedix)
 - Kahook Dual Blade (New World Medical)
 - Gonioscopy-assisted transluminal trabeculotomy with iTrack catheter (Ellex)
 - Trab360 (Sight Sciences)
- Ab Interno Viscocanalostomy
 - ABiC with iTrack microcatheter (Ellex)
 - Visco360 (Sight Sciences)
- Micro-Stents
 - iStent Trabecular Micro-Bypass Stent (Glaukos Corp, Laguna Hills, CA, USA)
 - Hydrus (Ivantis Inc, Irvine, CA, USA)
 - Cypass Micro-Stent (Transcend/Alcon)
 - iStent Supra (Glaukos)
 - Xen Glaucoma Implant (Aquesys/Allergan)
- Schlemm's Canal Stents
- iStent
 - FDA approved 2012 in conjunction with cataract surgery
 - Heparin-coated non-ferromagnetic titanium device used to stent open Schlemm's canal – 1 mm in length, 120 micron lumen
 - Future --> iStent Inject (injectable 2 stent therapy) approved in EU, Canada, Aus
 - Use of multiple stents may provide additional reductions in IOP and medication use
 - Hydrus
 - Investigational device Completed enrollment in Phase 3 FDA study
 - Flexible nickel/titanium alloy ("nitinol") 8 mm scaffold used to dilate Schlemm's canal
- Video of iStent/Hydra Placement
- Suprachoroidal Stents
- CyPass
 - FDA approved July 2016 in conjunction with cataract surgery
 - 6.35 mm long polyimide tube of 0.51 mm diameter designed to enter into supraciliary space via a guidewire
- iStent Supra

- Investigational device under Phase 3 FDA study
- 4 mm long tube made of PES and titanium
- Video of Cypass or iStent Supra insertion
- Subconjunctival Stents
- Xen
 - Investigational device in Phase 3 trials
 - 6 mm long pliable collagen-derived implant of varying lumen size to be inserted with a 27 G needle from the anterior chamber into the non-dissected tissue of the subconjunctival space, creating a bleb
 - Video of Xen

AB-INTERNO APPROACHES TO GLAUCOMA SURGERY

Morgan Renner, MD MPH

- Intraocular pressure reduction with minimal tissue destruction
- Enhanced safety profile – potentially less risks of hypotony
- Quick
- Can be performed using incisions used for cataract surgery
- Perhaps less efficacious than traditional surgical methods

- Ab Interno Trabeculotomy
 - Trabectome (NeoMedix)
 - Kahook Dual Blade (New World Medical)
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 - Flexible nickel/titanium alloy ("nitinol") 8 mm scaffold used to dilate Schlemm's canal



Video of iStent/Hydra Placement

Suprachoroidal Stents

- CyPass
 - FDA approved July 2016 in conjunction with cataract surgery
 - 6.35 mm long polyimide tube of 0.51 mm diameter designed to enter into supraciliary space via a guidewire
- iStent Supra
 - Investigational device under Phase 3 FDA study
 - 4 mm long tube made of PES and titanium

Video of Cypass or iStent Supra insertion

Subconjunctival Stents

• Xen

Video of Xen

- Investigational device in Phase 3 trials
- 6 mm long pliable collagen-derived implant of varying lumen size to be inserted with a 27 G needle from the anterior chamber into the non-dissected tissue of the subconjunctival space, creating a bleb

Obamacare: What to expect for 2016

Tom Chang MD
Founder

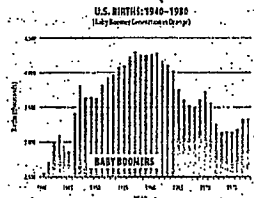
3 Forces at play currently in health care:

- 1) Baby boom
- 2) Increased numbers of patients insured
- 3) Shift from Fee for Service (FFS) to Capitation.



Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million



Baby Boom Generation:

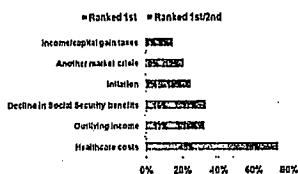
- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
 - 80% of all personal financial assets
 - 77% of all prescription drugs
 - 80% of all leisure travel

Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
- Sense of value

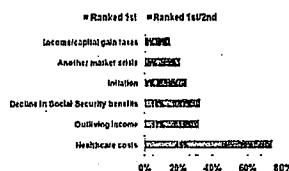
Baby Boom Generation:

Top Retirement Concerns Among Baby Boomers



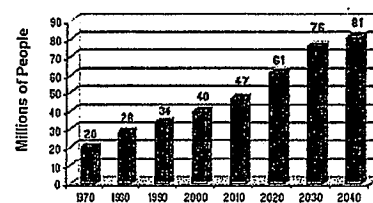
Baby Boom Generation:

Top Retirement Concerns Among Baby Boomers



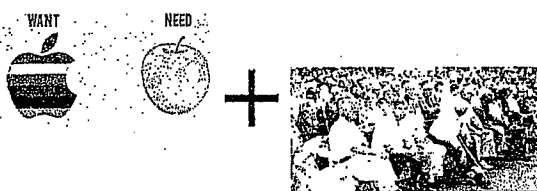
*Treat healthcare as more of an entitlement/expectation

Medicare enrollment:



Source: Health Care Financing Administration

Effect of baby boomers:



Effect of Baby Boomers on Medical practice:



Effect of Baby Boomers on Medical practice:



2. Increased number of insured

APPROVED

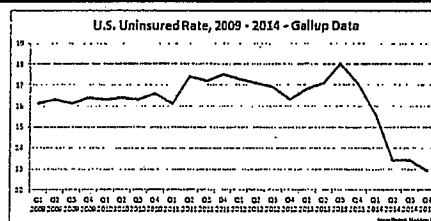
MAR 24 2010

Barack Obama

Effect of Obamacare on You:

- 1) Increased number of insured
- "individual mandate"

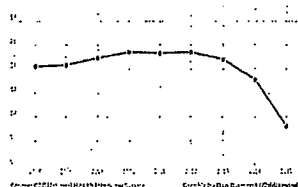
Obamacare: Reduction in 'uninsured'



Obamacare: Reduction in 'uninsured'

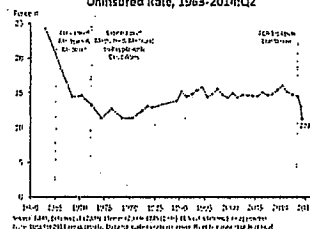
CDC: Uninsured rate falls below 10%

% of uninsured Americans, based on CDC early release data



Obamacare: Reduction in 'uninsured'

Uninsured Rate, 1969-2014: IQ2



What does this mean for Optometry?

Obamacare:

- Will increase the "headcount" in all clinics
- Most will be "Medi-cal"
- Most will have deferred healthcare needs



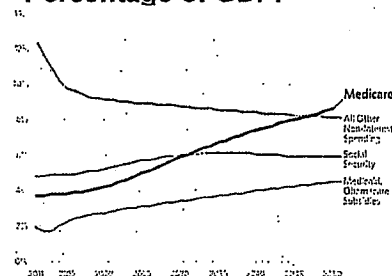
Effect of Obamacare on You:

- 1) Increased number of insured
- 2) Shift from FFS to Capitation

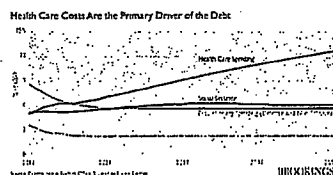
Shift to capitation:

WHY?

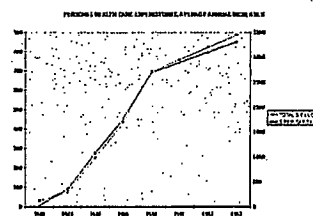
Percentage of GDP:



Health Care cost: effect on debt



Managed care: Effect on Healthcare cost growth



Shift to Cap: Why?

PROFIT
LOSS

Caveat:

Profits without quality improvements is a non-starter.



Quality measures:

- 1) P4P
- 2) e-prescribe
- 3) 5 star (HEDIS)
- 4) - % of anterior vitrectomies with CE
- % of success with primary Retinal det.

HEDIS Measures:

% of Diabetic population screened

- Screening: early detection resulting in clinically meaningful improvement

**HEDIS Measures:**

% of Diabetic population screened

Q: How to you increase the screening rates for this "at risk" population?

HEDIS measures:

Health Effectiveness Data and Information Set

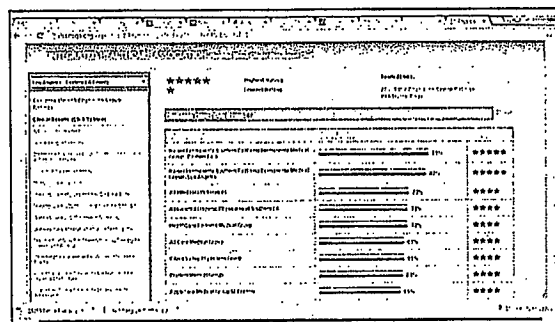
HEDIS Measures:

% of Diabetic population screened

HEDIS: Health Effectiveness Data and Information Set

- 80% = 5 star
70% = 4 star
60% = 3 star
50% = 2 star

HEALTH EFFECTIVENESS DATA AND INFORMATION SET (HEDIS) is a set of measures that assess the quality of care provided by health plans. The measures are based on the Health Effectiveness Data and Information Set (HEDIS) and are used to compare the performance of health plans. The measures are based on the Health Effectiveness Data and Information Set (HEDIS) and are used to compare the performance of health plans.



[illegible]

Shift to Capitation: Why?

Population based improvement:

- FFS system has limited ability to increase screening

Shift to Capitation: Why?

Patient choice: McGrath.

J. F. A. INSURANCE GROUP, INC.

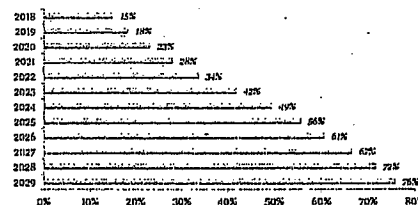
Time to Trade-In the Cadillac Health Plan

L. Kopp, F. Rindler-Schjerve, C. Voigt

[illegible][illegible]

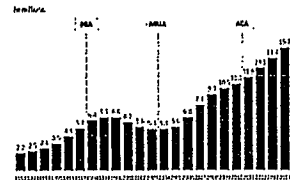
Shift to Capitation: Why?

Plans Exceeding ACA 'Cadillac Tax' Threshold



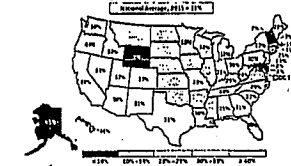
Medicare advantage:

Total Medicare Advantage Enrollment, 1992-2014



Medicare Advantage:

Share of Medicare Beneficiaries Enrolled in Medicare Advantage Plans, by State, 2015



MACRA bill (aka SGR repeal bill)**MACRA bill:**

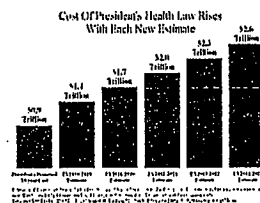
- replaces the former "SGR" fix (21% cut)

MACRA bill:

- replaces the former "SGR" fix (21% cut)
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- * bonus payments going to providers who switch to "alternative payment methods" (ie capitation)

MACRA bill:

- replaces the former "SGR" fix (21% cut)
- small 0.5% increases will take place 2016-2019
- Accelerated move from "volume based" payments to "value based" payments

Obamacare: New \$ in the system**News**

FOR IMMEDIATE RELEASE
January 24, 2013

Comments: HHS Press Office
202-693-4342

Better, Smarter, Healthier: In historic announcement, HHS sets clear goals and timeline for shifting Medicare reimbursements from volume to value

In a meeting with nearly two dozen leaders representing consumers, insurers, providers, and business leaders, Health and Human Services Secretary Kathleen Sebelius today announced new overall goals and a timeline to make the Medicare program, and the health care system at large, toward paying providers based on the quality, rather than the quantity of care they give patients.

HHS has set a goal of tying 30 percent of total direct, or fee-for-service, Medicare payments to quality or value through alternative payment models, such as Accountable Care Organizations (ACOs) or bundled payment arrangements by the end of 2015, and tying 50 percent of payments to these models by the end of 2019. HHS also set a goal of tying 50 percent of all traditional Medicare payments to quality or value by 2015 and 50 percent by 2019 through programs such as the Hospital Value-Based Purchasing and the Hospital Readmissions Reduction Programs. This is the first time in the history of the Medicare program that HHS has set explicit goals for alternative payment models or value-based payments.

To make these goals achievable beyond Medicare, Secretary Sebelius also announced the creation of a Health Care Payment Learning and Action Network. Through the Learning and Action Network, HHS will work with private payers, employers, consumers, providers, states and state-level health systems, and other providers to expand alternative payment models for health care. HHS will identify the tools, rules, and policies that will support adoption of alternative payment models through their own aligned work, sometimes partnering with the goals set for Medicare. The Network will hold its first meeting in March 2013, and more details will be released in the near future.

Shift to Capitation:

HHS has set a goal of tying 30 percent of traditional, or fee-for-service, Medicare payments to quality or value through alternative payment models, such as Accountable Care Organizations (ACOs) or bundled payment arrangements by the end of 2016, and tying 50 percent of payments to these models by the end of 2018. HHS also set a goal of tying 85 percent of all traditional Medicare payments to quality or value by 2016 and 90 percent by 2018 through programs such as the Hospital Value Based Purchasing and the Hospital Readmissions Reduction Programs. This is the first time in the history of the Medicare program that HHS has set explicit goals for alternative payment models and value-based payments.

Shift to Capitation:

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Summary:

- 1) Consecutive sweeping external pressures will likely result in wholesale changes in healthcare delivery.

Summary:

- 1) Consecutive sweeping/external pressures
- 2) More patients will be available for care (within defined plans)

Summary:

- 1) Consecutive sweeping/external pressures
- 2) More patients will be available for care (within defined plans)
- 3) Introduction of Big Business into medicine

How can you position yourself for the future?



- "the singularly most optometrically friendly practice in So Cal"

Partnering with RIC/CEES:

- as FFS business decreases the "capitation" practices will increase

Partnering with RIC/CEES:

- as FFS business decreases the "capitation" practices will increase
- Integration with a practice with experience and expertise in "alternative payment plans"

Partnering with RIC/CEES:

Two new initiatives:

- 1) Cataract/LASIK co-management

Partnering with RIC/CEES:

Two new initiatives:

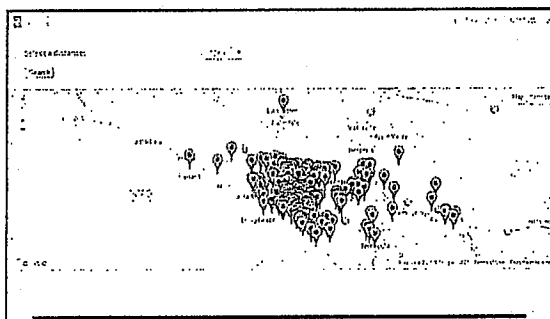
- 1) Cataract/LASIK co-management
- Erika, April, Christina

Partnering with RIC/CEES:

Two new initiatives:

- 1) Cataract/LASIK co-management
- 2) Single specialty IPA





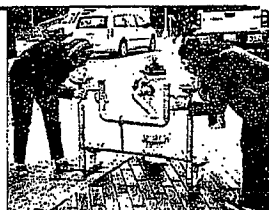
Vertically Integrated IPA:

- Single specialty (only eye)
- Whole risk
- Large capitation regions and populations



Eyecare United IPA:

- Opportunity for you as a solo practitioner to participate in large group plans
- Access to more patients



Eyecare United: Steps involved:

- 1) Enroll large numbers of providers

Eyecare United: Steps involved:

- 1) Enroll large numbers of providers
- 2) Negotiate contracted rates for larger populations

Eyecare United: Steps involved:

- 1) Enroll large numbers of providers
- 2) Negotiate contracted rates for larger populations
- 3) Credential/Accreditation of providers

Eyecare United: Steps involved:

- 1) Reply to the email sent to you
- 2) Join Eyecare United
- 3) Talk to your friends/colleagues about it.



Summary:



Thank you

Morgan Renner, MD

**Cataract Surgeon, Glaucoma Specialist, and
General Ophthalmologist**



Dr. Renner specializes in the diagnosis and medical/surgical management of glaucoma and cataracts.

After graduating summa cum laude from Arizona State University with a dual degree in Biology and Psychology, Dr. Renner obtained a Master's degree in Public Health from George Washington University. She then attended medical school at Georgetown University and completed her ophthalmology residency at the University of Rochester in New York. She spent one additional year of subspecialty training in glaucoma, cataract, and anterior segment disease at the University of Michigan, learning from renowned clinicians such as Drs. Paul Lee, Paul Lichter, and Sayoko Moroi.

Dr. Renner is a fellow of the American Academy of Ophthalmology and the American Glaucoma Society. She has published several ophthalmology articles as well as presented at national research conferences. In her free time, she enjoys travel, music, film, and taking advantage of all the new experiences California has to offer.

888-884-3805

www.acuityspecialists.com

ACUITY
EYE SPECIALISTS

Morgan Renner, MD

mrenner@acuityspecialists.com

Education

2004 | Bachelor of Science, Biology and Psychology
Arizona State University
Tempe, AZ

2007 | Master's of Public Health, Maternal and Child
Health, George Washington University,
Washington DC

2011 | Doctor of Medicine, Georgetown University
School Medicine, Washington DC

Professional Training

2011-2012 | Preliminary Medicine, Mt. Sinai St. Luke's
Roosevelt Hospital Center, New York, NY

2012-2015 | Residency, Ophthalmology, Flaum Eye
Institute, University of Rochester, New York,
NY

2015-2016 | Fellowship, Glaucoma, Kellogg Eye Center
University of Michigan Health System, Ann
Arbor, MI

Professional Affiliations

- American Academy of Ophthalmology
- American Glaucoma Society

Honors & Awards

- National Merit Scholarship
- Hallmark Family Foundation Award
- Summa Cum Laude Distinction
- Snell Ophthalmology Resident Investigator Award

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ACUITY
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OPTOMETRY

STATE BOARD OF OPTOMETRY
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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee: 50

1-3000/6457207/251336/50

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In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Obamacare: What to Expect for 2016</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Tom</u> (First) <u>Chang</u> (Last) _____ (Middle)	
License Number <u>A69909</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>tchang@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Obamacare: What to Expect for 2016

This lecture shared important information regarding Obamacare. The effects of the “Baby Boom Generation” was discussed and what all of this means for optometry. In summary the consecutive sweeping external pressures will likely result in wholesale changes in healthcare delivery and more patients will be available for care (within defined plans). Lastly, how optometrists can position themselves in the future was discussed in detail.

Tom Chang, MD.

Obamacare: What to expect for 2016

3 Forces at play currently in health care:

- Baby boom
- Increased numbers of patients insured
- Shift from Fee for Service (FFS) to Capitation.

Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million

Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
 - 80% of all personal financial assets
 - 77% of all prescription drugs
 - 80% of all leisure travel

Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
- Sense of value
- Medicare enrollment:

Effect of baby boomers:

- Effect of Baby Boomers on Medical practice:
 - Increased number of insured

Effect of Obamacare on You:

- Increased number of insured
- "individual mandate"

Obamacare: Reduction in 'uninsured'

- What does this mean for Optometry?

Obamacare:

- Will increase the "headcount" in all clinics
- Most will be "Medi-cal"
- Most will have deferred healthcare needs

Effect of Obamacare on You:

- Increased number of insured
- Shift from FFS to Capitation
- Shift to capitation:
 - Percentage of GDP:
- Health Care cost: effect on debt
- Managed care: Effect on Healthcare cost growth

Shift to Cap: Why?

- Caveat:
- Profits without quality improvements is a non-starter.
- Quality measures:
- P4P
- e-prescribe
- 5 star (HEDIS)
- - % of anterior vitrectomies with CE
 - % of success with primary Retinal det.

HEDIS Measures:

- % of Diabetic population screened
- Screening: early detection resulting in clinically meaningful improvement
- % of Diabetic population screened
- Q: How to you increase the screening rates for this "at risk" population?
- Health Effectiveness Data and Information Set

% of Diabetic population screened

- 80% = 5 star
- 70% = 4 star
- 60% = 3 star
- 50% = 2 star

Shift to Capitation: Why?

- Population based improvement:
- FFS system has limited ability to increase screening
- Shift to Capitation: Why?
- Patient choice:
- Shift to Capitation: Why?
- Medicare advantage:
- Medicare Advantage:
- MACRA bill (aka SGR repeal bill)
- MACRA bill:
 - replaces the former "SGR" fix (21% cut)
- MACRA bill:
 - replaces the former "SGR" fix (21% cut)
 - small 0.5% increases will take place 2016-2019
 - bonus payments going to provides who switch to "alternative payment methods" (ie capitation)
- MACRA bill:
 - replaces the former "SGR" fix (21% cut)
 - small 0.5% increases will take place 2016-2019
 - Accelerated move from "volume based" payments to "value based" payments
- Obamacare: New \$ in the system
- Shift to Capitation:

Summary:

- Consecutive sweeping external pressures will likely result in wholesale changes in healthcare delivery.

- Consecutive sweeping/external pressures
- More patients will be available for care (within defined plans)
- Introduction of Big Business into medicine

How can you position yourself for the future?

- “the singularly most optometrically friendly practice in So Cal”
- Partnering with RIC/CEES:
- as FFS business decreases the “capitation” practices will increase

Partnering with RIC/CEES:

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- Eyecare United: Steps involved:
- Reply to the email sent to you

Join Eyecare United

- Talk to your friends/colleagues about it.

Obamacare: What to expect for 2016

Tom Chang MD
Founder

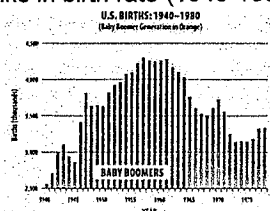
3 Forces at play currently in health care:

- 1) Baby boom
- 2) Increased numbers of patients insured
- 3) Shift from Fee for Service (FFS) to Capitation.



Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million



Baby Boom Generation:

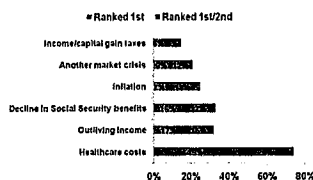
- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
 - 80% of all personal financial assets
 - 77% of all prescription drugs
 - 80% of all leisure travel

Baby Boom Generation:

- Post WW2 spike in birth rate (1946-1964)
- 80 million
- Have resources:
- Sense of value

Baby Boom Generation:

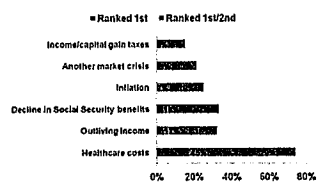
Top Retirement Concerns Among Baby Boomers



Source: MetLife Mature Market Institute, "Retirement Concerns Among Baby Boomers," August 2012

Baby Boom Generation:

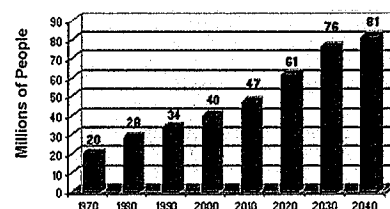
Top Retirement Concerns Among Baby Boomers



*Treat healthcare as more of an entitlement/expectation

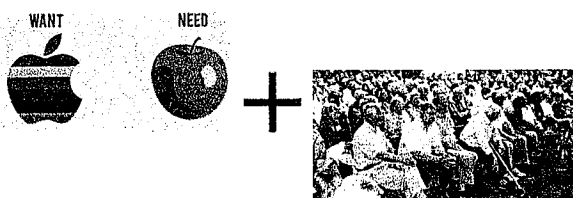
Source: MetLife Mature Market Institute, Survey of Retirement Concerns, 2012. Survey dates: Nov 2011 to Aug 2012.

Medicare enrollment:

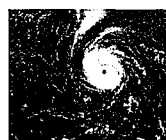


Source: Health Care Financing Administration

Effect of baby boomers:



Effect of Baby Boomers on Medical practice:



Effect of Baby Boomers on Medical practice:



2. Increased number of insured

APPROVED

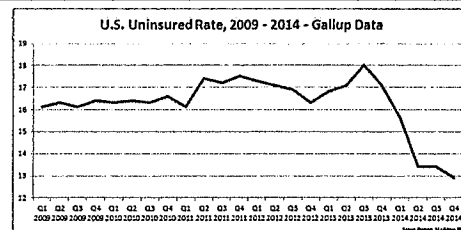
MAR 23 2010

Barack Obama

Effect of Obamacare on You:

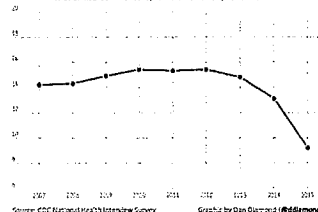
- 1) Increased number of insured
- "individual mandate"

Obamacare: Reduction in 'uninsured'



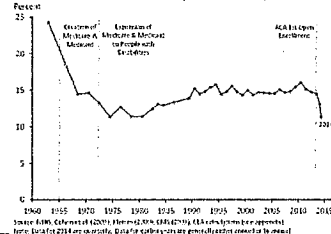
Obamacare: Reduction in 'uninsured'

CDC: Uninsured rate falls below 10%
% of uninsured Americans, based on CDC early release data



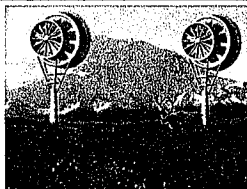
Obamacare: Reduction in 'uninsured'

Uninsured Rate, 1963-2014:Q2



What does this mean for Optometry?

- Obamacare:
- Will increase the "headcount" in all clinics
 - Most will be "Medi-cal"
 - Most will have deferred healthcare needs



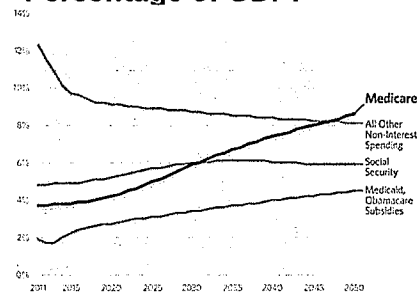
Effect of Obamacare on You:

- 1) Increased number of insured
- 2) Shift from FFS to Capitation

Shift to capitation:

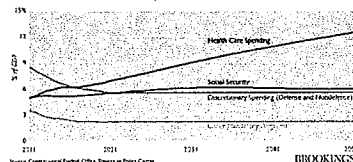
WHY?

Percentage of GDP:

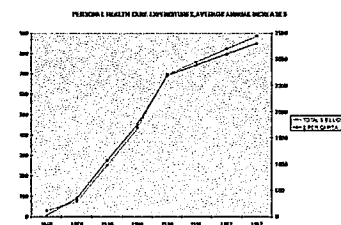


Health Care cost: effect on debt

Health Care Costs Are the Primary Driver of the Debt



Managed care: Effect on Healthcare cost growth



Shift to Cap: Why?



Caveat:

Profits without quality improvements is a non-starter.



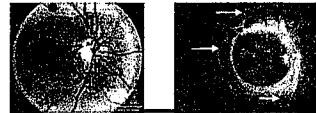
Quality measures:

- 1) P4P
- 2) e-prescribe
- 3) 5 star (HEDIS)
- 4) - % of anterior vitrectomies with CE
 - % of success with primary Retinal det.

HEDIS Measures:

% of Diabetic population screened

- Screening: early detection resulting in clinically meaningful improvement

**HEDIS Measures:**

% of Diabetic population screened

Q: How to you increase the screening rates for this "at risk" population?

HEDIS measures:

Health Effectiveness Data and Information Set

HEDIS Measures:

% of Diabetic population screened

HEDIS: Health Effectiveness Data and Information Set

- 80% = 5 star
70% = 4 star
60% = 3 star
50% = 2 star

14. MEASURE: Diabetes Screening (HEDIS) is the percentage of diabetic patients who have been screened for diabetes during the previous 12 months.

15. MEASURE: Diabetes Screening (HEDIS) is the percentage of diabetic patients who have been screened for diabetes during the previous 12 months.

16. MEASURE: Diabetes Screening (HEDIS) is the percentage of diabetic patients who have been screened for diabetes during the previous 12 months.

Physician Group	Screened (%)	Star Rating
Family Practice (All Physicians)	87%	★★★★★
Family Practice (All Physicians)	87%	★★★★★
Family Practice (All Physicians)	87%	★★★★★
Family Practice (All Physicians)	87%	★★★★★
Family Practice (All Physicians)	87%	★★★★★
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Family Practice (All Physicians)	87%	★★★★★

Company	Market Cap (\$B)	Revenue (\$B)	Profit (\$B)	EPS (\$)	P/E Ratio	Dividend Yield (%)	52-Week High (\$)	52-Week Low (\$)	Analyst Rating
HealthCare Partners IPA	1.2	1.1	0.1	0.1	12.0	0.0	1.2	0.8	★★★
United Medical Group	1.1	1.0	0.1	0.1	11.0	0.0	1.1	0.7	★★★
Angene IPA	1.0	0.9	0.1	0.1	10.0	0.0	1.0	0.6	★★★
Arkansas Medical Group	0.9	0.8	0.1	0.1	9.0	0.0	0.9	0.5	★★★
Pennant Medical Group	0.8	0.7	0.1	0.1	8.0	0.0	0.8	0.4	★★★
PHS Health Physicians - PA System	0.7	0.6	0.1	0.1	7.0	0.0	0.7	0.3	★★
Good Samaritan Medical Practice Association	0.6	0.5	0.1	0.1	6.0	0.0	0.6	0.2	★★
Prospect Physical Medical Care IPA Medical Group, Inc.	0.5	0.4	0.1	0.1	5.0	0.0	0.5	0.1	★★
Greenix Healthcare	0.4	0.3	0.1	0.1	4.0	0.0	0.4	0.0	★★
Pennant Valley Medical Group	0.3	0.2	0.1	0.1	3.0	0.0	0.3	0.0	★★
Summit of Omaha Medical Group, Inc.	0.2	0.1	0.1	0.1	2.0	0.0	0.2	0.0	★★
Illinois Physicians Medical Group	0.1	0.0	0.1	0.1	1.0	0.0	0.1	0.0	★★
United Physicians IPA	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	★
OmniCare Medical Group	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	★
HealthCare USA	0.0	0.0	0.1	0.1	0.0	0.0	0.0	0.0	★

Shift to Capitation: Why?

Population based improvement:

- FFS system has limited ability to increase screening

Shift to Capitation: Why?

Patient choice:

McGrath
INSURANCE GROUP, INC.

Time to Trade-In the Cadillac Health Plan

U.S. DEPARTMENT OF AGRICULTURE

In a few years, millions of Americans will likely be basing their careers on the

We're talking about cars. The government would offer you General Motors, so driving a Cadillac would be protecting your investment.

(4) if you have a "Gallie" health plan = one that lets you pick any more than the average plan = the

government plans to impose a 10% tax on premiums that exceed a price threshold beginning in 2010. The new law was included in the Patient Protection and Affordable Care Act, which passed in December.

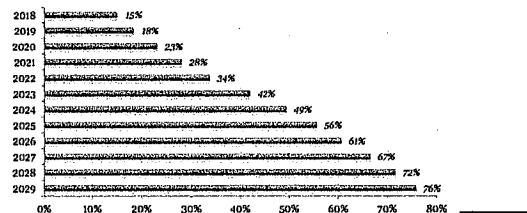
A full-time position is available with a salary of \$19,130 a year for a person with an M.S. in psychology.

coverage includes both employer and employee contributions to flexible spending and health savings

amounts, but not relating vision and dental benefits. If a plan exceeds the threshold numbers by \$100 (for example, the average employee would pay a \$100 tax

Shift to Capitation: Why?

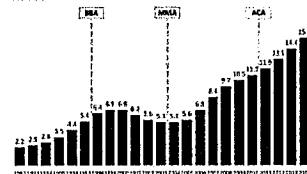
Plans Exceeding ACA 'Cadillac Tax' Threshold



Medicare advantage:

Total Medicare Advantage Enrollment, 1992-2014

la mifera.



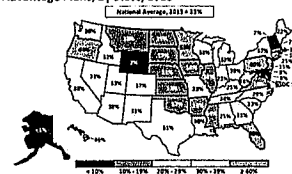
0070. In addition, we found that the growth and survival of *Spizella monticola* as well as other birds are affected by the presence of *Spizella monticola* in the same area. The presence of *Spizella monticola* in the same area as *Spizella monticola* is a result of the fact that *Spizella monticola* is a generalist species and can survive in a wide range of habitats. The presence of *Spizella monticola* in the same area as *Spizella monticola* is a result of the fact that *Spizella monticola* is a generalist species and can survive in a wide range of habitats.

Page 10 and Page 1000: [Log Page 10 with Figure 10] [Log Page 1000 with Figure 1000]

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Medicare Advantage:

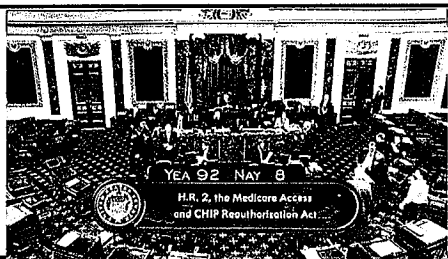
Share of Medicare Beneficiaries Enrolled in Medicare Advantage Plans, by State, 2015



Includes 3D file, and plans and nomenclature. Includes Special Needs Plans as well as other Medicare Advantage plans.

97411. Authors analysis of C/N ratio X purity Market Penetration File, 2215

100

MACRA bill (aka SGR repeal bill)**MACRA bill:**

- replaces the former "SGR" fix (21% cut)

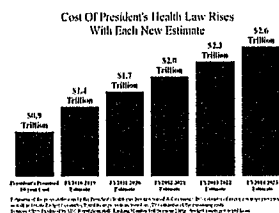
MACRA bill:

- replaces the former "SGR" fix (21% cut)
- small 0.5% increases will take place 2016-2019

* bonus payments going to providers who switch to "alternative payment methods" (ie capitation)

MACRA bill:

- replaces the former "SGR" fix (21% cut)
- small 0.5% increases will take place 2016-2019
- Accelerated move from "volume based" payments to "value based" payments

Obamacare: New \$ in the system**News**

FOR IMMEDIATE RELEASE
January 26, 2015

Contact: HHS Press Office
202-690-6243

Better, Smarter, Healthier: In historic announcement, HHS sets clear goals and timeline for shifting Medicare reimbursements from volume to value

In a meeting with nearly two dozen leaders representing consumers, insurers, providers, and business leaders, Health and Human Services Secretary Sylvia H. Burwell today announced measurable goals and a timeline to move the Medicare program, and the health care system at large, toward paying providers based on the quality, rather than the quantity of care they give patients.

HHS has set a goal of tying 30 percent of traditional, or fee-for-service, Medicare payments to quality or value through alternative payment models, such as Accountable Care Organizations (ACOs) or bundled payment arrangements by the end of 2016, and tying 50 percent of payments to these models by the end of 2018. HHS also set a goal of tying 95 percent of all traditional Medicare payments to quality or value by 2016 and 90 percent by 2018 through programs such as the Hospital Value Based Purchasing and the Hospital Readmissions Reduction Programs. This is the first time in the history of the Medicare program that HHS has set explicit goals for alternative payment models and value-based payments.

To make these goals scalable beyond Medicare, Secretary Burwell also announced the creation of a Health Care Payment Learning and Action Network. Through the Learning and Action Network, HHS will work with private payers, employers, consumers, providers, states and state Medicaid programs, and other partners to expand alternative payment models into their programs. HHS will intensify its work with states and private payers to support adoption of alternative payments models through their own aligned work, sometimes even exceeding the goals set for Medicare. The Network will hold its first meeting in March 2015, and more details will be shared in the near future.

Shift to Capitation:

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Summary:

- 1) Consecutive sweeping external pressures will likely result in wholesale changes in healthcare delivery.

Summary:

- 1) Consecutive sweeping/external pressures
- 2) More patients will be available for care (within defined plans)

Summary:

- 1) Consecutive sweeping/external pressures
- 2) More patients will be available for care (within defined plans)
- 3) Introduction of Big Business into medicine

How can you position yourself for the future?



- "the singularly most optometrically friendly practice in So Cal"

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- as FFS business decreases the "capitation" practices will increase

Partnering with RIC/CEES:

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Two new initiatives:

- 1) Cataract/LASIK co-management

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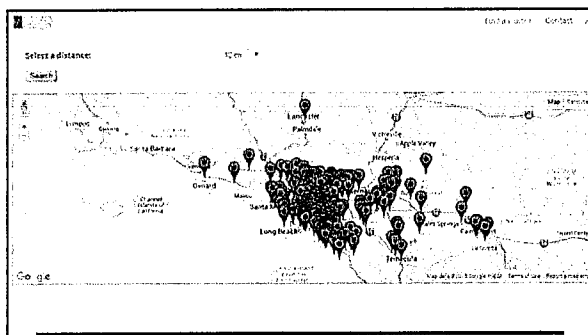
- 1) Cataract/LASIK co-management
- Erika, April, Christina

Partnering with RIC/CEES:

Two new initiatives:

- 1) Cataract/LASIK co-management
- 2) Single specialty IPA





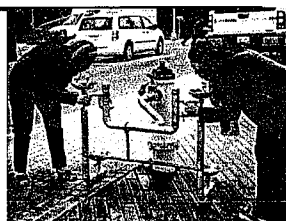
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- 1) Reply to the email sent to you
- 2) Join Eyecare United
- 3) Talk to your friends/colleagues about it.



Summary:



Thank you

Tom S. Chang, MD
Founder

Dr. Chang is an internationally renowned clinician, surgeon and educator. He received his MD from the University of Toronto Medical School and his ophthalmology residency training from the University of Western Ontario. He completed three fellowships in retinal diseases: an ophthalmic pathology fellowship from the Wilmer Eye Institute at Johns Hopkins University, a macular disease fellowship with Dr. Donald Gass at the Bascom Palmer Eye Institute of the University of Miami, and a vitreoretinal surgery fellowship at Emory University in Atlanta.



Upon completion of his training, Dr. Chang was Assistant Professor of Ophthalmology at the University of British Columbia for five years and then an Associate Professor of Ophthalmology at the Doheny Eye Institute for six years where he was Director of the Retina Fellowship. In November 2005, he founded the Retina Institute of California (RIC).

Dr. Chang was part of the team that performed the world's first surgical implantation of stem cell treatment for dry macular degeneration, which was in collaboration with the Johnson & Johnson Stem Cell organization. To date, the doctors at RIC have performed more sub-retinal stem cell surgeries than any other center in the world.

Dr. Chang has given over 120 lectures in 15 countries, and has written over 50 peer-reviewed publications. He has been listed in *Who's Who* and *Best Doctors in America*. He currently serves as the associate editor of the journal *Ophthalmology*, the editor-in-chief of the *Retina Times* and is on the editorial board of *Evidence Based Eye Care*. He was awarded the top teaching award by ophthalmology residents for three consecutive years.

He serves on the scientific advisory boards of several Fortune 500 companies and previously was the team ophthalmologist for the NBA Vancouver Grizzlies. His patients include many CEOs, professional athletes and physicians.

His research interests include health outcome assessments and drug delivery systems. His clinical interests include macular degeneration and diabetic retinopathy

800-898-2020



Biography

Tom S. Chang, MD

800-898-2020

tchang@retina2020.com

Cell: 626-676-0838

EDUCATION

- 1988 Medical degree, University of Toronto, Toronto, Ontario
- 1999 Master of Health Science in Epidemiology, University of British Columbia, Vancouver, British Columbia

PROFESSIONAL TRAINING

- 1988-89 General Comprehensive Medical Internship, Toronto General Hospital, Toronto, Ontario
- 1989-92 Resident in Ophthalmology, University of Western Ontario, London, Ontario

FELLOWSHIPS

- 1992-93 Ophthalmic Pathology Fellowship, Johns Hopkins/Wilmer., Baltimore, MD
- 1993-94 Macular Diseases Fellowship, Bascom Palmer Eye Institute, Miami, FL
- 1994-95 Vitreo-retinal Surgery Fellowship, Emory University, Atlanta, GA

PROFESSIONAL AFFILIATIONS

- > Retina Institute of California
- > American Academy of Ophthalmology
- > Retina Society
- > Macula Society
- > American Society of Retina Specialists
- > Club Vit
- > Umbo Society

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee P 4:50

1-3000/6457207/2853230/50

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Complications of Glaucoma Filtering Surgery</u>	Course Presentation Date <u>10/02/2016</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>
Provider Email Address <u>KSEYFI @ Retina 2020.com</u>
Will the proposed course be open to all California licensed optometrists? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation? <input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Brian</u> (First) <u>Chen</u> (Last) _____ (Middle)	
License Number <u>A127719</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>bchen@californiaeyeandear.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Complications of Glaucoma Filtering Surgery

Computer Vision Syndrome affects between 40-50% of patients and is causing issues such as headache, neck tension, eye fatigue, dry eyes and dizziness. Many Computer Vision Syndrome problems can be traced to a misalignment in the visual system that can be corrected for using Neurolenses. Once introduced, Neurolenses has a 95% success rate in reducing or eliminating the annoying issues of Computer Vision Syndrome.

Brian Chen, MD.

Complications of Glaucoma Filtering Surgery

- Patient Factors Influencing Surgery
- Age (Young)
- Race (African American)
- Type of glaucoma (Secondary or Developmental)
- Aphakia or pseudophakia
- Extent of optic nerve damage
- Duration of medical anti-glaucoma therapy
- Other ocular disease—uveitis, cataract (combined procedure)
- Patient Factors Influencing Surgery
- Nanophthalmos
 - Intraocular surgery associated with choroidal detachments and serous RD.
 - High risk for malignant glaucoma.
 - Filtration surgery contraindicated, except in extensive synechial closure/uncontrolled IOP despite MTMT.
- Patient Factors Influencing Surgery
- Sturge Weber Syndrome
 - High risk of expulsive hemorrhage, intra-op massive choroidal effusion, and serous RD.
 - Posterior pressure, flat AC, iris prolapse, vitreous prolapse.
 - Recommended a posterior sclerotomy before AC entered to allow any effusion to be drained to reduce posterior pressure.
- Filtering Surgery Early Complications
- Bleeding/Hyphema
- Over-filtration and bleb leaks
 - Lens-cornea touch, kissing choroidals, suprachoroidal hemorrhages
 - Flat AC, PAS and posterior synechiae, cataracts
- Infection
- Early failure to control IOP (first 3 months)
- Filtering Surgery Early Complications: Flat AC
- Spaeth Grading System
 - Grade I, II, III
- Grading by CCT
 - Useful for follow up
- Filtering Surgery Early Complications: Flat AC
- Determine whether IOP is higher than expected or excessively low.
- Grades I-II tend to resolve with med management.

- Grade III -eye emergency- will require frequent monitoring and possible surgical intervention.
- Filtering Surgery Early Complications: Flat AC
- An increased loss of corneal endothelial cells occurs when the chamber goes from grade II-III.
- Grade III AC: attempt to reform chamber immediately at slit lamp.
- If injected material comes out of the sclerostomy, may need to go to OR.
- Filtering Surgery Early Complications: Flat AC
- Flat AC with hypotony
 - Usually accompanied by choroidal effusions.
 - Kissing choroidals - an eye emergency.
 - Chronic angle closure glaucoma post trab responds poorly to med management and often require surgical intervention: predisposed to malignant glaucoma.
- Filtering Surgery Early Complications: Flat AC
- Draining choroidal effusions
 - 1+ sclerostomies inferiorly 4mm post to limbus over pars plana.
 - Reform A/C.
 - Drain choroidals while maintaining AC deep: AC maintainer device (Lewicky).
 - $\frac{3}{4}$ developed cataracts within 1st post op year.
 - Filtering Surgery Early Complications: Flat AC
- To avoid it: make sure AC maintains good depth at the end of the case, in the presence of adequate IOP.
- Prevent pupillary block and malignant glaucoma with a patent PI and generous cycloplegia at the end of the case.
- Filtering Surgery Early Complications: Flat AC
- Flat AC in normotensive/hypertensive eyes
 - Volume/pressure behind lens-iris diaphragm:
 - Pupillary block with an incomplete PI
 - Expansion of the choroid or enlargement of suprachoroidal space (blood or effusion)
 - Increased vitreous volume: blood or effusion
 - Aqueous misdirection (Malignant Glaucoma)
 - Filtering Surgery Early Complications: Flat AC
- Malignant Glaucoma
 - Grade II or III AC with shallowing of peripheral and central AC, uniformly.
 - IOP is higher than expected.
 - A patent PI must be established before the diagnosis can be considered.
 - Cycloplegics can be curative, miotics worsen.
 - If surgery is needed, disrupting or collapsing the hyaloid phase may be curative.
 - Bilateral in predisposition.
- Filtering Surgery Early Complications: Flat AC

- Malignant Glaucoma: Pathophysiology
 - Initiating event (shallowing of the AC in surgery) causes aqueous to move into or behind the vitreous body.
 - Increased vitreous swelling reduces movement of aqueous into the AC to drain.
 - Enlarging vitreous body is unable to exchange fluid across the hyaloid face.
 - Lens-iris diaphragm is pushed forward closing the angle further.
- Filtering Surgery Early Complications: Flat AC
- Malignant Glaucoma: Medical Management
 - Verify or create a patent PI.
 - Discontinue any miotics.
 - Vigorous cycloplegia and topical steroids.
 - Aqueous suppressants or osmotic agents.
 - Observe for 5 days, if controlled with above: ½ will resolve with above management.
- Filtering Surgery Early Complications: Flat AC
- Malignant Glaucoma: Surgical Management
 - Needle aspiration of the vitreous through the pars plana or PPV in phakic eyes.
 - S/P CE w/ posterior capsule - Nd: YAG through pupil-capsule-hyaloid face.
 - S/P CE w/o posterior capsule - Nd:YAG to hyaloid face centrally/peripherally or PPV.
 - Recurrences occur specially post incomplete PPV in phakic pts, may require CE in rare cases..
- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage
 - Rare during surgery in the phakic eye. More commonly 4-5 days post op w/ sudden severe pain+loss of vision.
 - Patients on systemic anticoagulants and eyes w/ significant post op hypotony are at higher risk.
 - Strong correlation between pre op IOP and risk of SCH
 - Also risk increased in longer eyes (>25.8mm).
- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage
 - Post OP SCH occurs more frequently in aphakic eyes with other pathology.
 - Also, more likely if the vitreous is liquified.
 - Intra op expulsive SCH is rarely seen in glaucoma surgery.
- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage: Management
 - Intra op SCH: close limbal incision immediately, do a posterior sclerostomy over presumed site of bleeding.
 - An AC maintainer may be used to get control over IOP.
- SCH Management: Posterior Sclerotomy

- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage Management: Post op Onset
 - Requires drainage if aqueous suppressants and hyperosmotics fail to control pressure.
 - 4-5 days are allowed for the clot to lyse in the suprachoroidal space if drainage can be delayed for that period of time.
 - Then a posterior sclerostomy is made over the area of elevated choroid about 2mm.
 - In aphakia, the choroid and retina can be pushed to the pupillary plane. Immediate surgical intervention is needed in these cases.
- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage Management: Post op Onset
 - If drainage cannot be postponed, a large scleral incision (10-12mm) for the clot to slide out near the center of the choroidal elevation.
 - BSS, air or viscoelastic injected to reform the AC vs an AC maintaining device.
 - Maintenance of high-normal IOP, helps force more of the clot out of the sclerostomy.
 - Helpful to inject viscoelastic in AC at the end of the case.
 - Allow pressures post op of 25-35mmHg for the first few days to maintain ocular integrity.
- Filtering Surgery Early Complications: Flat AC
- Suprachoroidal Hemorrhage: Prognosis
 - If there is no extrusion of intraocular contents aside from aqueous and liquefied vitreous, if blood does not break into the vitreous cavity and if high IOP is not sustained, prognosis is reasonably good.
 - Outcome is favorable if SCH is small, or if surgical intervention is done within the 1st 14 days.
 - Poor prognosis if a concurrent RD or 360 SCH
- Intra-Operative Flat AC: Other Causes
- Aqueous misdirection (ciliary block) during surgery: BSS is inadvertently diverted into the vitreous. The AC shallows and the eye gets firm
 - Close trab flap, and reform AC. If this fails...
 - ½-1ml of liquified vitreous removed through a sclerotomy 3mm post to limbus. Reform AC with BSS, viscoelastic or air bubble if needed to maintain it.
 - Atropine + topical steroids post op with close monitoring for recurrence
- Filtering Surgery Early Complications: Hyphema
- First 3-5 days post op
- Anticoagulants significant risk factor
- Bleeding usually from the iris, ciliary body or corneoscleral wound
- Restrict activities/protective eye shield
- Evacuation rarely needed: IOP + cornea status
- Large/Clotted Hyphema: remove clot with IA using viscoelastic for visualization.
- Filtering Surgery Early Complications: Conjunctival Button Holes

- Major Causes: poor visualization, use of instruments that penetrate the tissue, immediate or delayed necrosis post cauterization.
- High risk in scarred or inflamed areas.
- Best to recognize them at OR.
- Filtering Surgery Early Complications: Conjunctival Button Holes
- If early post OP: except in wound dehiscence, the management is initially medical
 - Cycloplegia
 - BCL or patch
 - Reduce or d/c - if possible - steroids/NSAIDs
 - Antibiotics
 - Cyanoacrylate under BCL, an alternative
 - Compression suture
- Filtering Surgery Early Complications: Conjunctival Button Holes
- If bleb is flat and/or the AC is flat: OR
 - Under General
 - Topical with facial block and sedation, an alternative in cooperative patients
 - Retrobulbar Block contraindicated
- Filtering Surgery Early Complications: Intraocular Infection
- Risk factors
 - thin blebs and those with leaks
 - antimetabolite use (as high as 2% incidence)
 - Myopia
 - releasable sutures
 - URTI
 - Blebs at inferior limbus
 - Unguarded filtration surgery
 - Poor compliance with antibiotics
 - DM
- Filtering Surgery Early Complications: Intraocular Infection
- Blebitis
 - Confined to the bleb
 - Responds faster to antibiotic therapy
 - Can be managed outpatient setting
 - More favorable visual prognosis
 - May be prodromal to endophthalmitis
 - Staph or Strep sp account for 1/2 of cultures+
- Filtering Surgery Early Complications: Intraocular Infection
- Endophthalmitis
 - Aggressive vitrectomy with intravitreal antibiotics (+/- steroids).
- Culture both AC and vitreous in the presence of a hypopyon.
- Patient awareness of new and unusual symptoms is key.
- Filtering Surgery Early Complications: Sympathetic Ophthalmia
- 2 wks to many years post any intraocular sx

- 0.08% incidence post glaucoma sx
- Symptoms
 - photophobia-blurred vision-redness
- Signs
 - Granulomatous uveitis and Dalen-Fuchs nodules
- Management
 - Immunosuppressive tx, atropine; possible enucleation of exciting eye.
- Dalen-Fuchs' nodules
- Filtering Surgery Early Complications: Filtration Failure
- Digital pressure/Ocular massage
 - Forcing aqueous through the sclerotomy may:
 - prevent closure of the sclerotomy
 - lift conj/episclera and slow scarring
 - allow aqueous flow, up permeability
 - No effect if done after 3 mo post op
 - Check IOP 40 mins post
- Filtering Surgery Early Complications: Filtration Failure
- Digital pressure/Ocular massage
 - If sclerostomy incision open, but bleb is sealing down over it... digital pressure by patient on a regular basis.
 - The goal is to reduce IOP w/o causing hypotony (less than 7-10mmHg)... can lead to more inflammation and Va fluctuation.
 - Gonioscopy 1st: r/o any iris, lens or vitreous incarceration in the sclerostomy.
 - Caution: PKP, or recent IOL placement
- Filtering Surgery Early Complications: Filtration Failure
- Failure during POW 1
 - Iris, vitreous, clot, ciliary process, or lens plug
 - Retained viscoelastic substance
 - Imperforate Descemet's membrane
 - Scleral flap too tight
 - Ciliary or pupillary block
- Filtering Surgery Early Complications: Filtration Failure
- Plugged Sclerostomy Site
 - Gonioscopy, if AC formed
 - Iris plug: after a flat AC, or if PI too small. Pilo 2 or 4% vs Argon vs Nd:YAG laser.
 - Blood Clot: digital pressure ok, if small+IOP not too high can wait 2-3 days for it to lyse. Argon laser useful in breaking large clots.
 - Vitreous: a scaffold for scar tissue, Nd:YAG of some benefit. Best management is prevention.
- Filtering Surgery Early Complications: Filtration Failure
- Retained viscoelastic material
 - Digital pressure OK

- No difference between Viscoat, Healon or Healon-GV in terms of endothelial cell count post sx, inflammation or post op IOP
 - Healon-5 can take several days before dissolving in the eye - prolonged high IOP
- Filtering Surgery Early Complications: Filtration Failure
- Tight scleral flap
 - If digital pressure is still required after 4-7 days post op or if it is unsuccessful initially, 1 or more sutures should be loosened.
 - Longer window of opportunity in antimetabolite eyes (3-4 weeks).
 - Releasable sutures important when laser access limited.
 - Laser suture lysis: Argon+special (Hoskins, Blumenthal) lens; conjunctival perforation possible.
- Filtering Surgery Early Complications: Filtration Failure
- Inadequate opening of descemet's membrane
 - More common in unguarded/full thickness procedures.
 - Internal sclerostomy, pressure is high and digital pressure does not work.
 - Nd:YAG to sclerostomy site and a bit deeper for several bursts and moderately high energy.
 - Digital pressure should work after this.
- Filtering Surgery Early Complications: Filtration Failure
- Encapsulated Bleb/Tenon's Cyst
 - 9-15% incidence after trabs.
 - 2-4th POW, with a dome-like elevation in bleb walled off from surrounding conjunctiva.
 - Prospective study and recent meta analysis showed superiority of medical management vs needling for long term success.
- Filtering Surgery Early Complications: Filtration Failure
- Encapsulated Bleb/Tenon's Cyst
 - Over 4-8 weeks the IOP falls and the aqueous suppressants tapered or D/C'd.
 - Apparently the aqueous modifies the bleb over time allowing it to filter better.
 - One study evaluated encapsulated blebs treated medically at 3.5 years compared to uncomplicated trabs: no difference in IOP.
 - Risk factors: limbus based conjunctival flap.
- Filtering Surgery Early Complications: Filtration Failure
- Progressive scarring of bleb and use of anti-metabolites
 - First months post op as part of acute wound healing process.
 - Bleb avascular, thickens, IOP rises
 - Digital pressure, 5-FU, MMC, suture lysis
 - Late scarring may be due to iritis or trauma; more commonly due to wound remodeling.
 - Late development of membranes over sclerostomy can also disrupt filtration.
 - Antimetabolites and post op steroids have reduced the incidence of above and increased success of surgery.

- Reoperation After Failed Filtration
- Revision of Encysted Bleb
 - After medical tx, massage and suture lysis... IOP still uncontrolled, then needling of bleb at slit lamp or minor sx room.
 - Study reviewed consecutive needling with 5-FU for 3.4 yrs
 - Immediate IOP <10mmHg
 - Fewer repeat needlings
 - Bleb elevation and microcysts
 - Full surgical revision at the OR sometimes needed.
- Reoperation After Failed Filtration
- Failed filtration with no bleb
 - First identify which factors were involved:
 - Technical error
 - Insufficient antimetabolite
 - Poor scheduling/compliance post op steroid
 - Uveitis/blepharitis
 - Inadvertent use of IOP lowering meds
 - Try a different surgery or modify the 1st
 - If one or more trabs have failed: GDD (GDI)
- Specific Complications of Filtering Procedures: Problems with Scleral Flap
- Tear or excessive leak: test ability to maintain AC depth to determine need for repair.
- Torn flap from base: additional cover the scleral flap needed
 - Tenons capsule autograft
 - Partial thickness scleral rotational graft
 - Donor scleral flap (scleral patch graft) as last resort
- Specific Complications of filtering Procedures: Problems with Scleral Flap
- Overfiltration
- These can help especially if no antimetabolites were used:
 - Large soft contact lens
 - A symblepharon ring
 - Simmons shell
- Hypotony Maculopathy
- Serious cause of visual impairment, often reversible following any IOP lowering surgery
- Persistent hypotony (<5mmHG) for many weeks post surgery with decreased visual acuity.
- Exam+ OCT: no edema, rather choroidal wrinkling behind the macula- choroidal folds
- Risk factors: high myopia, age < 50y/o associated with decreased scleral rigidity.
- Hypotony Maculopathy
- Hypotony Maculopathy
- Non surgical interventions are inconsistently effective
- Returning to the OR to tighten the scleral flap offers quickest return of VA/ IOP control...short term.

- Occasionally will require PPV/Gas
- Avoidance of hypotony is best
- Recovery seen in most with IOP >6mmHG:
 - Up to 8-24 month to restor Va to within 1-2 lines from pre op vision
 - Persistent metamorphopsia in some
 - Faster Va recovery with higher post-repair IOP
- Hypotony Maculopathy
- Dellen
- Bleb markedly elevated at the limbus, lid cannot spread tears over adjacent K
- Most are self-limited
- Ointments, frequent artificial tears or BCL
- Steroids drops contraindicated: retard healing
- Cryotherapy of the bleb adjacent to dellen has been effective in some.
- Filtering Surgery Late Complications
- Degenerative bleb changes:
 - Thin blebs: leaks, infection
 - Bleb migration
 - Diffuse bleb
 - Overfxn bleb
- Cataract formation: high risk in pre-existing cataracts and in post op shallow AC
- Late hypotony maculopathy
- Late filtration failure
- Filtering Surgery Late Complications
- Thin walled blebs
 - Some believe thin walled blebs last longer than diffuse blebs.
 - But these are more prone to leaks and infections.
 - Tend to be more elevated and uncomfortable.
 - Late bleb hole/ leak (button hole): hypotony, tearing and iritis at times.
- Filtering Surgery Late Complications
- Filtering Surgery Late Complications
- Filtering Surgery Late Complications
- Bleb migration onto cornea
 - Translucent white blister that slowly moves to center of cornea
 - If FB sentation: artificial tears, ointment or NSAIDs
 - If no relief: dissected out like a pterygium
 - when the limbus is reached it can be dissected w/o collapsing the filter
 - After several days of aqueous weeping, it heals
- Filtering Surgery Late Complications
- Diffuse blebs
 - Pale/subtle conjunctival elevation with interepithelial microcysts, more visible near the limbus.
 - More cosmetically acceptable, comfortable and less likely to leak/get infected.
 - Best seen with scleral scatter and retroillumination.

- Late Hypotony after Filtration Surgery
- Occult filtering bleb
 - After CE or glaucoma sx, subconjunctival leak
 - May only be apparent by injecting fluorescein in the AC and tracking its exit
 - Can attempt to apply cryotx to produce a 1-2mm ice ring around the fistula
 - More commonly will require repair at OR
- Late Hypotony after Filtration Surgery
- Occult cyclodialysis clefts
 - Location associated to the most recent surgical site
 - Atropine: raises IOP
 - Miotics: lower IOP
 - Injection of viscoelastic in the AC may allow visualization. Also, UBM
 - Can at times seem migratory as if the ciliary ring is fish-mouthing in different areas
 - 1st line: full cycloplegia (risk of IOP spike)
 - Argon or Diode laser to the cleft, cryotherapy, and transcleral suturing also successful
- Cyclodialysis Cleft
- Cyclodialysis Cleft
- Late Hypotony after Filtration Surgery
- Aqueous suppression in contralateral eye
 - Topical beta-blockers in fellow eye, or oral CAIs after a failed filter.
 - Reported to cause profound hypotony with choroidals in the operated eye
 - Supersensitivity of the ciliary epithelium: profound aqueous suppression
 - Hypotony ceases with d/c of the drug
 - Also crossover effect
- Late Hypotony after Filtration Surgery
- RD: sudden hypotony; eyes s/p PPV for PDR; Repair of RD cures the hypotony as well.
- Iritis or ischemia: chronic uveitis or prior surgeries predispose to cyclitic membranes.
 - These contract and detach the ciliary body.
 - Scleral depression or UBM can identify these and surgical repair is warranted
- Rare: cil body ischemia from vasculitis
- If no evident cause is found, and there is chronic cell and flare, often steroids and cycloplegia will resolve the problem
- Treatment of shallow AC following filtration
- Thank you
- References
 - Becker-Shaffer's Diagnosis and Therapy of the Glaucomas 8th edition. Stamper, Lieberman, Drake. 2009.

- Shields Textbook of Glaucoma 6th Edition. Allingham, Damji, Freedman, Moroi, Rhee. 2011.
- Complications of Glaucoma Therapy. Sherwood, Spaeth. 1990.

Complications of Glaucoma Filtering Surgery

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Eye & Ear

Financial Disclosures

- ☐ No financial disclosures

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Patient Factors Influencing Surgery

- ☐ Age (Young)
- ☐ Race (African American)
- ☐ Type of glaucoma (Secondary or Developmental)
- ☐ Aphakia or pseudophakia
- ☐ Extent of optic nerve damage
- ☐ Duration of medical anti-glaucoma therapy
- ☐ Other ocular disease—uveitis, cataract (combined procedure)

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Patient Factors Influencing Surgery

- ☐ Nanophthalmos
 - ☐ Intraocular surgery associated with choroidal detachments and serous RD.
 - ☐ High risk for malignant glaucoma.
 - ☐ Filtration surgery contraindicated, except in extensive synchial closure/uncontrolled IOP despite MTMT.



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Patient Factors Influencing Surgery

- ☐ Sturge Weber Syndrome
 - ☐ High risk of expulsive hemorrhage, intra-op massive choroidal effusion, and serous RD.
 - ☐ Posterior pressure, flat AC, iris prolapse, vitreous prolapse.
 - ☐ Recommended a posterior sclerotomy before AC entered to allow any effusion to be drained to reduce posterior pressure.



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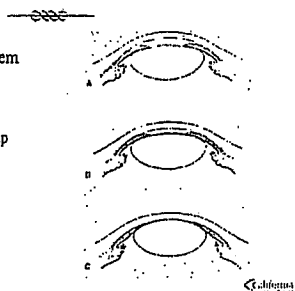
Filtering Surgery Early Complications

- ☐ Bleeding/Hyphema
- ☐ Over-filtration and bleb leaks
 - ☐ Lens-cornea touch, kissing choroidals, suprachoroidal hemorrhages
 - ☐ Flat AC, PAS and posterior synechiae, cataracts
- ☐ Infection
- ☐ Early failure to control IOP (first 3 months)

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Filtering Surgery Early Complications: Flat AC

- ca Spaeth Grading System
 - ca Grade I, II, III
- ca Grading by CCT
 - ca Useful for follow up

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Filtering Surgery Early Complications: Flat AC

- ca Determine whether IOP is higher than expected or excessively low.
- ca Grades I-II tend to resolve with med management.
- ca Grade III - eye emergency - will require frequent monitoring and possible surgical intervention.

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Filtering Surgery Early Complications: Flat AC

- ca An increased loss of corneal endothelial cells occurs when the chamber goes from grade II-III.
- ca Grade III AC: attempt to reform chamber immediately at slit lamp.
- ca If injected material comes out of the sclerostomy, may need to go to OR.

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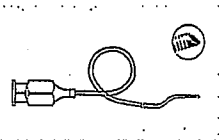
Filtering Surgery Early Complications: Flat AC

- ca Flat AC with hypotony
 - ca Usually accompanied by choroidal effusions.
 - ca Kissing choroids - an eye emergency.
 - ca Chronic angle closure glaucoma post trab responds poorly to med management and often require surgical intervention: predisposed to malignant glaucoma.

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1997-1998

Filtering Surgery Early Complications: Flat AC

- ca Draining choroidal effusions
 - ca 1+ sclerostomies inferiorly 4mm post to limbus over pars plana.
 - ca Reform A/C.
 - ca Drain choroids while maintaining AC deep: AC maintainer device (Lewicky).
 - ca ¼ developed cataracts within 1st post op year.

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1997-1998

Filtering Surgery Early Complications: Flat AC

- ca To avoid it: make sure AC maintains good depth at the end of the case, in the presence of adequate IOP.
- ca Prevent pupillary block and malignant glaucoma with a patent PI and generous cycloplegia at the end of the case.

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Filtering Surgery Early Complications: Flat AC

- ca Flat AC in normotensive/hypertensive eyes
 - ca Volume/pressure behind lens-iris diaphragm:
 - ca Pupillary block with an incomplete PI
 - ca Expansion of the choroid or enlargement of suprachoroidal space (blood or effusion)
 - ca Increased vitreous volume: blood or effusion
 - ca Aqueous misdirection (Malignant Glaucoma)

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eye care

Filtering Surgery Early Complications: Flat AC

- ca Malignant Glaucoma
 - ca Grade II or III AC with shallowing of peripheral and central AC, uniformly
 - ca IOP is higher than expected.
 - ca A patent PI must be established before the diagnosis can be considered.
 - ca Cycloplegics can be curative, miotics worsen.
 - ca If surgery is needed, disrupting or collapsing the hyaloid face may be curative.
 - ca Bilateral in predisposition.



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Filtering Surgery Early Complications: Flat AC

- ca Malignant Glaucoma: Pathophysiology
 - ca Initiating event (shallowing of the AC in surgery) causes aqueous to move into or behind the vitreous body.
 - ca Increased vitreous swelling reduces movement of aqueous into the AC to drain.
 - ca Enlarging vitreous body is unable to exchange fluid across the hyaloid face.
 - ca Lens-iris diaphragm is pushed forward closing the angle further.



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Filtering Surgery Early Complications: Flat AC

- ca Malignant Glaucoma: Medical Management
 - ca Verify or create a patent FI.
 - ca Discontinue any miotics.
 - ca Vigorous cycloplegia and topical steroids.
 - ca Aqueous suppressants or osmotic agents.
 - ca Observe for 5 days, if controlled with above: 1/2 will resolve with above management.



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- ca Malignant Glaucoma: Surgical Management
 - ca Needle aspiration of the vitreous through the pars plana or PPV in phakic eyes.
 - ca S/P CE w/ posterior capsule - Nd: YAG through pupil-capsule-hyaloid face.
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 - ca Recurrences occur specially post incomplete PPV in phakic pts, may require CE in rare cases..

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Filtering Surgery Early Complications: Flat AC

- ca Suprachoroidal Hemorrhage
 - ca Rare during surgery in the phakic eye. More commonly 4-5 days post op w/ sudden severe pain+loss of vision.
 - ca Patients on systemic anticoagulants and eyes w/ significant post op hypotony are at higher risk.
 - ca Strong correlation between pre op IOP and risk of SCH
 - ca Also risk increased in longer eyes (>25.8mm).



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Filtering Surgery Early Complications: Flat AC

- ca Suprachoroidal Hemorrhage
- ca Post OP SCH occurs more frequently in aphakic eyes with other pathology.
- ca Also, more likely if the vitreous is liquified.
- ca Intra op expulsive SCH is rarely seen in glaucoma surgery.



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170-171

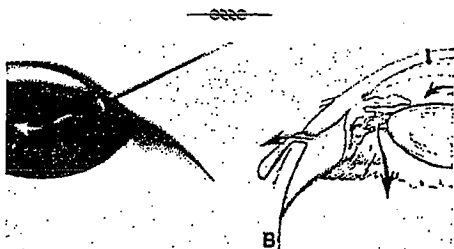
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- ca Suprachoroidal Hemorrhage: Management
- ca Intra op SCH: close limbal incision immediately, do a posterior sclerostomy over presumed site of bleeding.
- ca An AC maintainer may be used to get control over IOP.



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SCH Management: Posterior Sclerotomy



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Filtering Surgery Early Complications: Flat AC

- ca Suprachoroidal Hemorrhage Management: Post op Onset
- ca Requires drainage if aqueous suppressants and hyperosmotics fail to control pressure.
- ca 4-5 days are allowed for the clot to lyse in the suprachoroidal space if drainage can be delayed for that period of time.
- ca Then a posterior sclerostomy is made over the area of elevated choroid about 2mm.
- ca In aphakia, the choroid and retina can be pushed to the pupillary plane. Immediate surgical intervention is needed in these cases.

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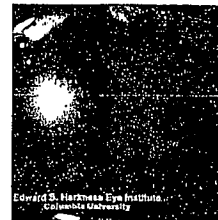
Filtering Surgery Early Complications: Flat AC

- ca Suprachoroidal Hemorrhage Management: Post op Onset
- ca If drainage cannot be postponed, a large scleral incision (10-12mm) for the clot to slide out near the center of the choroidal elevation.
- ca BSS, air or viscoelastic injected to reform the AC vs an AC maintaining device.
- ca Maintenance of high-normal IOE, helps force more of the clot out of the sclerostomy.
- ca Helpful to inject viscoelastic in AC at the end of the case.
- ca Allow pressures post op of 25-35mmHg for the first few days to maintain ocular integrity.

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Filtering Surgery Early Complications: Flat AC

- ca Suprachoroidal Hemorrhage: Prognosis
- ca If there is no extrusion of intraocular contents aside from aqueous and liquified vitreous, if blood does not break into the vitreous cavity and if high IOE is not sustained, prognosis is reasonably good.
- ca Outcome is favorable if SCH is small, or if surgical intervention is done within the 1st 14 days.
- ca Poor prognosis if a concurrent RD or 360 SCH



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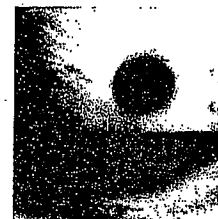
Intra-Operative Flat AC: Other Causes

- ca Aqueous misdirection (ciliary block) during surgery: BSS is inadvertently diverted into the vitreous. The AC shallows and the eye gets firm
- ca Close trab flap, and reform AC. If this fails...
- ca ½-1ml of liquified vitreous removed through a sclerotomy 3mm post to limbus. Reform AC with BSS, viscoelastic or air bubble if needed to maintain it.
- ca Atropine + topical steroids post op with close monitoring for recurrence

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Filtering Surgery Early Complications: Hyphema

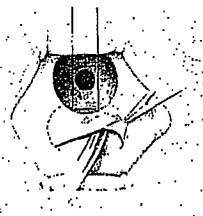
- ca First 3-5 days post op
- ca Anticoagulants significant risk factor
- ca Bleeding usually from the iris, ciliary body or corneoscleral wound
- ca Restrict activities/protective eye shield
- ca Evacuation rarely needed: IOP + cornea status
- ca Large/Clotted Hyphema: remove clot with IA using viscoelastic for visualization.



California
1974-1977

Filtering Surgery Early Complications: Conjunctival Button Holes

- ca Major Causes: poor visualization, use of instruments that penetrate the tissue, immediate or delayed necrosis post cauterization.
- ca High risk in scarred or inflamed areas.
- ca Best to recognize them at OR.



California
1974-1977

Filtering Surgery Early Complications: Conjunctival Button Holes

- ca If early post OP: except in wound dehiscence, the management is initially medical
- ca Cycloplegia
- ca BCL or patch
- ca Reduce or d/c - if possible - steroids/NSAIDs
- ca Antibiotics
- ca Cyanoacrylate under BCL, an alternative
- ca Compression suture



California
1974-1977

Filtering Surgery Early Complications: Conjunctival Button Holes

- ca If bleb is flat and/or the AC is flat: OR
 - ca Under General
 - ca Topical with facial block and sedation, an alternative in cooperative patients
 - ca Retrobulbar Block contraindicated

California
1974-1977

Filtering Surgery Early Complications: Intraocular Infection

- ca Risk factors
 - ca thin blebs and those with leaks
 - ca antimetabolite use (as high as 2% incidence)
 - ca Myopia
 - ca releasable sutures
 - ca URTI
 - ca Blebs at inferior limbus
 - ca Unguarded filtration surgery
 - ca Post compliance with antibiotics
 - ca DM



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1974-1977

Filtering Surgery Early Complications: Intraocular Infection

- ca Blebitis
 - ca Confined to the bleb
 - ca Responds faster to antibiotic therapy
 - ca Can be managed outpatient setting
 - ca More favorable visual prognosis
 - ca May be prodromal to endophthalmitis
 - ca Staph or Strep sp account for 1/2 of cultures+



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Filtering Surgery Early Complications: Intraocular Infection

- ca Endophthalmitis
 - ca Aggressive vitrectomy with intravitreal antibiotics (+/- steroids).
- ca Culture both AC and vitreous in the presence of a hypopyon.
- ca Patient awareness of new and unusual symptoms is key.



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Filtering Surgery Early Complications: Sympathetic Ophthalmia

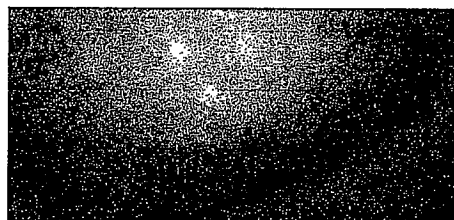
- ca 2 wks to many years post any intraocular sx
- ca 0.08% incidence post glaucoma sx
- ca Symptoms
 - ca photophobia-blurred vision-itchiness
- ca Signs
 - ca Granulomatous uveitis and Dalen-Fuchs nodules
- ca Management
 - ca Immunosuppressive tx, atropine; possible enucleation of exciting eye.



Dalen-Fuchs' nodules

California
eye care

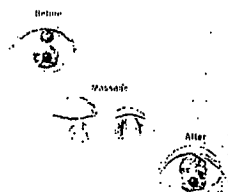
Dalen-Fuchs' nodules



California
eye care

Filtering Surgery Early Complications: Filtration Failure

- ca Digital pressure/Ocular massage
 - ca Forcing aqueous through the sclerostomy may:
 - ca prevent closure of the sclerostomy
 - ca lift conj/episclera and slow scarring
 - ca allow aqueous flow, up permeability
 - ca No effect if done after 3 mo post op
 - ca Check IOP 40 mins post



California
eye care

Filtering Surgery Early Complications: Filtration Failure

- ca Digital pressure/Ocular massage
 - ca If sclerostomy incision open, but bleb is sealing down over it... digital pressure by patient on a regular basis.
 - ca The goal is to reduce IOP w/o causing hypotony (less than 7-10mmHg)... can lead to more inflammation and Va fluctuation.
 - ca Gonioscopy 1st: r/o any iris, lens or vitreous incarceration in the sclerostomy.
 - ca Caution: PKP, or recent IOL placement

California
eye care

Filtering Surgery Early Complications: Filtration Failure

- ❑ Failure during POW 1
 - ❑ Iris, vitreous, clot, ciliary process, or lens plug
 - ❑ Retained viscoelastic substance
 - ❑ Imperforate Descemet's membrane
 - ❑ Scleral flap too tight
 - ❑ Ciliary or pupillary block



Calhoun
11-11-16

Filtering Surgery Early Complications: Filtration Failure

- ❑ Plugged Sclerostomy Site
 - ❑ Gonioscopy, if AC formed
 - ❑ Iris plug: after a flat AC, or if PI too small. Pilo 2 or 4% vs Argon vs Nd:YAG laser.
 - ❑ Blood Clot: digital pressure ok, if small+IOP not too high can wait 2-3 days for it to lyse. Argon laser useful in breaking large clots.
 - ❑ Vitreous: a scaffold for scar tissue, Nd:YAG of some benefit. Best management is prevention.

Calhoun
11-11-16

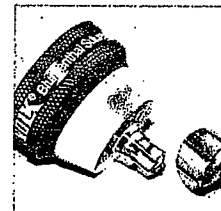
Filtering Surgery Early Complications: Filtration Failure

- ❑ Retained viscoelastic material
 - ❑ Digital pressure OK
 - ❑ No difference between Viscoat, Healon or Healon-GV in terms of endothelial cell count post sx, inflammation or post op IOP
 - ❑ Healon-5 can take several days before dissolving in the eye - prolonged high IOP

Calhoun
11-11-16

Filtering Surgery Early Complications: Filtration Failure

- ❑ Tight scleral flap
 - ❑ If digital pressure is still required after 4-7 days post op or if it is unsuccessful initially, 1 or more sutures should be loosened.
 - ❑ Longer window of opportunity in antimetabolite eyes (3-4 weeks).
 - ❑ Releasable sutures important when laser access limited.
 - ❑ Laser suture lysis: Argon +special (Hodkins, Blumenthal) lens; conjunctival perforation possible.



Calhoun
11-11-16

Filtering Surgery Early Complications: Filtration Failure

- ❑ Inadequate opening of descemet's membrane
 - ❑ More common in unguarded/full thickness procedures.
 - ❑ Internal sclerostomy, pressure is high and digital pressure does not work.
 - ❑ Nd:YAG to sclerostomy site and a bit deeper for several bursts and moderately high energy.
 - ❑ Digital pressure should work after this.

Calhoun
11-11-16

Filtering Surgery Early Complications: Filtration Failure

- ❑ Encapsulated Bleb/Tenon's Cyst
 - ❑ 9-15% incidence after trabs.
 - ❑ 2-4th POW, with a dome-like elevation in bleb walled off from surrounding conjunctiva.
 - ❑ Prospective study and recent meta analysis showed superiority of medical management vs needling for long term success.



Calhoun
11-11-16

Filtering Surgery Early Complications: Filtration Failure

- ca Encapsulated Bleb/Tenon's Cyst
 - ca Over 4-8 weeks the IOP falls and the aqueous suppressants tapered or D/C'd.
 - ca Apparently the aqueous modifies the bleb over time allowing it to filter better.
 - ca One study evaluated encapsulated blebs treated medically at 3.5 years compared to uncomplicated trabs: no difference in IOP.
 - ca Risk factors: limbus based conjunctival flap.

Colonna
1992

Filtering Surgery Early Complications: Filtration Failure

- ca Progressive scarring of bleb and use of anti-metabolites
 - ca Firsts months post op as part of acute wound healing process.
 - ca Bleb avascular, thickens, IOP rises
 - ca Digital pressure, 5-FU, MMC, suture lysis
 - ca Late scarring may be due to iritis or trauma; more commonly due to wound remodeling.
 - ca Late development of membranes over sclerostomy can also disrupt filtration.
 - ca Antimetabolites and post op steroids have reduced the incidence of above and increased success of surgery.

Colonna
1992

Reoperation After Failed Filtration

- ca Revision of Encysted Bleb
 - ca After medical tx, massage and suture lysis... IOP still uncontrolled, then needling of bleb at slit lamp or mirror at room.
 - ca Study reviewed consecutive needling with 5-FU for 3.4 yrs
 - ca Immediate IOP <10mmHg
 - ca Fewer repeat needlings
 - ca Bleb elevation and microcysts
 - ca Full surgical revision at the OR sometimes needed.



Colonna
1992

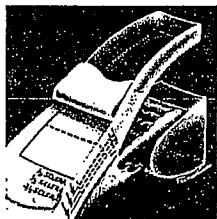
Reoperation After Failed Filtration

- ca Failed filtration with no bleb
 - ca First identify which factors were involved:
 - ca Technical error
 - ca Insufficient antimetabolite
 - ca Poor scheduling/compliance post op steroid
 - ca Uveitis/blepharitis
 - ca Inadvertent use of IOP lowering meds
 - ca Try a different surgery or modify the 1st
 - ca If one or more trabs have failed: GDD (GDI)

Colonna
1992

Specific Complications of Filtering Procedures: Problems with Scleral Flap

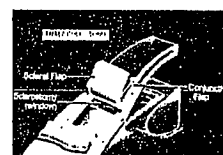
- ca Tear or excessive leak; test ability to maintain AC depth to determine need for repair.
- ca Torn flap from base: additional cover the scleral flap needed
 - ca Tenons capsule autograft
 - ca Partial thickness scleral rotational graft
 - ca Donor scleral flap (scleral patch graft) as last resort



Colonna
1992

Specific Complications of filtering Procedures: Problems with Scleral Flap

- ca Overfiltration
 - ca These can help especially if no antimetabolites were used:
 - ca Large soft contact lens
 - ca A symblepharon ring
 - ca Simmons shell



Colonna
1992

Hypotony Maculopathy

- ❑ Serious cause of visual impairment, often reversible following any IOP lowering surgery
- ❑ Persistent hypotony (<5mmHG) for many weeks post surgery with decreased visual acuity.
- ❑ Exam+ OCT: no edema, rather choroidal wrinkling behind the macula- choroidal folds
- ❑ Risk factors: high myopia, age < 50y/o associated with decreased scleral rigidity.

California
1997

Hypotony Maculopathy



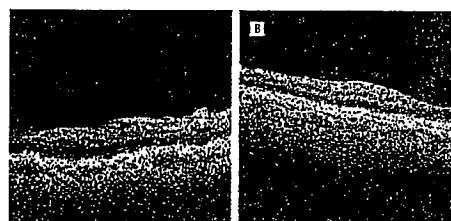
California
1997

Hypotony Maculopathy

- ❑ Non surgical interventions are inconsistently effective
- ❑ Returning to the OR to tighten the scleral flap offers quickest return of VA/ IOP control...short term.
- ❑ Occasionally will require PPV/Gas
- ❑ Avoidance of hypotony is best
- ❑ Recovery seen in most with IOP >6mmHG:
 - ❑ Up to 8-24 month to restore VA to within 1-2 lines from pre op vision
 - ❑ Persistent metamorphopsia in some
 - ❑ Faster VA recovery with higher post-repair IOP

California
1997

Hypotony Maculopathy



California
1997

Dellen

- ❑ Bleb markedly elevated at the limbus, lid cannot spread tears over adjacent K
- ❑ Most are self-limited
- ❑ Ointments, frequent artificial tears or BCL
- ❑ Steroids drops contraindicated: retard healing
- ❑ Cryotherapy of the bleb adjacent to dellen has been effective in some.



California
1997

Filtering Surgery Late Complications

- ❑ Degenerative bleb changes:
 - ❑ Thin blebs: leaks, infection
 - ❑ Bleb migration
 - ❑ Diffuse bleb
 - ❑ Overfxn bleb
- ❑ Cataract formation: high risk in pre-existing cataracts and in post op shallow AC
- ❑ Late hypotony maculopathy
- ❑ Late filtration failure

California
1997

Filtering Surgery Late Complications

- ca Thin walled blebs
 - ca Some believe thin walled blebs last longer than diffuse blebs.
 - ca But these are more prone to leaks and infections.
 - ca Tend to be more elevated and uncomfortable.
 - ca Late bleb hole/ leak (button hole): hypotony, tearing and iritis at times.



Coltarma
100-24-17

Filtering Surgery Late Complications



Coltarma
100-24-17

Filtering Surgery Late Complications



Coltarma
100-24-17

Filtering Surgery Late Complications

- ca Bleb migration onto cornea
 - ca Translucent white blister that slowly moves to center of cornea
 - ca If FB sensation: artificial tears, ointment or NSAIDs
 - ca If no relief: dissected out like a pterygium
 - ca when the limbus is reached it can be dissected w/o collapsing the filter
 - ca After several days of aqueous weeping, it heals



Coltarma
100-24-17

Filtering Surgery Late Complications

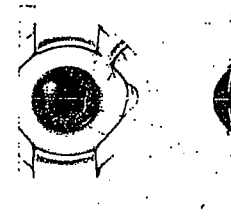
- ca Diffuse blebs
 - ca Pale/subtle conjunctival elevation with interepithelial microcysts, more visible near the limbus.
 - ca More cosmetically acceptable, comfortable and less likely to leak/get infected.
 - ca Best seen with scleral scatter and retroillumination.



Coltarma
100-24-17

Late Hypotony after Filtration Surgery

- ca Occult filtering bleb
 - ca After CE or glaucoma sx, subconjunctival leak
 - ca May only be apparent by injecting fluorescein in the AC and tracking its exit
 - ca Can attempt to apply cryotx to produce a 1-2mm ice ring around the fistula
 - ca More commonly will require repair at OR



Coltarma
100-24-17

Late Hypotony after Filtration Surgery

- ca Occult cyclodialysis clefts
 - ca Location associated to the most recent surgical site
 - ca Atropine: raises IOP
 - ca Miotics: lower IOP
 - ca Injection of viscoelastic in the AC may allow visualization. Also, UBM
 - ca Can at times seem migratory as if the ciliary ring is fish-mouthing in different areas
 - ca 1st line: full cycloplegia (risk of IOP spike)
 - ca Argon or Diode laser to the cleft, cryotherapy, and transcleral suturing also successful

Coltortina
10/1/16

Cyclodialysis Cleft



Coltortina
10/1/16

Cyclodialysis Cleft



Coltortina
10/1/16

Late Hypotony after Filtration Surgery

- ca Aqueous suppression in contralateral eye
 - ca Topical beta-blockers in fellow eye, or oral CAIs after a failed filter.
 - ca Reported to cause profound hypotony with choroidals in the operated eye
 - ca Supersensitivity of the ciliary epithelium: profound aqueous suppression
 - ca Hypotony ceases with d/c of the drug
 - ca Also crossover effect

Coltortina
10/1/16

Late Hypotony after Filtration Surgery

- ca RD: sudden hypotony; eyes s/p PPV for PDR; Repair of RD cures the hypotony as well.
- ca Iritis or ischemia: chronic uveitis or prior surgeries predispose to cyclitic membranes.
 - ca These contract and detach the ciliary body.
 - ca Scleral depression or UBM can identify these and surgical repair is warranted
- ca Rare: cil body ischemia from vasculitis
- ca If no evident cause is found, and there is chronic cell and flare, often steroids and cycloplegia will resolve the problem

Coltortina
10/1/16

Treatment of shallow AC following filtration

Bleb Height	IOP	DDx	Treatment
Elevated	Low	Excessive Filtration	Bleb revision
Flat	Low	Choroidal detachment Bleb Leak	Cycloplegia, steroid, drainage Anti-infective, aqueous suppressants, stop steroid, AC reformation, pressure patch, large diameter CL, glue, laser, autologous blood. Consider surgical intervention for impending failure of bleb, flat AC with K decompensation, kissing choroidals, progressive cataract
Flat	High	SCH Pupillary block Malignant Glaucoma	Drainage Cycloplegia, steroid, PI Cycloplegia, aqueous suppressants, PI, YAG ant vitrealysis, PPV
Elevated	High	Encapsulated bleb	Needling, aqueous suppressants, bleb revision

Coltortina
10/1/16

Thank you



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10.11.16

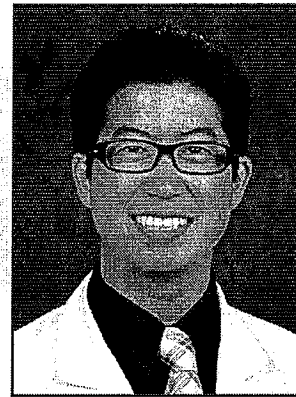
References



- ☞ Becker-Shaffer's Diagnosis and Therapy of the Glaucomas 8th edition. Stamper, Lieberman, Drake. 2009.
- ☞ Shields Textbook of Glaucoma 6th Edition. Allingham, Damji, Freedman, Moroi, Rhee. 2011.
- ☞ Complications of Glaucoma Therapy. Sherwood, Spaeth. 1990.

California
07.11.16

Brian Chen, MD
California Eye & Ear Surgeon



Dr. Brian Chen specializes in the medical and surgical treatment of anterior segment disease including cataracts and glaucoma. After growing up in the Los Angeles area, he earned his bachelor's degree at UC Berkeley in molecular and cell biology with an emphasis in neurobiology. He then completed his master's degree in physiology and biophysics at Georgetown University in Washington D.C. His medical degree is from Drexel University School of Medicine in Philadelphia, Pennsylvania.

Immediately after medical school, Dr. Chen remained in Philadelphia and completed both an internal medicine internship and an ophthalmology residency at Hahnemann University Hospital, where he was the chief resident and was awarded the Golden Apple Award for Excellence in Teaching.

Wanting to subspecialize in treating glaucoma patients, Dr. Chen completed a glaucoma fellowship at the University of South Florida, in Tampa, Florida. He has authored several papers in ophthalmology journals on the topic.

Dr. Chen is excited to serve the San Gabriel Valley community not only as a physician but as a resident. His interests include traveling, art, photography, and tennis. He speaks Mandarin, Taiwanese, and some Spanish.

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Education

- 2004 | Bachelor of Art, Molecular and Cell Biology, University of California, Berkeley, CA
- 2005 | Master of Science, Physiology and Biophysics, Georgetown University, Washington, D.C.
- 2009 | Doctor of Medicine, Drexel University School of Medicine, Philadelphia, PA

Professional Training

- 2010 | Internship, Internal Medicine, Hahnemann University Hospital, Philadelphia, PA
- 2013 | Residency, Ophthalmology, Hahnemann University Hospital, Philadelphia, PA
- 2014 | Fellowship, Glaucoma, University of South Florida, Tampa, FL

Awards

- Intern of the Month, Hahnemann University Hospital
- Golden Apple Award, Excellence in Teaching, Drexel University School of Medicine

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Improving diagnosis and trajectory of wet AMD from OCT Imagery of Retina</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyki</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>John</u> (First) <u>Irvine</u> (Last) (Middle)	
License Number <u>NIA</u>	License Type <u>PhD</u>
Phone Number (800) <u>898-2020</u>	Email Address <u>jirvine@draper.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Inferring Diagnosis and Trajectory of Wet AMD From OCT Imagery of Retina

The initial analysis of OCT imagery indicates that features derived from imagery can provide useful biomarkers for characterization and quantification of AMD. This lecture discussed the importance of the accurate measurement of Wet AMD. Image-based methods offer the potential for objective, quantitative measures.

John Irvine, Ph.D.

Inferring Diagnosis and Trajectory of Wet Age-Related Macular Degeneration from OCT Imagery Of Retina

- Image Based Retinal Diagnostic
- Situation:
 - *A pharmaceutical company is in early clinical trials with a novel treatment for a retinal disease*
 - *FDA views visual acuity data as semi-subjective, requires objective measurement for assessing efficacy for approval*
 - *Early trial results showed that some patients respond to therapy, some stay the same, some get worse. Clinicians have indicated that they are reluctant to prescribe the drug unless they can avoid treating those who will get worse*
- Goal: Develop Automated Retinal Analysis Tool For
 - *Efficacy Analysis: Given optical coherence tomography (OCT) images from pre- and post-procedure visit, can clinically relevant changes in the images correlate with outcome, i.e. vision score?*
 - *Procedure Outcome Prediction: Given OCT images from a pre-procedure visit, can a successful outcome be a priori recognized?*
 - Assumed Concept of Operations
- Product is a software package that is stand alone and device independent
- It operates at the clinician's site taking in images, analyzing and scoring within a few minutes
- Some amount of "clinician in the loop" during analysis
- Objective
- Quantitative biomarkers for assessing the presence, severity, and progression of AMD
 - *Benefit research, diagnosis, and treatment for AMD*
- Image-based methods offer the potential for objective, quantitative measures.
- Research to develop and validate quantitative biomarkers using OCT imagery of the retina.
 - OCT Imagery
- OCT imaging obtains surface and sub-surface images of translucent or opaque materials.
 - *For retinal imaging, OCT provides a non-invasive technique*
 - *Based on low coherence interferometry*
 - *Cross-sectional images*
- Image Processing
- Feature Extraction
- The profiles from vertical transects represent the layered structure
 - *Statistical features include run lengths and numbers of crossings for quantiles of the gray-scale values.*
 - *Wet AMD image transects show more chaotic behavior.*
- Classification Results

- Classification analysis shows separability between Wet AMD & controls
 - *Transects at 25th and 75th percentiles yield good features*
 - *Probability of correct classification is 95.7%*
- Predicting Visual Acuity
- Conclusions
- Initial analysis of OCT imagery indicates that features derived from imagery can provide useful biomarkers for characterization and quantification of AMD
- Accurate assessment of Wet AMD
- Does not rely on segmentation of the OCT image
- Approach is more robust to noisy or degraded images
- Next steps include larger scale testing and validation

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Inferring Diagnosis and Trajectory of Wet Age-Related Macular Degeneration from OCT Imagery Of Retina

Nastaran Ghader, John M. Irvine, Steve Duncan, David Ebyd,
David O'Dowd, Krislie Lin, Tom Chang

Image Based Retinal Diagnostic

Situation:

- A pharmaceutical company is in early clinical trials with a novel treatment for a retinal disease
- FDA views visual acuity data as semi-subjective, requires objective measurement for assessing efficacy for approval
- Early trial results showed that some patients respond to therapy, some stay the same, some get worse. Clinicians have indicated that they are reluctant to prescribe the drug unless they can avoid treating those who will get worse

Goal: Develop Automated Retinal Analysis Tool For

- Efficacy Analysis: Given optical coherence tomography (OCT) images from pre- and post-procedure visit, can clinically relevant changes in the images correlate with outcome, i.e. vision score?
- Procedure Outcome Prediction: Given OCT images from a pre-procedure visit, can a successful outcome be a priori recognized?

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2

Assumed Concept of Operations



- Product is a software package that is stand alone and device independent
- It operates at the clinician's site taking in images, analyzing and scoring within a few minutes
- Some amount of "clinician in the loop" during analysis

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3

Objective

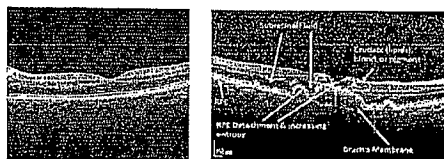
- Quantitative biomarkers for assessing the presence, severity, and progression of AMD
—Benefit research, diagnosis, and treatment for AMD
- Image-based methods offer the potential for objective, quantitative measures.
- Research to develop and validate quantitative biomarkers using OCT imagery of the retina.

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4

OCT Imagery

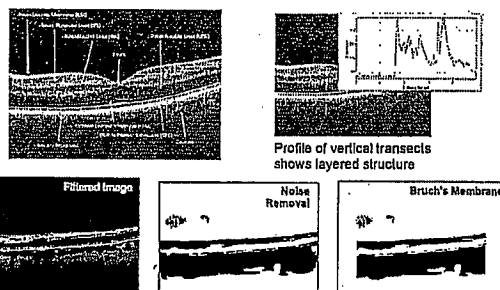
- OCT imaging obtains surface and sub-surface images of translucent or opaque materials.
-- For retinal imaging, OCT provides a non-invasive technique
-- Based on low coherence interferometry
-- Cross-sectional images



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5

Image Processing



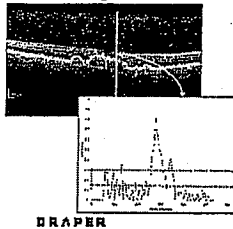
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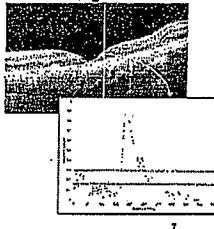
Feature Extraction

- The profiles from vertical transects represent the layered structure
 - Statistical features include run lengths and numbers of crossings for quantiles of the gray-scale values.
 - Wet AMD image transects show more chaotic behavior.

Wet AMD Image



Control Image

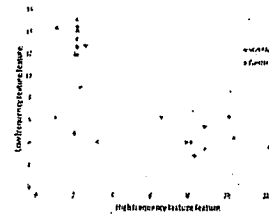


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7

Classification Results

- Classification analysis shows separability between Wet AMD & controls
 - Transects at 25th and 75th percentiles yield good features
 - Probability of correct classification is 95.7%



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8

Predicting Visual Acuity

Linear Model for Predicting Visual Acuity (- Log₁₀(MAR))

Image Feature	Coefficient	Std. Error	t-statistic	P-value
(Constant)	1.471	.164	8.990	0.000
Transect_Cross_75	-0.122	.012	-10.399	0.000
Histogram_2	0.007	.003	2.382	0.027

R² = 0.846

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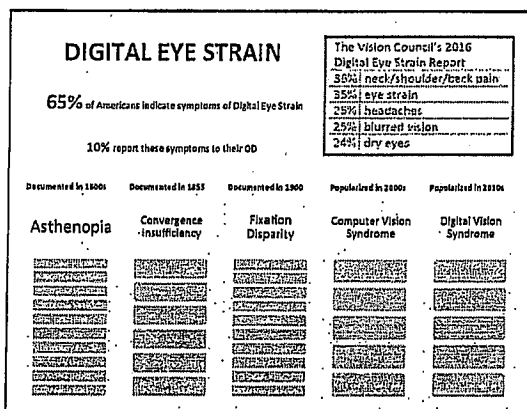
9

Conclusions

- Initial analysis of OCT imagery indicates that features derived from imagery can provide useful biomarkers for characterization and quantification of AMD
 - Accurate assessment of Wet AMD
 - Does not rely on segmentation of the OCT image
 - Approach is more robust to noisy or degraded images
 - Next steps include larger scale testing and validation

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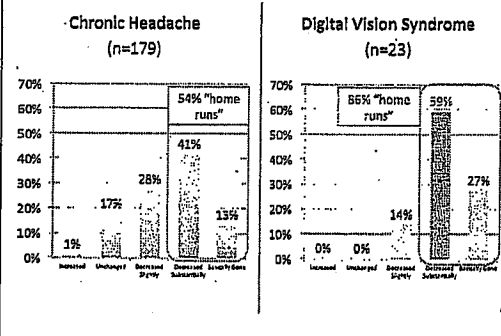
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Limited traction with current market solutions

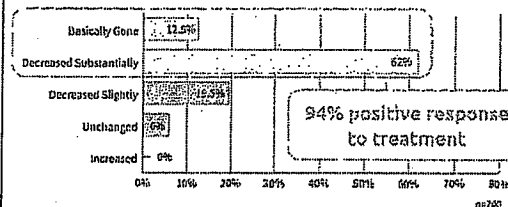
- Clinical philosophy based on a "lack of accommodation"
- Small amounts of add power at near to "relax" accommodation
- Current clinical outcomes lack consistency
- Headache, stiff neck/shoulders not believed to be vision related
- High quality eye exam results in a primary pair of lenses, a second sale of specialty computer lenses poses difficulty
- eyeBrain data shows that "lack of alignment" not "lack of accommodation" is causal factor in Digital Eye Strain
- This moves the solution from the current progressive design to a unique variable prism addition lens
- The amount of variable prism needed to relieve symptoms is measured by a novel instrument & calculation via SightSync

Data from previous Clinical Studies



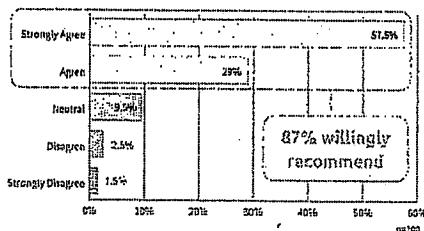
Commercial Outcomes -- Efficacy

Since wearing NeuroLenses, how do you feel your headaches, neck pain, or other digital vision syndrome symptoms have responded?



Commercial Outcomes -- WTR

Based upon my experience wearing NeuroLenses, I would willingly recommend eyeBrain Medical to my friends and family.





eyeBrain Technology Overview

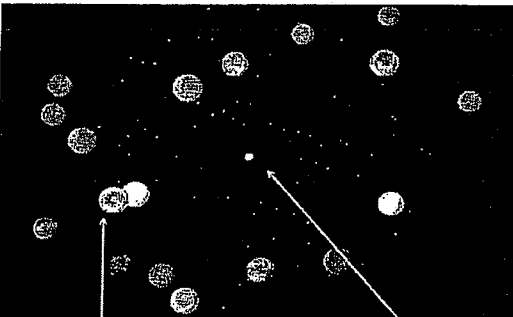
An orientation of eyeBrain's offering for the world's most comfortable vision

SightSync Measurement

- Pre-screening Instrument
- Fast: 90-120 seconds
- Fully automated, objective
- Accurate
 - SightSync: ± 0.25
 - Traditional (phoria): ± 3.00





Distance:	2.3 BI
Near:	3.5 BI




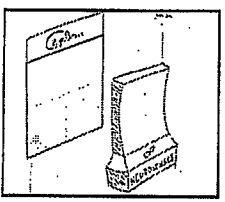
Rotating outer planets = binocular
(important for peripheral fusion lock)

Central vision target = monocular
(alternates eyes, making it seem like target is "blinking")


 SightSync™

NeuroLens Therapy

Alignment with Accommodation

NeuroLenses seamlessly align the images so that you don't have to



JOHN M. IRVINE, PH.D.
CHIEF SCIENTIST FOR DATA ANALYTICS
CHARLES STARK DRAPER LABORATORY

Education:

Yale University:

PhD (Mathematical Statistics), 1982

Dissertation: "Changes in Regime in Regression Models"

Advisor: Prof. Francis J. Anscombe

MPhil (Mathematical Statistics), 1978

Georgetown University

MA (Government, specialization in National Security Studies), 1986

Pomona College

BA (Mathematics & Economics), 1976

Phil Beta Kappa, *Cum Laude*

Summary of Capabilities and Experience

Dr. Irvine, Chief Scientist for Data Analytics, is one of the Laboratory Technical Staff (LTS) which is the highest level technical position at Draper Laboratory. Prior to joining Draper, he was the Deputy Division Manager for Systems and Technology and a Technical Fellow at SAIC. He has over 30 years of experience and his areas of interest include signal and image processing, design and analysis of experiments, user-oriented evaluations, performance modeling and analysis, standards for data quality, judgmental forecasting, and novel biometrics. Recent highlights include:

- Principal Investigator for *Image-based Socio-Cultural Observation, Predication, and Estimation (iSCOPE)*, to develop novel remote-sensing based methods for Human Geography.
- Principal Investigator for *Identifying Biomarkers that Distinguish Post-Traumatic Stress Disorder and Mild Traumatic Brain Injury Using Advanced Magnetic Resonance Spectroscopy*, under the Congressionally Directed Medical Research Program (CDMRP) Program.
- Principal Investigator for "Bayesian modeling for decision support in surgical wound closure" which is a joint project with the Naval Medical Research Center and Department of Surgery, Uniformed Services University of Health Sciences.
- Principal Investigator for IARPA's Aggregative Contingent Estimation (ACE) Program
- Principal Investigator for "Remote Sensing and Indicators of Well-being and Governance," a project sponsored by Office of Naval Research under the Human Social Culture Behavior Modeling Program (HSCB).
- Principal Investigator for "Image-based Culturally Aware Syntactic Computation for Activity Detection and Estimation (iCASCADE)," sponsored by Office of Naval Research
- Principal Investigator for joint Draper-NGA Cooperative Research and Development Agreement (CRADA) on Activity-based GEOINT
- Senior scientist for performance evaluations of Automatic Target Recognition (ATR) and Automated Feature Extraction (AFE) algorithms for the National Geospatial-Intelligence Agency

- Senior scientist for NGA program to explore and develop quality and interpretability metrics for motion imagery
- Principal Investigator for the development of novel human identification techniques (biometrics) under the DARPA HumanID Program. (Patent for new biometric techniques)
- Principal Investigator for OSD-sponsored effort to develop and demonstrate standardized methodology for evaluation of ATR technology, with emphasis on fusion-based processing and exploitation
- Senior scientist for the military utility and technical performance assessment of ATR technology, under DARPA's Semi-Automated IMINT Processing (SAIP) Program
- Senior scientist for the development and validation of National Imagery Interpretability Rating Scale (NIIRS), a standard family of metrics for quantifying image quality/interpretability for various imaging modalities
- Principal Investigator for study of DOE hazardous waste sites that applied remote sensing and data fusion, emphasizing the synergistic use of multispectral and multi-sensor imagery with mathematical modeling.
- Conducted and supported numerous image chain evaluations, image quality studies, and image utility studies

Professional Experience:

Charles Stark Draper Laboratory

Chief Scientist for Data Analytics and Laboratory Technical Staff (LTS) which is the highest level technical position at Draper Laboratory. Served as Capability Leader for Information and Decision Systems. Served as Acting Division Leader for Mission Systems. Directs and coordinates internal research and development (IRAD) and university collaborations in the areas of information and decision systems. Principal Investigator or Technical Director for multiple sponsored projects related to clinical decision support, prediction and forecasting, image exploitation, image/video processing and image quality, information and image fusion, geospatial intelligence, systems integration, human signals, and biometrics. Currently, Principal Investigator for *Image-based Socio-Cultural Observation, Predication, and Estimation (iSCOPE)*, sponsored by the National Geospatial-Intelligence Agency (NGA) and Principal Investigator for *Identifying Biomarkers that Distinguish Post-Traumatic Stress Disorder and Mild Traumatic Brain Injury Using Advanced Magnetic Resonance Spectroscopy*, under the Congressionally Directed Medical Research Program (CDMRP) Program. Previously, Principal Investigator and Technical Director for Principal Investigator and Technical Director for "Remote Sensing and Indicators of Well-being and Governance," an ONR-sponsored project under the Human Social Culture Behavior Modeling Program (HSCB) and Principal Investigator for "Image-based Culturally Aware Syntactic Computation for Activity Detection and Estimation (iCASCADE)," also sponsored by Office of Naval Research. Principal Investigator for "Bayesian modeling for decision support in surgical wound closure" which is a joint project with the Naval Medical Research Center and Department of Surgery, Uniformed Services University of Health Sciences. Principal Investigator for the "System for Prediction, Aggregation, Display, and Elicitation (SPADE)," under IARPA's Aggregative Contingent Estimation (ACE) Program.

SAIC, 1997-2008

Deputy Division Manager for the Systems and Technology and a Technical Fellow of SAIC. Senior scientist for ongoing evaluations of ATR and Automatic Feature Extraction (AFE) technology employing panchromatic, multispectral, and hyperspectral imagery to generate geospatial and intelligence products for NGA. Principal Investigator for NGA-sponsored program to investigate and characterize the interpretability and quality of motion imagery. Principal Investigator for a program with the Deputy Under Secretary of Defense for Science and Technology (DUSD/S&T) for the development and demonstration of new evaluation methodology for fusion-based image exploitation. Principal Investigator and Program Manager for program on non-imaging biometrics under the DARPA Human Identification at a Distance (Human ID) Program. Senior scientist for assessment of Community MASINT program for the Central MASINT Committee. Chief scientist for the evaluation of DARPA's Semi-Automated IMINT Processing (SAIP) system, an assisted image exploitation system that employs Automatic Target Recognition (ATR) and image understanding technology. Responsible for developing an innovative methodology for evaluating assisted exploitation technology where exploitation performance depends on both the algorithm and the human. Also, developed methodology and measures of effectiveness for assessing military utility of the technology. These methods are now employed by NGA for evaluating assisted exploitation tools for both intelligence and geospatial applications. Directed assessment of advanced SAR image compression algorithms for DARPA. Developed methodology and tools for ATR assessments under OSD-sponsored effort. Senior Scientist for studies of landmine detection using hyperspectral data, which included the development and integration of a testbed system phenomenology studies, analysis of HSI data, and development of mine detection algorithms, including data fusion algorithms.

ERIM, 1989-1997

Deputy Director of the Image Exploitation Support Department, based in ERIM's Washington Office. Supported Air Force Operational Test and Evaluation Center (AFOTEC) in design of experiments, development of Measures of Performance and Measures of Effectiveness, and methods for data fusion. Key member of the team that developed and validated National Imagery Interpretability Rating Scales (NIIRS), which are the standard metrics for assessing image interpretability for various sensor types, including synthetic aperture radar, thermal IR, and multispectral systems. Developed and directed a program to apply remote sensing and data fusion for environmental issues, emphasizing the synergistic combination of multispectral and multi-sensor remote sensing with mathematical modeling. Program achieved cost savings of 5 million-dollar in the remediation of one site. Project lead for evaluating new technology for ATR algorithms and computer-assisted image exploitation. Project lead for NIMA program to assess the utility of the emerging civil and commercial satellite imaging systems to support both intelligence and geospatial requirements. The program examined image utility with respect to satisfaction of intelligence requirements, feature extraction for geospatial products, and positional accuracy. Conducted research projects in several other areas, including modeling, simulation and experimental design for operational test and evaluation of military systems and mathematical aspects of artificial neural networks.

Central Intelligence Agency, 1982-1989

As Chief of Analytic Methods at the Central Intelligence Agency, supervised a staff of mathematical statisticians and computer specialists who provided internal consulting services to the Agency, directed the development of computer databases and specialized software, monitored external contract work, and served as senior technical advisor on issues related to mathematical modeling and statistical analysis. Senior Methodologist in the Office of Soviet Analysis, responsible for quantitative analyses related to Soviet nuclear forces, developed improved methods for projecting future force levels, designed and implemented force-exchange models to analyze nuclear conflict, and assessed various monitoring issues related to current and future arms control agreements. As a Senior Operations Research Analyst, consulted on numerous intelligence issues.

ASA/NSF Research Fellow, US Census Bureau, 1980-1982

Research Fellow at the US Census Bureau, under a program sponsored by the National Science Foundation and the American Statistical Association. Analyzed survey design sources of bias, participated in the re-design for the Current Population Survey, analyzed unemployment, income and reservation wages, and developed methods for identifying structural changes in econometric models.

Independent Statistical Consulting, 1977-present

Participated in basic medical research, designed and analyzed pre-clinical pharmaceutical trials, conducted bio-equivalency studies, analyzed surveys of consumer attitudes, and developed statistical software. Clients included Astra Pharmaceutical, Veterans Administration, Consumers Union, Yale Medical School, IMRA, Michael Klein Associates, the American Petroleum Institute, Galaxy Scientific Corporation, Batelle, and MITRE.

Lecturer in Computer Science and Statistics, 1978-1980

Lecturer in Computer Science at Southern Connecticut State College, and in Statistics at Yale University, Yale Medical School, and Albertus Magnus College.

Research Intern, Federal Reserve Board, 1976-1977

Research Intern at the Board of Governors of the Federal Reserve System: Performed econometric modeling, data analysis, and software development in support of short term forecasting for the Wages, Prices, and Productivity Section of the Division of Research and Statistics.

Professional Service:

- Defense Science Board Summer Study on Constrained Military Operations, 2016.
- Program Committee for 23rd International Conference On Pattern Recognition
- General Chair for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop 2015
- Deputy Chair for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop 2014

- Program Committee for the 2014 International Conference on Pattern Recognition (ICPR 2014)
- Program Chair for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop 2012
- Program Committee for 21st International Conference on Pattern Recognition (ICPR 2012)
- Member of the Editorial Board for the *International Journal of Cognitive Biometrics*
- Program Committee for International Conference on Biologically Inspired Cognitive Architectures 2011
- SPIE Biometrics Program Committee for the Defense, Security and Sensing Conference 2010-2011.
- Technical Program Committee: 2010 International Conference on Pattern Recognition (ICPR)
- Program Chair for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop 2009
- Served on Department of Energy Independent Technical Review Panels (2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, and 2013)
- General Chair for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop 2008
- Sensors, Electronics and Electronic Warfare (SEEW) Technology Area Review and Assessment (TARA) Panel for Office of the Secretary of Defense, 2003 – 2006.
- Industry Co-Chair for Automated Target Recognize Working Group (ATRWG) 2002 – present
- Technical Steering Group for the Global Network Centric Surveillance and Targeting (GNCST) Program
- Executive Committee for IEEE Applied Imagery and Pattern Recognition (AIPR) Workshop: 2001-present
- Senior Review Panel for DUSD/S&T ATR Program (2000-2001)
- Evaluation Committee Co-Chair for Automated Target Recognize Working Group (ATRWG) 1998 – 2002
- Referee for professional journals: *Journal of Electronic Imaging*, *Journal of the American Statistical Association (JASA)*, *Human Factors*, *Journal of Artificial Neural Networks*, *Optical Engineering*, and *Photogrammetric Engineering and Remote Sensing*, *IEEE Transactions on Information Forensics & Security*, *International Journal of Cognitive Biometrics*, *The Computer Journal*, and *Pattern Recognition Letters*

Affiliations:

American Statistical Association (ASA)
 American Society of Photogrammetry and Remote Sensing (ASPRS)
 The International Society for Optical Engineering (SPIE)
 The Institute of Electrical and Electronic Engineers (IEEE)
 Society for Industrial and Applied Mathematics (SIAM)
 Association of Military Surgeons of the United States (AMSUS) – The Society of Federal Health Professionals

Association for Research in Vision and Ophthalmology (ARVO)
Military Operations Research Society (MORS)
Data Science Association

Honors and Awards:

- Best Poster Award for "Physiological Correlates of Emotional State" presented at *HCI International 2011*
- SAIC Technical Fellows Council 2008 Publication Award for best paper in Engineering and Systems Integration
- SAIC Technical Fellows Council 2007 Publication Award for best paper in Engineering and Systems Integration
- SAIC Executive Science and Technology Council 2005 Award for best paper in Engineering and Systems Integration
- SAIC Technical Fellow and Member of Engineering, Science, and Technology Council, 2005 - 2008
- SAIC Executive Science and Technology Council 2004 Award for best paper in Engineering and Systems Integration
- SAIC Executive Science and Technology Council 2002 Award for best paper in Engineering and Systems Integration
- Best of Session Paper at the *Third Thematic Conference on Marine Remote Sensing* (1995)
- Best of Session Paper at the *Tenth Thematic Conference on Geologic Remote Sensing* (1994)
- Barchi Prize Nominee, 1991, 59th MORS Symposium
- American Statistical Association & National Science Foundation Research Fellow at US Census Bureau
- Sigma Xi
- Ethel Bois Morgan Fellowship
- Morris B. Pendleton Award in Economics
- Pi Mu Epsilon
- Graduation Honors: Phi Beta Kappa, *Cum Laude*
- Honors at Entrance to Pomona College
- Pomona Scholar
- National Merit Commendation

Patents:

- *Human Identification By Analysis of Physiometric Variation*. Patent Number 06993378 Cl. 600-509, U.S. Utility Patent Application Serial Number 60/300,070, filed 28 June 2002, granted 31 January 06
- *Systems and Methods for Detecting and Tracking Objects in a Video Stream*. Patent Application Number: 102590-0463. Washington, DC: U.S. Patent and Trademark Office.
- *System And Method For The Segmentation Of Optical Coherence Tomography Slices*, U.S. Provisional Patent Application No.: 62/243,435, Filed: October 19, 2015

- *Method and System for Obtaining and Analyzing Information From a Plurality of Sources.* (Provisional Patent: HBSR Docket No.: 5000.1004-000)
- *Auto-redaction and Anonymization of Individuals in Video.* (provisional patent)
- *A Novel Method and Procedure for Classifying and Quantifying Wet and Dry Age-related Macular Degeneration (AMD) Using OCT Imagery of the Retina.* (provisional patent)
- *System And Method For The Segmentation Of Optical Coherence Tomography Slices,* Reference: 102590-0501, U.S. Provisional Patent Application No.: 62/243,435

Publications:

Journal Papers:

1. B. Rowland, L. Mariano, J.M. Irvine, A.P. Lin, "Correcting for frequency drift in clinical MR spectroscopy" *Journal of Neuroimaging* (JON-16-4688) (in press).
2. Laura Mariano, John M. Irvine, Ben Rowland, Kristen Heaton, and Alexander Lin, (2016) "The Importance of Control Subjects in Biomarker Discovery Using Magnetic Resonance Spectroscopy", *Journal of Military Medicine*, (in submission).
3. John M. Irvine, Joseph D. Caruso, Maricela Rodriguez, Rajiv Luthra, Jonathan Forsberg, Nicole J. Crane, Eric Elster, (2016) "Predicting Outcome for Porcine Acute Limb Ischemia: A Comparison of Models" *Journal of Trauma and Acute Care Surgery*, (in submission)
4. Andrew Crooks, Arie Croitoru, Xu Lu, Sarah Wise, John M. Irvine, and Anthony Stefanidis (2105) "Walk this Way: Improving Pedestrian Agent-Based Models through Scene Activity Analysis" *ISPRS International Journal of Geo-Information* 2015, 4(3): 1627-1656.
5. Poore, J.C., Forlines, C., Miller, S., Regan, J., Irvine, J. "Personality, Cognitive Style, Motivation and Aptitude Predict Systematic Trends in Analytic Forecasting Behavior and Confidence." *Journal of Cognitive Engineering and Decision Making*, December 2014.
6. Steven A. Israel, John M. Irvine, (2012) "Heartbeat Biometrics As A Sensing System" *International Journal of Cognitive Biometrics*, Vol. 1, No. 1, pp.39–65.
7. John M. Irvine, Steven A. Israel, (2009) "A Sequential Procedure for Individual Identity Verification Using ECG" *EURASIP Journal on Advances in Signal Processing*, Vol. 2009, Article ID 243215
8. John M. Irvine, Steven A. Israel, W. Todd Scruggs, William J. Worek, (2008) "EigenPulse: Robust Human Identification From Cardiovascular Function" *Pattern Recognition*, Volume 41, Issue 11, November 2008, Pages 3427-3435.

9. John M. Irvine, Ana Ivelisse Aviles, David M. Cannon, Charles Fenimore, Donna Haverkamp, Steven A. Israel, Gary O'Brien, John Roberts (2007) "Developing an Interpretability Scale for Motion Imagery" Optical Engineering November 2007, Vol. 46, No. 11.
10. Steven A. Israel, John M. Irvine, Andrew Cheng, Mark D. Wiederhold, Brenda K. Wiederhold (2005) "ECG to identify individuals" Pattern Recognition 38(1):133-142, 2005
11. John M. Irvine (2004) "Assessing Target Search Performance: The Free Response Operator Characteristic (FROC) Model" Optical Engineering, vol.43, no.12, Dec. 2004, pp.2926-2934.
12. Wilson Harvey, J. Chris McGlone, David M. McKeown, and John M. Irvine (2004) "User-centric Evaluation of Semi-automated Road Network Extraction" Photogrammetric Engineering and Remote Sensing, Vol. 70, No.12, December 2004.
13. John M. Irvine (2002) "Targeting Breast Cancer Detection with Military Technology", IEEE Engineering in Medicine and Biology, November/December 2002
14. John M. Irvine, Barbara A. Eckstein, Robert Hummel, Richard Peters, Rhonda Ritzel (2002) "Evaluation of the Tactical Utility of Compressed Imagery" Optical Engineering, Vol. 41, No. 6 June 2002, pp.1262-1272.
15. Jon Leachtenauer, William Malila, John M. Irvine, Linda Colburn, Nanette Salvaggio, (2000) "General Image-Quality Equation for Infrared Imagery", Applied Optics, Vol. 39, No. 26, 10 September 2000, pp. 4826-4828.
16. Alfred J. Garrett, John M. Irvine, Thomas K. Evers, John Smyre, Amy L. King, Clell Ford, Dan Levine (2000) "An Imagery-Based Hydrodynamic Simulation of Effluent Streams Entering the Clinch River" Photogrammetric Engineering and Remote Sensing, vol.66, No.3, March 2000, pp.329-335.
17. Jon Leachtenauer, William Malila, John M. Irvine, Linda Colburn, Nanette Salvaggio (1997) "General Image Quality Equation" Applied Optics, November 1997, pp. 8322- 8328, Vol. 36, No. 32.
18. John M. Irvine, Thomas K. Evers, John L. Smyre, Gary Stahl, Julie Odenweller, Dale Huff, Amy L. King, "Detection and Mapping of Buried Waste", International Journal of Remote Sensing, 1997, vol.18, no.7, 1583-1595.
19. John M. Irvine, Nancy A. David, "Statistical Allocation of Resources for Operational Testing" AFOTEC Technical Journal, 1994.

20. Irvine, John M. and Ralph Carroll, "A Methodology for Selecting Surrogate Targets for OT&E", AFOTEC Technical Journal, 1993.
21. John M. Irvine, Blackwell, K.T., Daniel L. Alkon, Thomas P. Vogl, (1992) "Angular Separation in Neural Networks" Journal of Artificial Neural Networks, vol.1, no.1, 169-182.
22. John M. Irvine, "Effects of A Priori Knowledge and Risk Assessment In Test Design and Analysis Planning", AFOTEC Technical Journal, Vol. 4, No. 2, 1991.
23. A.K. Rigler, John M. Irvine, and Thomas P. Vogl, "Rescaling of Variables in Back Propagation Learning," Neural Networks, vol.4, pp. 225-229, 1991.
24. Edward Cotlier, Yr Sharma, J. Zuckerman, J. Pucklin, B. Teasley, John M. Irvine, "Plasma Tryptophan in Humans with Diabetic and Senile Cataracts," Experimental Eye Research, (1981), vol.33 (3), pp. 247-252.
25. Bennett A. Shaywitz, John M. Irvine, et. al., "Ontogenesis of Spontaneous Activity and Habituation of Activity in the Rat Pup," Developmental Psychobiology, (1979), vol.12, no.4, pp. 359-367.
26. David Abrahamson, John M. Irvine, and Deborah Taper, "Improving Juror Utilization," Interface (1976) vol. 3, no. 2.

Book Chapters:

1. Michael Schmidt, John M. Irvine, Sarah Miller, (2016) "Data Visualization" in book, *Neurocritical Care Informatics – Translating Data into Bedside Action*. Michael De Georgia, MD and Ken Loparo, PhD,(eds), Springer Verlag. (in press)
2. John M. Irvine, (2014) "Transforming Data into Information: Enabling Detection and Discovery for Socio-Cultural Analysis" in *Sociocultural Behavior Sensemaking: State of the Art in Understanding the Operational Environment*, Jill Egeth, Gary Klein, and Dylan Schmorow (eds), MITRE Corporation.
3. Tareq Ahram, Kathleen Carley, Chris Elsaesser, Chris Glazner, John M. Irvine, John James, Waldemar Karwowski, Matt Koehler, Jennifer Mathieu, Les Servi, (2014) "Computational Sociocultural Models Used for Forecasting" in *Sociocultural Behavior Sensemaking: State-of-the-Art in Understanding the Operational Environment*, Jill Egeth, Gary Klein, and Dylan Schmorow (eds), MITRE Corporation.
4. John M. Irvine and Steven A. Israel, "Quantifying Interpretability Loss Due to Image Compression," in *Video Compression, Video Compression*, ISBN 979-953-307-604-0, InTech Publishing, 2012.

5. Steven A. Israel, John M. Irvine, Brenda K. Wiederhold, Mark D. Wiederhold "The Heartbeat: The Living Biometric" in Biometrics: Theory, Methods, and Applications, Edited by N. V. Boulgouris, E. Micheli-Tzanakou, and K. N. Plataniotis, pp.429-460, IEEE/Wiley, November 2009, ISBN-13: 978-0470247822.
6. John M. Irvine "National Imagery Intelligence Rating Scale (NIIRS)" in The Encyclopedia of Optical Engineering, Marcel Dekker, October 2003, (invited paper).
7. John M. Irvine, Gary Stahl, Julie Odenweller, John L. Smyre, Thomas K. Evers, Dale Huff, Amy L. King, "Thermal Remote Sensing to the Detection of Buried Waste Material", in Methods in Environmental Geology: Remote Sensing for Site Characterization, Friedrich Kuehn, Bernhard Hoerig, Trude V.V. King, Douglas C. Peters, eds. Springer-Verlag, Berlin, 2000, pp96-105.
8. Vogl, T.P., Blackwell, K.T., Irvine, J.M., Barbour, G.S., Hyman, S.D., Alkon, D.L. "Dystal: A Neural Network Architecture Based on Biological Associative Memory". In Progress in Neural Networks, III, C.L. Wilson and O.M. Omidvar, Eds., Ablex Publishing Co., Norwood, N.J. 1996.
9. Hyman S.D., Vogl T.P., Blackwell K.T., Barbour G.S., Irvine J., Alkon D.L. (1991) Classification of Japanese Kanji using principal component analysis as a preprocessor to an artificial neural network. Proceedings of the IJCNN '91 I: 233-238.

Conference Proceedings and Presentations:

1. Pineles, S.L., Irvine, J., Webb, A., Nillni, Y.I., Resick, P.A. Orr, S.P., & Rasmusson, A. M. (2016, November). Neurobiological Mechanisms of Menstrual Cycle Effects on Extinction Retention among Women with and without PTSD. In K. Felmingham (Chair), "The Effects of Stress and Sex Hormones on Mechanisms of Posttraumatic Stress Disorder". Symposium to be conducted at the *32nd annual meeting of the International Society for Traumatic Stress Studies*, Dallas, TX.
2. Nillni, Y. I., Irvine, J., Webb, A., Resick, P.A. Orr, S.P., Rasmusson, A. M, & Pineles, S. L. (2016, November). "Differences in ovarian hormone steroids across the menstrual cycle among women with and without PTSD." In Y. Nillni (Chair), Trauma, PTSD, and Women's Reproductive Health. Symposium to be conducted at the 32nd annual meeting of the *International Society for Traumatic Stress Studies*, Dallas, TX.
3. John M. Irvine, Laura J. Mariano, Benjamin Rowland, Alexander P. Lin, "Robust functional data analysis approach to data harmonization and signal estimation", *International Society for Magnetic Resonance in Medicine: Workshop on MR Spectroscopy: From Current Best Practice to Latest Frontiers*, Konstanz, Germany, 14-17 August 2016.

4. Benjamin Rowland, Laura J. Mariano, John M. Irvine, Alexander P. Lin, "OpenMRSLab: An open-source software repository for Magnetic Resonance Spectroscopy data analysis tools", *International Society for Magnetic Resonance in Medicine: Workshop on MR Spectroscopy: From Current Best Practice to Latest Frontiers*, Konstanz, Germany, 14-17 August 2016.
5. John M. Irvine, Nastaran Ghadar, Steve Duncan, David O'Dowd, Kristie Lin, Tom Chang, "Quantitative Assessment of Wet AMD Using OCT Imagery" Association for Research in Vision and Ophthalmology (ARVO) 2016 Imaging Conference, April 30, 2016, Seattle, WA.
6. Andrew Kalukin, Josh Harguess, A. J. Maltenfort, John Irvine, "Automated video quality measurement based on manmade object characterization and motion detection" *SPIE Defense and Commercial Sensing*, paper 9828-14, April 18, 2016, Baltimore, MD.
7. Mariano L, Irvine JM, Rowland B, Liao HJ, Ladner J, Heaton K, Lin AP (2015), "Novel Processing of Magnetic Resonance Spectroscopy Signal Enables Biomarker Discovery for PTSD and mTBI," 2105 AMSUS Meeting, 1-4 December 2015, San Antonio, TX.
8. Richard Wood and John Irvine, (2015) "Auto-Redaction and Anonymization in Video" *IEEE Applied Imagery Pattern Recognition Conference*, October 13-15, 2015, Washington, DC.
9. John M. Irvine, Mon Young, Ross Eaton, Stan German, (2015) "Perceived X-ray Image Quality for Baggage Screening" *IEEE Applied Imagery Pattern Recognition Conference*, October 13-15, 2015, Washington, DC.
10. John M. Irvine, Steve Duncan, David Floyd, Nathan Lowry, David O'Dowd, Richard Wood, (2015) "Development of Quantitative Biomarkers for Wet AMD from OCT Imagery", SPIE/NIH Workshop: Biophotonics from Bench to Bedside, September 24-25, 2015, Bethesda, MD.
11. John M. Irvine, (2015), "Large Scale Analytics in the Era of Abundant Data" *ENVI Analytics Symposium (EAS)*, August 25-26, 2015 Boulder, Colorado.
12. Mariano L, Irvine JM, Rowland B, Heaton K, Lin AP (2015), "Biomarkers Discovery for PTSD and mTBI using Magnetic Resonance Spectroscopy," Military Health System Research Symposium, 17-20 August 2015.
13. John M. Irvine, Laura Mariano, Ben Rowland, Kristin Heaton, Alexander Lin, (2015) "Know Your Control Group: Comparison of Military and Civilian Controls in the Study of Traumatic Brain Injury" *Joint Statistical Meetings (JSM)* 2015, 8-13 August 2015, Seattle, Washington.

14. Laura Mariano, Ben Rowland, John M. Irvine, Alexander Lin, (2015) "Signal Drift and Calibration for Magnetic Resonance Spectroscopy" *Joint Statistical Meetings (JSM) 2015*, 8-13 August 2015, Seattle, Washington.
15. Ann Rasmusson and John M. Irvine (2015) "The Neurobiology of Executive Function Under Stress and Optimization of Performance" *17th International Conference on Human-Computer Interaction*, Los Angeles, CA, USA, 2-7 August 2015
16. John M. Irvine (2015) "Towards a Unified Understanding of Image Quality: Quantifying Spatial, Temporal, and Spectral Information for Computer Vision" *Beyond Visible Spectrum: Computer Vision and Pattern Recognition*, June 8-12, 2015, Boston, MA.
17. John M. Irvine, (2015) "The Role of Remote Sensing in Modeling CB Transport" *Chemical and Biological Defense Science & Technology Conference*, 12-14 May 2015, St. Louis, MO
18. Colin Gounden, John M. Irvine, Richard Wood, (2015) "Promoting Food Security Through Improved Analytics" *Humanitarian Technology: Science, Systems and Global Impact*, 12 – 14 May 2015, Boston, MA USA
19. John M. Irvine and Richard J. Wood (2015) "Context and Quality Estimation in Video For Enhanced Event Detection" *SPIE Defense + Security*, 20 - 24 April 2015, Baltimore, Maryland
20. John M. Irvine (2015) "Estimating Economic and Social Indicators from Imagery", *INFORMS Conference on Business Analytics and O.R.*, April 12-14, 2015, Huntington Beach, California.
21. John Irvine, Jennessa Kimball, Janet Lepanto, John Regan, Richard Wood, (2014), "Imagery-based Modeling of Social, Economic, and Governance Indicators in Sub-Saharan Africa" *IEEE Applied Imagery Pattern Recognition Conference*, 14-16 October 2014, Washington, DC.
22. John M. Irvine, John Regan, "Temporal Perceptions and Heuristic Adjustments in Short-term Forecasts," *Joint Statistical Meetings (JSM) 2014*, 2-7 August 2014, Boston, MA.
23. Richard J. Wood, John M. Irvine, "A Comparison Of Robust Background Modeling Methods For Enhancing Event Detection In Video," *Joint Statistical Meetings (JSM) 2014*, 2-7 August 2014, Boston, MA.
24. Laura Mariano, John M. Irvine, Alexander Lin, Yorghos Tripodis, Robert Stern, "Towards a Multimodal Characterization of Chronic Traumatic Encephalopathy," *Joint Statistical Meetings (JSM) 2014*, 2-7 August 2014, Boston, MA.

25. K. Lin, R. Mangoubi, T. Chang, A. Ho, N. Lowry, L. Hamilton, D. O'Dowd, J. Irvine, S. Popma, "Development of Imaging Biomarker Algorithms to Assess Drug Efficacy and predict Responders in Age-Related Muscular Degeneration Treatment," *The Association for Research in Vision and Ophthalmology (ARVO 2014)*, May 3-8, 2014, Orlando, FL.
26. Richard J. Wood, David Reed, Janet Lepanto, John M. Irvine; "Robust Background Modeling for Enhancing Object Tracking in Video," *SPIE Defense Security + Sensing (DSS) Conference*, 5-9 May 2014, Baltimore, MD.
27. John M. Irvine, "Video Analysis: The Right Data for the Right Problem" *Video Surveillance Systems & Technologies Symposium*, April 1-2, 2014, Washington, DC.
28. Richard J. Wood, David Reed, Brian Collins, John M. Irvine; "Enhancing Event Detection in Video Using Robust Background and Quality Modeling," *Video Surveillance and Transportation Imaging Applications Section of the SPIE Electronic Imaging 2014*, 2-6 February 2014, San Francisco, CA.
29. John M. Irvine, John Regan, Tammy A. Spain, Joseph D. Caruso, Maricela Rodriguez, Rajiv Luthra, Jonathan Forsberg, Nicole J. Crane, Eric Elster; "Analysis of Temporal Dynamics in Imagery During Acute Limb Ischemia and Reperfusion." *Image Processing Section of the SPIE Medical Imaging 2014*, 15 - 20 February 2014, San Diego, CA.
30. John M. Irvine, Richard J. Wood, David Reed, Janet Lepanto "Video Image Quality Analysis for Enhancing Tracker Performance," *IEEE Applied Imagery Pattern Recognition Conference*, 23-25 October 2013, Washington, DC.
31. John M. Irvine, Jennessa Kimball, John Regan, Janet Lepanto; "Application of Commercial Remote Sensing to Issues in Human Geography" *IEEE Applied Imagery Pattern Recognition Conference*, 23-25 October 2013, Washington, DC.
32. Sarah Miller, Cliff Forlines, John Irvine, "Collaboration in Forecasting: How much and what type of information" Human Factors and Ergonomics Society 2013, San Diego, California, September 30-October 4, 2013.
33. John M. Irvine, John C. Coleman, Joseph D. Caruso, Maricela Rodriguez, Rajiv Luthra, Jonathan Forsberg, Nicole J. Crane, Eric Elster, "Predicting Outcome for Porcine Acute Limb Ischemia: A Comparison of Models", Military Health System Research Symposium (MHSRS), 12-15 August 2013, Fort Lauderdale, Florida.
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159. John M. Irvine, "Rotation Group Bias," Proceedings of the American Statistical Association, 1984, Section on Survey Methods.
160. John M. Irvine and Daniel B. Ramey, "T-Statistics: A Short Tale of Long Tails," Proceedings of the American Statistical Association, 1984, Section on Statistical Computing.
161. John M. Irvine, "Testing for Changes in Regime in Regression Models," Proceedings of the American Statistical Association, 1982, Section on Business and Economics.

Mentoring:

Graduate Advisor:

- Payden, McBee, Northeastern University (current student)
- Jonathon Paynter, M.S. in Operations Research at MIT, Cambridge, MA
- Andrew Lee, M.S. in Transportation at MIT, Cambridge, MA .

PhD committees (graduated):

- Nathan Lowry, Aeronautics and Astronautics, Massachusetts Institute of Technology.
- Dale Herdeggen, Computer Science and Electrical Engineering; George Washington University.
- Waleed A. Yousef, Computer Science and Electrical Engineering; George Washington University;
- Hilary Holtz, Computer Science and Electrical Engineering; George Washington University;



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OPTOMETRY

CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee**\$400 additional received**

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Digital Eye Strain & EyeBrain Technology</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)		
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>		
Provider Email Address <u>KSEYFI@Retina2020.com</u>		
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Erny</u> (First) <u>Lovcik</u> (Last) _____ (Middle)		
License Number <u>8273TPG</u>	License Type <u>OD</u>	
Phone Number <u>(714) 637-1640</u>	Email Address <u>ghsjg5@aol.com</u>	

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/14
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Digital Eye Strain & eyeBrain Technology

Computer Vision Syndrome affects between 40-50% of patients and is causing issues such as headache, neck tension, eye fatigue, dry eyes and dizziness. Many Computer Vision Syndrome problems can be traced to a misalignment in the visual system that can be corrected for using Neurolenses. Once introduced, Neurolenses has a 95% success rate in reducing or eliminating the annoying issues of Computer Vision Syndrome.



Gary Lovcik, OD.

Digital Eye Strain & eyeBrain Technology

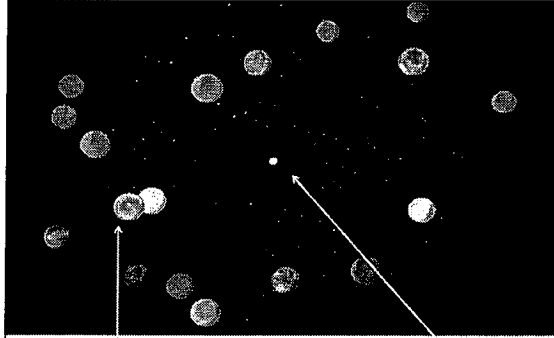
- Limited traction with current market solutions
- Chronic Headache
- (n=179)
- Digital Vision Syndrome
- (n=23)
- Clinical Misconception:
 - Current computer lens designs are founded on a “lack of accommodation” philosophy
 - Prescribing methods result in small amounts of add power at near to “relax” the accommodative system
 - A market leader has not been established as consistent clinical outcomes have been limited
- eyeBrain Technology Overview
 - An orientation of eyeBrain’s offering for the world’s most comfortable vision
 - SightSync Measurement
- SightSync Measurement:
 - Pre-screening Instrument
 - Fast: 90 -120 seconds
 - Fully automated, objective
 - Accurate
 - SightSync: $\pm 0.5D$
 - Traditional (phoria): $\pm 3.0D$
- Neurolens Therapy
 - Alignment with Accommodation
 - NeuroLenses seamlessly align the images so that you don’t have to

SightSync Measurement

- Pre-screening Instrument
- Fast: 90 -120 seconds
- Fully automated, objective
- Accurate
 - SightSync: $\pm 0.5D$
 - Traditional (phoria): $\pm 3.0D$





Distance: 2.3 BI
Near: 3.5 BI



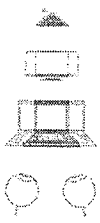
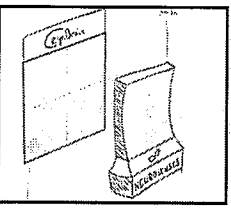
Rotating outer planets = binocular
(important for peripheral fusion lock)

Central vision target = monocular
(alternates eyes, making it seem like target is "blinking")

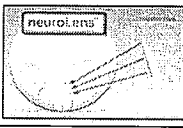
 SightSync™

NeuroLens Therapy

Alignment with Accommodation

NeuroLenses seamlessly align the images so that you don't have to



5701 E. Santa Ana Canyon Road Suite H
Anaheim Hills, CA 92807
(714) 637-1640
Email LovcikOD@yahoo.com

Gary M. Lovcik, OD

- | | | |
|--|--|---|
| Experience | 1987-present | Gary M. Lovcik, OD/Anaheim Hills
Optometric Center |
| | Private Practice | |
| | <ul style="list-style-type: none">▪ Family Eye Care/ Medical Eye Care▪ Contact Lenses▪ LASIK and Cataract Surgery Comanagement▪ Headache Treatment and Management | |
| | 2010-present | Ultimeyes |
| | Clinical Investigator | |
| | 2010-2011 | Nike/ Johnson and Johnson |
| | Consultant | |
| | <ul style="list-style-type: none">▪ Sports Vision Consultant▪ Contact Lens Consultant | |
| | 2015-present | Johnson and Johnson |
| | Innovative Speakers Bureau | |
| <ul style="list-style-type: none">▪ Teacher to other doctors | | |
| Education | 2015-present | eyeBrainmedical |
| | Investigator | |
| | <ul style="list-style-type: none">▪ Implement new technology to alleviate headaches | |
| | 1985-2000 | Fullerton Eye Medical Center |
| | Staff Optometrist/Manager | |
| | <ul style="list-style-type: none">▪ Provided optometric care and managed the optical | |
| | 1981-1985 | Southern California College of
Optometry Fullerton, CA |
| | Optometry Doctor | |
| | 1977-1981 | North Dakota State University Fargo, ND |
| | B.S. Zoology | |



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OPTOMETRY

CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Around The Orbit With Madhu Agarwal,</u> <u>MD</u>	Course Presentation Date <u>10/02/2016</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyri</u> (Last) _____ (Middle)		
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>		
Provider Email Address <u>KSEYFI@Retina2020.com</u>		
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Madhu</u> (First) <u>Agarwal</u> (Last) _____ (Middle)	
License Number <u>A7397B</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-1020</u>	Email Address <u>madhuagarwalmd@yahoo.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Around The Orbit with Madhu Agarwal, MD

This lecture reviewed the diagnoses of metastatic breast cancer, Orbital lymphoma and multiple sclerosis. In addition, the treatment options and diagnostic criteria for each of these conditions was thoroughly reviewed with detailed descriptions.

Madhu Agarwal, M.D.

AROUND THE ORBIT WITH MADHU AGARWAL, M.D.

- NEURO-OPHTHALMOLOGY, OCULOPLASTICS, AND ADULT STRABISMUS
- Case 1
 - 64 yo Caucasian female with 6 mo binocular horizontal diplopia.
 - Referring optometrist x 6 months to get prism glasses and nothing helping.
 - PMH: None
 - PSH: CE OU, Cholecystectomy
 - No Meds
 - Social: 1ppd smoker
 - exam
 - Va: 20/30 cc OU
 - Tp, Ant seg, Post seg unremarkable except:
 - PF: 8, 6
 - LF 16, 14
 - External photo
 - Motility: ? MG
- CT Scan
- Pathology
- Treatment Plan
 - Lung metastasis, 4, 5, 6, 8th ribs, T6, T8, L5.
 - Large palpable breast mass with lobular carcinoma and positive lymph nodes
 - ER+, PR-, her2neu-
 - 4th round of chemotherapy with partial response.
- CASE 2
 - 59 year old Caucasian female with 1 month of orbital edema, discomfort, and pressure pain.
 - Patient had seen ENT, Allergists, Endocrinologists in last month. Started steroids and allergy medications. Then more facial swelling and ear edema. Had neg head CT and sinus CT.
 - POHx: Duane's
 - PMH: DM, Chol
 - Family Hx: Duane's
 - Surgeries: Strabismus x 4; tonsils, hysterectomy
 - Exam
 - Va 20/60; 20/70
 - Tp: 20, 22
 - Diffuse Conjunctival Injection/ Chemosis OU
 - Diffuse Eyelid Edema.
 - Motility: Minimal adduction OD; Total ophthalmoplegia OS
 - Motility- SAME IN ALL GAZES!

- Imaging
- Hospital
 - Did very well with interventional neuroradiology.
- REMEMBER CCF IS TRICKY!!
- POSTOPERATIVE COURSE
- Case 3
 - 25 year old Caucasian female with tearing OD x many years.
 - She also notes difficulty hearing and breathing.
 - Meds: Augmentin for Dacryocystitis
- CASE 3
 - PMHx: None
 - PSHx: Csection - One 2-year-old daughter
 - NKDA
 - Exam: 20/25 sc OU
 - Unremarkable anterior and posterior segment except:
 - Fullness right orbit
 - Orbit ct
 - Biopsy: ALVEOLAR rHABDOMYOSARCOMA
 - After 2 cycles of chemotherapy
- CASE 4
 - 39 YEAR OLD INDIAN FEMALE ATTORNEY WITH SIX MONTHS OF PROGRESSIVE PROPTOSIS LEFT SIDE
 - PAINLESS, NO DIPLOPIA
 - PMH: NONE
 - PSH: CSECTION
 - MEDS: NONE
 - EXAM
 - 20/20 SC OU
 - HERTEL : 20, 26MM; BASE 102 MM
 - MOTILITY: 6 PRISM DIOPTERS OF EXOTROPIA IN RIGHT GAZE.
 - 3MM ADDUCTION DEFICIT OS
 - NORMAL ANTERIOR AND POSTERIOR SEGMENTS
 - External photo
- Coronal mri
- Axial mri with vasculature
- It's a boy?!?!?
- My gross dissection!
- PATHOLOGY: SOLITARY FIBROUS TUMOR

AROUND THE ORBIT WITH MADHU
AGARWAL, M.D.

NEURO-OPHTHALMOLOGY,
OCULOPLASTICS, AND ADULT
STRABISMUS
NEWPORT BEACH/ REDLANDS



CASE 1

64 YO CAUCASIAN FEMALE WITH 6 MO BINOCULAR
HORIZONTAL DIPLOPIA.
REFERRING OPTOMETRIST X 6 MONTHS TO GET PRISM
GLASSES AND NOTHING HELPING.

PMH: NONE
PSH: CE OU, CHOLECYSTECTOMY
NO MEDS
SOCIAL: 1PPD SMOKER

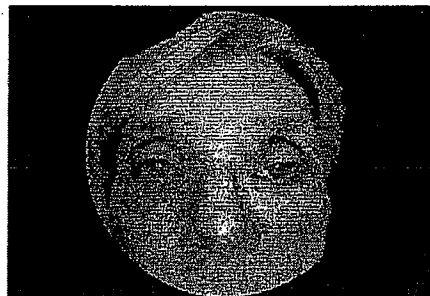
EXAM

VA: 20/30 CC OU

TP, ANT SEG, POST SEG UNREMARKABLE EXCEPT:

PF: 8, 6
LF 16, 14

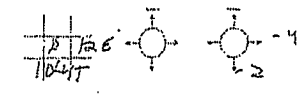
EXTERNAL PHOTO



CT SCAN



Medline: ? MG



PATHOLOGY



TREATMENT PLAN

LUNG METASTASIS, 4, 5, 6, 8TH RIBS, T6, T8, L5.
 LARGE PALPABLE BREAST MASS WITH LOBULAR
 CARCINOMA AND POSITIVE LYMPH NODES
 ER+, PR-, HER2NEU-

4th ROUND OF CHEMOTHERAPY WITH PARTIAL
 RESPONSE

CASE 2

50 C 1
 DISCOMFORT, AND PRESSURE PAIN.

PATIENT HAD SEEN ENT, ALLERGISTS, ENDOCRINOLOGISTS IN LAST
 MONTH. STARTED STEROIDS AND ALLERGY MEDICATIONS. THEN MORE
 FACIAL SWELLING AND EAR EDEMA. HAD NEG HEAD CT AND SINUS CT.

POHx: DUANE'S
 PMH: DM, CHOL
 FAMILY Hx: DUANE'S
 SURGERIES: STRABISMUS X 4; TONSILS, HYSTERECTOMY

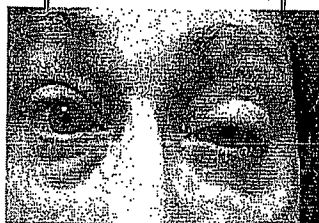
EXAM

VA 20/60; 20/70
 Ty: 20, 22

DIFFUSE CONJUNCTIVAL INJECTION/ CHEMOSIS OU
 DIFFUSE EYELID EDEMA.

MOTILITY: MINIMAL ADDUCTION OD; TOTAL OPHTHALMOPLÉGIA OS

MOTILITY-SAME IN ALL GAZES!



IMAGING



HOSPITAL

DID VERY WELL WITH INTERVENTIONAL
NEURORADIOLOGY.

REMEMBER CCF IS TRICKY!!

POSTOPERATIVE COURSE



CASE 3

25 YEAR OLD CAUCASIAN FEMALE WITH TEARING OD
X MANY YEARS.

SHE ALSO NOTES DIFFICULTY HEARING AND
BREATHING.

MEDS: AUGMENTIN FOR DACRYOCYSTITIS

CASE 3

PMHx: NONE

PSHx: CSECTION - ONE 2-YEAR-OLD DAUGHTER
NKDA

EXAM: 20/25 SC OU

UNREMARKABLE ANTERIOR AND POSTERIOR SEGMENT
EXCEPT:

FULLNESS RIGHT ORBIT



ORBIT CT



BIOPSY: ALVEOLAR
RHABDOMYOSARCOMA



AFTER 2 CYCLES OF
CHEMOTHERAPY



CASE 4

39 YEAR OLD INDIAN FEMALE ATTORNEY WITH
SIX MONTHS OF PROGRESSIVE PROPTOSIS LEFT
SIDE

PAINLESS, NO DIPLOPIA

PMH: NONE
PSH: CSECTION

MEDS: NONE

EXAM

20/20 SC OU

HERTEL : 20, 26MM; BASE 102 MM

MOTILITY: 6 PRISM DIOPTERS OF EXOTROPIA
IN RIGHT GAZE.

3MM ADDUCTION DEFICIT OS

NORMAL ANTERIOR AND POSTERIOR
SEGMENTS

EXTERNAL PHOTO



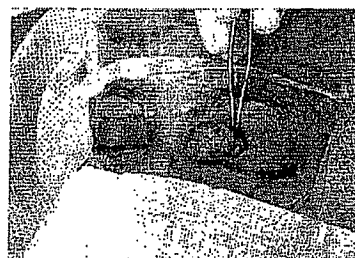
CORONAL MRI



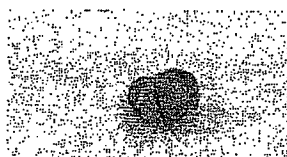
AXIAL MRI WITH VASCULATURE



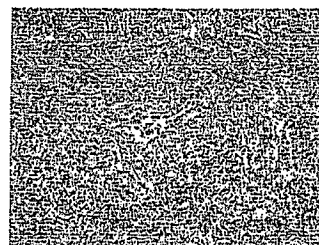
IT'S A BOY?!



MY GROSS DISSECTION!



PATHOLOGY: SOLITARY FIBROUS TUMOR



THANKS!

NEURO/PLASTICS/ STRAB

NEWPORT BEACH (949) 441-5058

INLAND EMPIRE/REDLANDS
(909) 792-6000



CALIFORNIA OCULAR CONSULTANTS

MADHU R. AGARWAL, M.D.
California Orbital Consultants, Inc.
1200 California Street, Suite 140
Redlands, CA 92374
(909) 792-6000
Email: dr@myeyelidsurgeon.com

CURRICULUM VITAE

GENERAL INFORMATION

MAIDEN NAME: Madhu R. Chopra

BIRTHPLACE: Los Angeles, California

BOARD CERTIFICATION: American Academy of Ophthalmology

LANGUAGES: Fluent in Spanish and Hindi

PRIVATE PRACTICE

- ◆ California Orbital Consultants, Redlands, California

PREVIOUS EMPLOYMENT

- ◆ Associate Professor of Ophthalmology and Neurosurgery,
Loma Linda University Department of Ophthalmology (8/2004-11/10)
- ◆ Clinical Instructor in Ophthalmology, Doheny Eye Institute, University of
Southern California (7/2003-7/2004)

EDUCATION

FELLOWSHIP

- ◆ Neuro-ophthalmology and Orbital Surgery (Ophthalmic Plastics/Adult
Strabismus)
Doheny Eye Institute, University of Southern California
Faculty: Alfredo A. Sadun, M.D., Ph.D. and Peter A. Quiros, M.D.
(7/2003-7/2004)

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RESIDENCY

- ◆ Ophthalmology, Doheny Eye Institute, University of Southern California (7/2000-6/2003)

INTERNSHIP

- ◆ Internal Medicine, University of California, Los Angeles-Olive View Medical Center, (7/1999-6/2000)

MEDICAL EDUCATION

- ◆ University of California, Los Angeles School of Medicine (8/1995-5/1999)
 - Doctor of Medicine

UNDERGRADUATE EDUCATION

- ◆ University of California, Los Angeles (9/1992-6/1995)
 - Bachelor of Science in Biochemistry with Highest Honors
 - Phi Beta Kappa, Magna cum laude

PROFESSIONAL ACTIVITIES

- ◆ Scientific Reviewer, Frontiers in Neuro-Ophthalmology (2010- present)
- ◆ Co-Chair, NANOS Symposium at the American Academy of Ophthalmology Meeting, San Francisco (2009)
- ◆ Committee Member, Neuro-ophthalmology Planning Group for the American Academy of Ophthalmology Sub-specialty Meeting (2009-present)
- ◆ Scientific Reviewer, *Eye* (2008-9)
- ◆ Vice-Chair, Patient Education Committee for North American Neuro-Ophthalmology Society (2008-10)
- ◆ Panel Member/Editor, Practicing Ophthalmologists Committee /Recertification Curriculum in Neuro-ophthalmology for the American Academy of Ophthalmology (2009-2014)
- ◆ Elected Commissioner, Joint Commission of Allied Health Personnel in Ophthalmology (2007-2012)

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Redlands, CA 92374
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- ◆ Committee Member, North American Neuro-ophthalmology Society
Committee to the American Academy of Ophthalmology (2006-present)
- ◆ Committee Member, LLU Residency Selection Committee (2005, 2006, 2007)
- ◆ Committee Member, LLU School of Medicine Compliance (2005-date)
- ◆ Co-Director of Quality Assurance, LLU Department of Ophthalmology (2005-date)
- ◆ Committee Member, LLU Department of Ophthalmology Marketing (2006-date)
- ◆ Committee Member, LLU Department of Ophthalmology Compensation (2006-2007)
- ◆ Chair, LLU Department of Ophthalmology Resident Research Day (June 2006)
- ◆ Scientific Reviewer, *Ophthalmology* (2005)

HONORS

- ◆ UCLA Medical Alumni Association Award for Distinguished Service
- ◆ UCLA Obstetrics and Gynecology Stipend for the Advancement of Breast Cancer Research
- ◆ American Heart Association Student Research Grant/Award
- ◆ Phi Beta Kappa Honors Society
- ◆ Golden Key National Honors Society
- ◆ Alpha Lambda Delta Honors Society
- ◆ UCLA Faculty Women's Club Scholarship liaison
- ◆ National Merit Scholarship
- ◆ UCLA Dean's Honor List All Quarters

PRESENTATIONS AS INVITED SPEAKER

- ◆ "Double Trouble: A Look at Breast Cancer Metastases in Your Neighborhood." Doheny Eye Institute. Los Angeles, CA. April 10, 2010.
- ◆ "Hang in There: Myasthenia Gravis." American Academy of Ophthalmology Meeting, San Francisco, October 24, 2009.
- ◆ "Ischemic Optic Neuropathies." Inland Empire Optometric Symposium. Ontario, CA. March 15, 2009.
- ◆ "Taking a History in the Evaluation of Optic Atrophy." Doheny Eye Institute at USC. December 13, 2008.
- ◆ "Eyelid Skin Cancer." California Optometric Association/Optowest. Monterey, CA. November 16, 2008.

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Email: dr@myeyelidsurgeon.com

- ◆ "Neuro-ophthalmology Basics." California Optometric Association/Optowest. Monterey, CA. November 15, 2008.
- ◆ "Understanding MS and Other Neurological Conditions." California Optometric Association/Optowest. Monterey, CA. November 14, 2008.
- ◆ "Ptosis: Nuances for the Clinician." Joint Commission for Allied Health Professionals in Ophthalmology National Meeting. New Orleans. November 9, 2008.
- ◆ "Giant Cell Arteritis." Joint Commission for Allied Health Professionals in Ophthalmology National Meeting. New Orleans. November 10, 2008.
- ◆ "So You Think It's Just Ptosis." Senior Instructor for the American Academy of Ophthalmology Conference. New Orleans, November 10, 2008.
- ◆ "Thyroid Eye Disease". Department of Ophthalmology Conference for Optometrists. Loma Linda University. November 4, 2008.
- ◆ Moderator/Speaker. Walsh Meeting at the North American Neuro-ophthalmology Society Meeting. Orlando, FL. March 9, 2008.
- ◆ "Review of Neuro-ophthalmology and Oculoplastics." Inland Empire Optometry Society. February 22, 2008.
- ◆ "Understanding Diplopia." Doheny Eye Institute at USC. December 8, 2007.
- ◆ "Ocular Malingering". Department of Ophthalmology Conference for Optometrists. Loma Linda University. November 4, 2007.
- ◆ "Ophthalmology and Multiple Sclerosis: Breakfast with the Experts." American Academy of Ophthalmology Conference. New Orleans. November 12, 2007.
- ◆ "Thyroid Eye Disease: Nuances for the Clinician." Joint Commission for Allied Health Professionals in Ophthalmology National Meeting. New Orleans. November 9, 2007.
- ◆ "So You Think It's Just Ptosis." Senior Instructor for the American Academy of Ophthalmology Conference. New Orleans. November 11, 2007.
- ◆ "Challenging Syndromes in Neuro-ophthalmology". C and E Optometry Symposium. Anaheim Marriot. October 29, 2007.
- ◆ "Ophthalmology and Multiple Sclerosis: Breakfast with the Experts." American Academy of Ophthalmology Conference. Las Vegas, Nevada. November 14, 2006.
- ◆ "Around the World in Neuro-ophthalmology and Oculoplastics." Department of Ophthalmology Conference for Optometrists. Loma Linda University. November 5, 2006.
- ◆ "Neuro-ophthalmology Basics." Neuro-ophthalmology Symposium. Anaheim Marriot. October 29, 2006.
- ◆ "Posterior Ischemic Optic Neuropathy." Department of Anesthesiology Grand Rounds. Loma Linda University. October 11, 2006.
- ◆ "Trigeminal Neuralgia." Doheny Eye Institute's Ophthalmic Pain Symposium. September 9, 2006.
- ◆ "Thyroid Eye Disease." Department of Medicine Grand Rounds. Loma Linda University. August 6, 2006.

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- ◆ "Oculoplastics for the Beginning Ophthalmology Resident." Department of Ophthalmology Grand Rounds. Loma Linda University. July 20, 2006.
- ◆ "Neuro-ophthalmology and Oculoplastics." Inland Empire Ophthalmic Technician Meeting. July 12, 2006.
- ◆ "Cita Con Su Medico." Spanish Radio Show about Ophthalmology. June 25, 2006.
- ◆ "Eyelid Reconstruction." Department of Dermatology Grand Rounds. Loma Linda University. April 26, 2006.
- ◆ "Eyelid Cancer." Inland Empire Optometry Symposium. Ontario Marriot. March 26, 2006.
- ◆ "Painful Clinical Syndromes in Neuro-ophthalmology and Orbital Surgery". Alumni Weekend, APC. Loma Linda University. March 5, 2006.
- ◆ "Oculoplastics." Lecture for Loma Linda University Housestaff. Loma Linda. February 8, 2006
- ◆ "Neuro-ophthalmology Update." "Neurosurgery Update." Department of Neurosurgery. Loma Linda University. February 15, 2006.
- ◆ "Oculoplastics for the Plastic Surgeon." Department of Plastic Surgery Grand Rounds. Loma Linda University. February 8, 2006.
- ◆ "Understanding Blepharospasm." Dystonia Support Group of the Inland Empire. Loma Linda University. February 2, 2006.
- ◆ "Hook, Line, and Sinker: Surprising Outcomes in Neuro-ophthalmology and Orbital Surgery." Inland Empire Optometric Society. Ontario, CA. January 11, 2006.
- ◆ "Neuro-ophthalmology and Orbital Surgery." Department of Family Medicine Grand Rounds. Loma Linda University. December 9, 2006.
- ◆ "The Double Whammy." Department of Ophthalmology Conference for Optometrists. Loma Linda University. November 6, 2005.
- ◆ "Comprehensive Review of Ophthalmology." Loma Linda University School of Medicine. October 28, 2005.
- ◆ "Neuro-ophthalmology and Orbital Disease." Department of Neurology Grand Rounds. Loma Linda University School of Medicine. October 26, 2005.
- ◆ "Cranial Nerve Palsies." Women in Optometry. Riverside, CA. September 21, 2005.
- ◆ "The Wild World of Disc Edema." Inland Empire Optometric Society. Ontario, CA March 20, 2005.
- ◆ "Clinicopathology of Tumors of the Ccular Adnexa." Annual Postgraduate Conference. Loma Linda University Medical Center. March 6, 2005.
- ◆ "Painful Clinical Syndromes in Neuro-ophthalmology and Orbital Disease." Pain Management Symposium. Doheny Eye Institute. February 12, 2005.
- ◆ "Benign intracranial hypertension: Is it really benign?" Women in Optometry. Inland Empire Optometric Society. January 18, 2005.

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- ◆ "Giant Cell Arteritis." Conference in Ophthalmology for Optometrists. Loma Linda University. October 31, 2004.
- ◆ "Amniotic Membrane Transplantation." Department of Ophthalmology, Resident Research Day. Loma Linda University Medical Center. June 5, 2004.

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- ◆ Hsu V, **Agarwal MR**, Chen CS, Rossi C. Ig A associated orbital plasmacytoma. *Ophthalmic Plastic and Reconstructive Surgery*. 2010 Mar-Apr. 26(2): 126-7.
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BOOK CHAPTERS

- ◆ Sadun AA and **Agarwal MR**: Topical Diagnoses in Neuro-ophthalmology. In Walsh and Hoyt's Clinical Neuro-Ophthalmology. Sixth Edition. Williams & Wilkins, Baltimore. 2005.

PROFESSIONAL CERTIFICATIONS

- ◆ Board Certified, American Academy of Ophthalmology
- ◆ North American Neuro-ophthalmological Society
- ◆ American Academy of Ophthalmology
- ◆ American Society of Cataract and Refractive Surgery
- ◆ UCLA Association of Chemists and Biochemists

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VOLUNTEER EXPERIENCE

- ◆ Board of Directors, UCLA Medical Alumni Association (1995-1999)
- ◆ UCLA Medical Center Career Conference Planning Committee (1995-1999)
- ◆ Celebration of Sight at Cedars Sinai Medical Center (1998)
- ◆ San Fernando Valley Health Fair- Ophthalmic screening exams (1998)
- ◆ Camp Ronald McDonald for Good Times- Pediatric Oncology (1997-1999)
- ◆ Umma Free Clinic- Downtown Los Angeles (1997-1999)
- ◆ Salvation Army Homeless Clinic (1997-1998)

PERSONAL INTERESTS

- ◆ Ballroom dance, cooking, running

OPTOMETRY

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Diabetic Retinopathy</u>	Course Presentation Date <u>10/02/2016</u>
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Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Sara</u> (First) <u>Haji</u> (Last) _____ (Middle)	
License Number <u>133198</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>shaji@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Diabetic Retinopathy

Diabetic retinopathy is the leading cause of blindness among U.S. working-aged adults. Blindness is 25 times more common in diabetics. It is projected that by 2020 almost half of American adults will be pre diabetic or diabetic. Average medical expenditures in diabetics are 2.3 times higher than those without diabetes. Early diagnosis of diabetic retinopathy and timely treatment reduce the risk of vision loss. However, nearly 50% of diabetics are not getting eye examination or are diagnosed too late for the treatments to be effective. Goal of the eye care provider should be to screen for diabetic retinopathy and to educate the patients. Our current treatments are very effective in preventing vision loss when provided on time.

Sara Haji, MD.

Diabetic Retinopathy

Diabetes

- In 2012, 9.3% of the population in US had diabetes
 - WHO: 9% of adults >18 yo had diabetes in 2014
- 7th leading cause of death in US
- 1 out of 4 do now know they have diabetes
- 1 out of 3 adults have prediabetes (9 out of 10 do know they are prediabetic)

Diabetes

- Projected that by 2020: half of American adults will be diabetic or prediabetic
- Average medical expenditures in diabetics are 2.3 times higher than those without diabetes

Future of DM

- According to estimates from the United States Census Bureau, **one-third of Americans are at risk of developing diabetes**
- Alarming increase in the frequency of Type 2 diabetes in children
 - Associated with childhood obesity
 - Increase costs for health care and the burdens of disability

Diabetes

- Type 1: autoimmune destruction of the beta-cells in the pancreas → severe insulin deficiency
- Type 2: usually have a “relative” insulin deficiency
 - May take insulin, yet do not need insulin for survival
 - Obesity insulin resistance
- 90% to 95% of patients with diabetes have Type 2 diabetes
 - **Larger proportion of the disease burden**, even though Type 1 diabetes is associated with more severe ocular complications

DM and Eyes

- DM causes a variety of eye problems
 - Most common: diabetic retinopathy (DR)
 - other: cataract, neovascular glaucoma, ocular motor nerve palsies
- DR is the leading cause of blindness among U.S. working-aged adults aged 20–74 years
 - most productive years.
- Prevalence of DR in adults with diabetes >40 yo in the US is 28.5% (4.2 million people)
 - By 2020, this will increase to 6 million persons
- Blindness is 25 times more common in diabetes
- Early diagnosis of DR and timely treatment reduce the risk of vision loss
 - 50% of diabetics are not getting their eyes examined or are diagnosed too late for treatment to be effective

Diabetic Retinopathy

- Exact mechanism of DR is not fully understood

- **Nonproliferative:** Microvascular damage → retinal **capillary nonperfusion and increased vasopermeability** → non-proliferative changes and macular edema
- **Proliferative:** **Closure of arterioles and venules with secondary proliferation of new vessels** → macular ischemia, vitreous hemorrhage, and tractional retinal detachment

DR Risk Factors

- **Duration of Diabetes:** Most important risk factor
 - If pt diagnosed before age of 30, incidence of DR
 - After 10 yrs: 50%
 - After 20 yrs: 90%
 - 5% of Type 2 DM have NPDR at presentation
 - Likely due to late diagnosis

Risk Factors

- **Glycemic control:** does not prevent but delays development of DR
 - Tight glycemic control: decreases developing DR by 75%
- **Medical conditions:** medical conditions such as high blood pressure, high cholesterol, kidney disease, anemia, obesity, and sleep apnea
- **Race:** *Hispanic* and *African Americans* are at greater risk for developing DR; *Asians* are at slightly higher risk than Caucasians

Risk Factors

- **Pregnancy:** higher risk for developing diabetes and diabetic retinopathy
 - If gestational diabetes higher risk of developing diabetes
- **Family History:** Type II DM has strong genetic basis
 - 1/3 have positive family history

Ocular Risk Factors

- **PVD:** may prevent development of PDR because hyaloid is needed as a scaffold for NV
 - attached posterior hyaloid is associated with increased risk of DME
- **high myopia:** may protect against DR
 - maybe by reducing metabolic need of retina
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 - Should undergo treatment prior to surgery if media is clear
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Features of DR

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 - the visual acuity would be dropped
 - Best seen on fluorescein angiography (as “capillary drop-out”)

Features of DR

- Neovascularization: an attempt (by residual healthy retina) to revascularize hypoxic retinal tissue

Diabetic retinopathy

- Progresses in an orderly fashion from mild to more severe stages (late for intervention)
 - **Important to recognize the stages when treatment may be most beneficial**

Ophthalmic Exam

- **History:** Duration of DM, glycemic control (HbA1c), meds, medical hx (HTN, kidney disease, pregnancy, neuropathy), and ocular history
- **Physical exam:** VA, IOP, pupillary assessment, slit lamp exam, gonioscopy when NVA suspected, thorough dilated fundoscopic exam
 - in undilated pts, only 50% are correctly diagnosed with DR
- **Ancillary tests:**
 - *Color fundus photography:* documents severity of disease and response to treatment.
 - *OCT:* quantifies retinal thickness, monitor macular edema and response to treatment
 - *Fluorescein angiography:* identify capillary nonperfusion, and differentiate DME from other causes of CME
 - *Ultrasound:* used with media is not clear (secondary to VH or cataract) to identify TRD

Management

- Prevention and early detection: **treatment is 90% effective in preventing severe vision loss**
- Purpose of screening: Determine who needs to be referred to an ophthalmologist for close follow-up and possible treatment and who may simply be screened annually.
 - Obstacle: fewer patients with diabetes are referred by their PCP than expected according to guidelines by the ADA
 - 2 studies: 43% to 65% of diabetics did not have a dilated eye examination

Management

- **Secondary prevention:** Establishing a close partnership between the eye care provider and the PCP to ensure optimal patient care
 - Educate diabetics and PCPs about ophthalmologic implications of controlling blood glucose, BP and serum lipid.
 - Commonly asked question: Aspirin therapy and DR
 - ASA does not slow the progression of DR
 - It does not cause more severe VH
 - No need to change ASA therapy

Management

- **Normal or minimal NPDR:** Re-examine annually
- **Mild to moderate NPDR without DME:** F/U within 6 to 12 mo.
- **Mild to moderate NPDR with DME:**
 - Center Involving CME:
 - anti-VEGF
 - Steroid: Ozurdex and Iluvien
 - Non-center involving: focal laser
- **Severe NPDR:** 50% of these patients will develop PDR within 1 year
 - Consider PRP before the eye reached PDR → Risk of severe vision loss will be reduced by 50%
 - PRP esp. if non-compliant or limited access to healthcare

Management

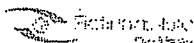
- High-risk PDR: Presence of 3 of following:
 - Any NV
 - NVD
 - NVD > ¼ DA or NVE > ½ DA
 - pre-retinal or vit heme
- Should receive PRP to reduce risk of severe vision loss
- If also have DME anti-VEGF and PRP
- If impossible to laser due to severe VH vitrectomy and intra-op PRP
- TRD: surgical repair; usually guarded prognosis

Summary

- DR is the most common cause of vision loss among adults 20-74
- During first 2 decades of disease, nearly all type 1 DM and >60% of type 2 patients have retinopathy
- Duration of the disease, glycemic and blood pressure control are the important risk factors
- Goal of the eye care provider is to screen and prevent permanent vision loss
- Our current treatments are 90% effective in preventing vision loss when provided on time

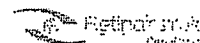
Diabetic Retinopathy

Sara Haji Abdollahi, MD
Retina Institute of California



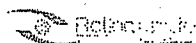
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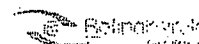
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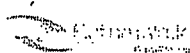
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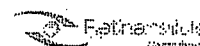
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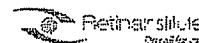
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Diabetes Type	Recommended Initial Evaluation	Recommended Follow-up
Type 1	Shortly after diagnosis	Yearly
Type 2	At time of diagnosis	Yearly
Pregnant (Type 1 or Type 2)	Shortly after delivery and early in 2nd trimester	<ul style="list-style-type: none"> • Annually for 1 year after delivery if PDR or NPDR • Semi-annually if no retinopathy



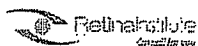
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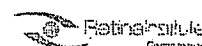
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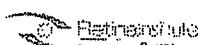
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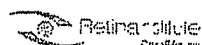
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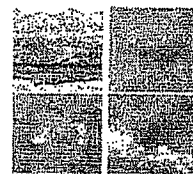
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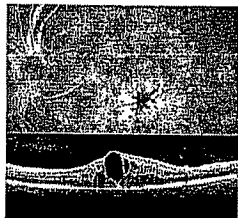
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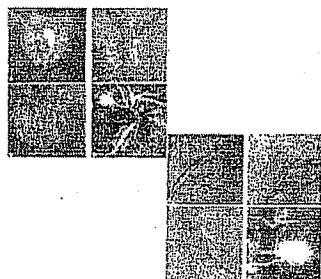
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Ophthalmology

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 - No need to change ASA therapy

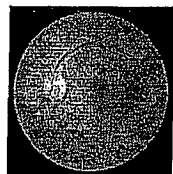

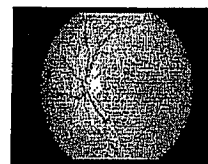

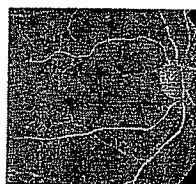

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Management

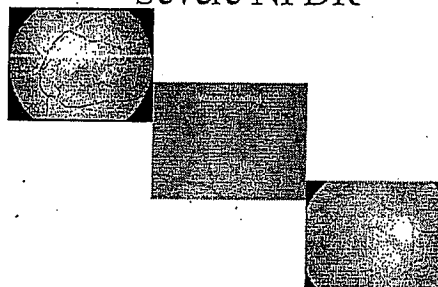

Disease Severity Level	Findings Observable upon Dilated Ophthalmoscopy
No apparent retinopathy	No retinopathy
Mild NPDR (see Glossary)	Microaneurysms only
Moderate NPDR (see Glossary)	More than just microaneurysms but less than severe NPDR
Severe NPDR	More than just microaneurysms but less than severe NPDR
U.S. Definition	Any of the following (4-2-1 rule) and no signs of proliferative neovascularization <ul style="list-style-type: none"> • Severe intraretinal hemorrhages and microaneurysms in each of four quadrants • Definite venous beading in two or more quadrants • Moderate IRMA in one or more quadrants
International Definition	Any of the following and no signs of proliferative neovascularization <ul style="list-style-type: none"> • More than 20 intraretinal hemorrhages in each of four quadrants • Definite venous beading in two or more quadrants • Moderate IRMA in one or more quadrants
PDR	One or both of the following <ul style="list-style-type: none"> • Neovascularization • Vitreous/preretinal hemorrhage

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Minimal NPDR


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The call for you
Mild to Moderate NPDR
without DME
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The call for you
Mild to Moderate NPDR
with DME
 Retina Institute
The call for you

Severe NPDR



 Retina Institute
The call for you

PDR


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The call for you

Management

- Normal or minimal NPDR: Re-examine annually
- Mild to moderate NPDR without DME: F/U within 6 to 12 mo.
- Mild to moderate NPDR with DME:
 - Center involving CME:
 - anti-VEGF
 - Steroid Ozurdex and Iluvien
 - Non-center involving: focal laser
- Severe NPDR: 50% of these patients will develop PDR within 1 year
 - Consider PRP before the eye reached PDR → Risk of severe vision loss will be reduced by 50%
 - PRP esp. if non-compliant or limited access to healthcare


 Retina Institute
The call for you

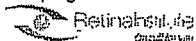
Management

- High-risk PDR: Presence of 3 of following:

- Any NV
- NVD
- NVD > ¼ DA or NVE > ½ DA
- pre-retinal or vit heme



- Should receive PRP to reduce risk of severe vision loss
- If also have DME → anti-VEGF and PRP
- If impossible to laser due to severe VH → vitrectomy and intra-op PRP
- TRD: surgical repair; usually guarded prognosis



Summary

- DR is the most common cause of vision loss among adults 20-74
- During first 2 decades of disease, nearly all type 1 DM and >60% of type 2 patients have retinopathy
- Duration of the disease, glycemic and blood pressure control are the important risk factors
- Goal of the eye care provider is to screen and prevent permanent vision loss
- Our current treatments are 90% effective in preventing vision loss when provided on time



Thank You



Sara Haji Abdollahi, MD
Retina Institute Surgeon

Dr. Haji Abdollahi is a vitreoretinal specialist who focuses on treatment of both medical and surgical retinal diseases such as diabetic eye disease, macular degeneration, and retinal vascular diseases. She performs advanced retinal surgeries for the treatment of various vitreoretinal diseases such as macular holes, epiretinal membrane, retinal detachments, and other complex retinal pathology.



After graduating cum laude and receiving her Bachelor of Science degree in molecular biology from the University of Texas at Dallas, Dr. Haji Abdollahi received her medical degree from University of Texas Medical Branch at Galveston, Texas. She then completed her internal medicine internship and her ophthalmology residency at University of Louisville School of Medicine.

Dr. Haji Abdollahi received her vitreoretinal surgery training at Harvard Medical School, Massachusetts Eye and Ear Infirmary. Prior to joining the Retina Institute of California, she was an assistant in ophthalmology, active staff, at the Massachusetts Eye and Ear Infirmary.

She is a board-certified ophthalmologist and a member of the American Academy of Ophthalmology (AAO) and American Society of Retina Specialists (ASRS) and she has published articles in numerous peer-reviewed journals.

Dr. Haji Abdollahi was born in Tehran, Iran and is fluent in Farsi. She lives in Pasadena where she enjoys spending time with her family.

800-898-2020



Biography

Sara Haji Abdollahi, MD

800-898-2020

Shaji@retina2020.com

cell: 818-395-8939

EDUCATION

2004 Bachelor of Science, Molecular Biology, University of Texas, Dallas, TX
2008 Doctor of Medicine, University of Texas, Galveston, TX

PROFESSIONAL TRAINING

2008-2009 Internship, Internal Medicine, University of Louisville, Louisville, KY
2009-2012 Residency, Ophthalmology, University of Louisville, Louisville, KY

FELLOWSHIPS

2012-2014 Fellowship, Vitreoretinal, Massachusetts Eye and Ear Infirmary,
Harvard Medical School

BOARD CERTIFICATION

2013 American Board of Ophthalmology

PROFESSIONAL AFFILIATIONS

American Academy of Ophthalmology
Kentucky Academy for Eye Physicians and Surgeons
American Medical Association

HONORS & AWARDS

Excellence in Clinical Teaching Award, University of Louisville,
Best Resident Clinical Research Presentation, University of Louisville

www.retina2020.com

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>New concepts in Pediatric Retina</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyri</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Michael</u> (First) <u>Samuel</u> (Last) (Middle)	
License Number <u>A83237</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>msamuel@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

New Concepts in Pediatric Retina

Update on Stem Cell research for dry age-related macular degeneration. Also discussed the CNTO-2476 technique developed by Johnson & Johnson. Reviewed the results of the study and complications. Reviewed the next steps in the study and when we can expect this technology to reach the next phase.

Michael Samuel, MD.

New Concepts in Pediatric Retina

Blinding Diseases in Children

- ◆ Retinopathy of Prematurity
- ◆ Trauma
- ◆ Developmental Anomalies: PHPV, Coloboma, Norrie's
- ◆ Retinoschisis: X-linked, Shaken Baby
- ◆ Retinal Detachment: High Myopia, Wagner-Stickler, Marfan
- ◆ Retinal Vascular Diseases: FEVR, IP, Diabetes, Sickle Cell, Von Hippel Lindau, Coats', Sturge-Weber
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- ◆ Axial length 15 – 18 mm
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- ◆ Follow-up examinations are challenging
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Retinopathy of Prematurity

- ◆ In-Utero Retina Avascular – 4 months
- ◆ Vessels Extend from Optic Disc to Periphery
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- ◆ At Premature Birth the Vasculature Stops

ROP Classification

- ◆ ROP Begins: Junction of Avascular & Vascular Retina
- ◆ Stage I – Demarcation Line
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- ◆ Stage IV – Retinal Detachment A&B
- ◆ Stage V – Total RD
- ◆ Zone I
- ◆ Zone II
- ◆ Zone III
- ◆ Plus Disease

ROP Classification

Timing of Treatment

- ◆ Type 1 ROP (High-risk Pre-threshold):
 - ❖ zone I, any stage w/plus
 - ❖ zone I, stage 3 w/o plus
 - ❖ zone II, stage 2 or 3 w/plus

Timing of Treatment

- ◆ Type 2 ROP:
 - ❖ zone I, stage 1 or 2 w/o plus
 - ❖ zone II, stage 3 w/o plus

Ret Cam 120

Ret Cam FA for ROP

- ◆ Detection of skip areas
- ◆ Quantification of vascular activity
- ◆ Early detection of zone 1 disease
- ◆ Documentation

Management of ROP in 2010

- ◆ Early Ablative Therapy of Ischemic Eyes
 - ❖ Diode Laser
 - ❖ ETROP Study
- ◆ Pharmacotherapy if Persistently Active
 - ❖ Angiostatic Steroids
 - ❖ Anti-VEGF – Avastin
- ◆ Vitreo-Retinal surgery at onset of retinal detachment or significant traction.
- ◆ Lens-Sparing Vitrectomy for dry Stage IV
- ◆ Scleral Buckle for active Stage IV
- ◆ Open Sky Vitrectomy for Stage V

Features of ROP Retinal Detachment

- ◆ Lens relatively large but can be spared with iris root entry
- ◆ Vitreoschisis is the rule while posterior vitreous detachment is the exception
- ◆ Breaks are tolerated poorly and can be rarely repaired with enduring success
- ◆ Cyclitic membranes and pupil occlusion from incomplete lensectomy

Case 1: Intolerance of Breaks Surgical Options in ROP Detachment

- ◆ Lens-Sparing Vitrectomy
- ◆ Pars-Plicata 3-Port Vitrectomy - Lensectomy
- ◆ Scleral Buckle
- ◆ Scleral Buckle with Vitrectomy
- ◆ Open-Sky Vitrectomy

Lens-Sparing Vitrectomy

- ◆ Described by Maguire and Trese in '92
- ◆ Two-port iris-root approach with 20 gauge end-irrigating instruments
- ◆ Limited zone of free instrument movement bounded by lens and ridge
- ◆ Anatomic success around 90% for ideal 4A detachments

20 vs. 25-Gauge Vitrectomy

25-g Advantages

- ◆ Smaller sclerotomies – 0.5 vs. 0.9 mm
- ◆ 6X - Lower flow at given suction
- ◆ Safer dissection between ridge and lens
- ◆ Better stability - high vacuum – maintaining globe
- ◆ Faster recovery – less traumatic
- ◆ Less flow - ↓ late cataract

Lens Sparing Vitrectomy: Technical Pearls

- ◆ Enter 1 mm posterior to limbus
- ◆ Relief Traction: 4 Primary Vectors
 - ❖ ridge to nerve
 - ❖ ridge to lens & ciliary body
 - ❖ ridge to ridge
 - ❖ circumferential
- ◆ Anterior Hyaloidal Dissection
- ◆ Err on side of damaging lens

Recurrent question?

- ◆ Given advances in vitrectomy technique...
- ◆ Is there a role for scleral buckle in contemporary ROP surgery?
- ◆ Potential roles of Scleral Buckle:
 - ❖ Primary therapy, used alone
 - ❖ Combined with LSV
 - ❖ Re-operation after failed LSV

Scleral Buckle

- ◆ Technically simpler than LSV
- ◆ Low rate of complications
- ◆ Can temporize – allows later vitrectomy
- ◆ Does not induce proliferation
- ◆ Uniformly lens-sparing

Preferred technique

- ◆ Encircle or segmental radial if pathology isolated
- ◆ 240 or 41 band placed at level of ridge
- ◆ Imbrication 1.5 to 2 mm using h. mattress – minimize myopia
- ◆ 4-0 Vicryl clove hitch (no migration when examined years later) – avoid second procedure
- ◆ External drainage posterior to buckle
- ◆ Additional laser or cryotherapy to untreated retina

Scleral Buckle:

- ◆ Which cases are not appropriate for SB?

- ❖ Zone 1 detachment
- ❖ Dry, well ablated detachment where ridge well away from lens and traction vectors well visualized
- ❖ Lack of familiarity with LSV is not an appropriate indication for SB

Treatment Options in ROP

- ◆ Pre-detachment - Laser
- ◆ Detachment Stage IV A or B -
 - ❖ Lens-Sparing Vitrectomy
 - ❖ Pars-Plicata 3-Port Vitrectomy - Lensectomy
 - ❖ Scleral Buckle
 - ❖ Scleral Buckle with Vitrectomy
- ◆ Detachment Stage V
 - ❖ Vitrectomy /Lensectoms
 - ❖ Open-Sky Vitrectomy

Open Sky Vitrectomy

- ◆ 1960: Schepens (GRT with rolled flap)
 - ❖ Discouraged by failure (PVR and retrocorneal membrane)
- ◆ 1970s: Hirose and Schepens (297 cases)
- ◆ Lost art
- ◆ Procedure of choice in a minority of cases
 - ❖ Funnel closed anteriorly
 - ❖ Flat anterior chamber
 - ❖ Corneal opacity
 - ❖ Older child that missed screening

Open Sky Vitrectomy

- ◆ Indications for Open Sky
 - ❖ ROP, PHPV, trauma, anterior PVR
- ◆ Eyes in which entering anteriorly would result in retinal dialysis
- ◆ Membrane too tough to cut with 20g instruments
- ◆ Retinal reattachment
 - ❖ 32% (Hirose and Schepens, 1981)
 - ❖ 35% (Tasman et al, 1987)
- ◆ Improved vision
 - ❖ 16% (Hirose and Schepens, 1981)

Post-op photo

Persistent Hyperplastic Primary Vitreous (PHPV)

Surgical Indications for PHPV

Surgical Management: Techniques

- ◆ Limbal entry anterior to iris
- ◆ Complete removal of lens and capsule
- ◆ Diathermy and transection of hyaloid artery
- ◆ Open-sky technique where the membrane is very dense

Coats Disease

- ◆ Young males (>75%)
- ◆ Occurs in the first 2 decades of life
- ◆ Mean age at diagnosis - 5 years (range 1month - 63 yrs)
- ◆ >95% of cases - unilateral
- ◆ No racial predilection

Clinical Features: Posterior Segment

- ◆ Vascular changes
 - ❖ Peripheral retinal telangiectasia -
 - » Capillary and small vessel dilatation and tortuosity
 - » Small aneurysms
 - ❖ Located bn equator and ora serrata
 - ❖ Inferotemporal location most common
 - ❖ Macula uncommonly involved

Differential Diagnosis

- Retinoblastoma
- Persistent fetal vasculature (PFV)
- Ocular toxocariasis
- Familial exudative vitreo-retinopathy (FEVR)
- Retinal capillary hemangiomatosis (VHL)

Case Presentation:

- Five year old healthy boy with blurred vision OD.
- NLP with Abnormal light reflex
- Born at term uncomplicated pregnancy
- No past medical or family history
- Left eye normal

◆ **Diagnosis??**

- ◆ Progressed to painful, inflamed eye with Neovascular glaucoma
- ◆ Enucleation
- ◆ Intraretinal mass extend from ora to ora
- ◆ Subretinal fluid
- ◆ Exudate within viable tumor mass
- ◆ Areas of necrosis with prominent vascularity
- ◆ No choroidal or optic nerve involvement

- ◆ Area of necrosis with prominent vascularity
- ◆ Vitreous seedings at the pars plana near ora serrata region

- ◆ NVI
- ◆ Prominent rubeosis iridis with ectropion uvea

- ◆ tumor mass arising from the retina
- ◆ Exudate within viable tumor mass
- ◆ Vitreous seeds

- ◆ Undifferentiated, diffuse Retinoblastoma
- ◆ Scanty cytoplasm
- ◆ Mitotic figures

Diffuse Infiltrating Retinoblastoma

- ◆ 1 to 2% retinoblastoma
- ◆ Vitreous/anterior segment seed (Pseudohypopyon)
- ◆ Older patient (presumed slow growing)
- ◆ Low incidence of calcification
- ◆ Retrolaminar optic nerve invasion is uncommon

Case Presentation -2

- ◆ 1 month old male, presents with leukocoria OD.
- ◆ Full term
- ◆ No family history, No medical problems

Case Presentation -2

- ◆ Diagnosis????

PHPV

Case 3

- ◆ HPI: 9 yo wm, failed school test.
- ◆ No previous complaints. No trauma, no pain.

◆ POH: NL

◆ FH: NL

Case 3

Case Presentation 4

◆ 7 year old Hispanic male, hit in eye with ball.

◆ VA: 20/20 OD / NLP OS

◆ T – 34 OS

◆ SLE: NVI, Shallow AC

◆ FMH - None

◆ PMH - WNL

B-Scan and FA

Case Presentation 4

◆ Placed on multiple glaucoma medications.

◆ Told to follow up next day.

◆ Two Months Later

◆ Painful OD

◆ VA – NLP

◆ T – 43

Case 5

◆ 8 yo - shadow in his eye

◆ B-scan - no calcium

◆ Ciliary Body Tumor

◆ Biopsy - Leiomyoma

Case Presentation 6

◆ 3 yo, red eyes for several months.

◆ Can't see well

Case Presentation 6

Munchausen By Proxy

◆ Fabrication of Disease for Attention

◆ Mother – Outwardly concerned, knowledgeable

◆ Mother is only witness

◆ Only gets "Sick" in her care

- ◆ Usually less than 2
- ◆ Cannot Verbalize

Symptoms of RP

Additional Care **Stargardt's**

Frequency of Stargardt's disease is approximately 1 in 60,000.

Onset of symptoms generally occurs in the first or second decade of life. Patients often complain of decrease in central visual acuity.

Early in the course of Stargardt's disease, the central macula demonstrates symmetric atrophic RPE changes. The changes often appear as "beaten bronze" accompanied by adjacent surrounding yellow-white pisciform "flecks."

Stargardt's Disease

- ◆ Most prevalent inherited macular dystrophies
 - » Accounts for 7% of all retinal dystrophies
 - » Defined by the characteristic flecks that accumulate at the level of the RPE
- ◆ Atrophic Macular Dystrophy with Flecks
- ◆ Fundus Flavimaculatus:
 - ❖ Flecks distributed throughout the fundus
 - ❖ Onset in adulthood
- ◆ Stargardt's Disease:
 - ❖ Flecks are confined mostly to the posterior pole
 - ❖ Presents earlier in life

Genetics

- ◆ Usually inherited as an autosomal recessive trait
- ◆ Affected families that are autosomal dominant have been described
- ◆ Autosomal recessive form
 - ❖ Mapped to short arm of chromosome 1
- ◆ Autosomal dominant form
 - ❖ Mapped to chromosome 13q

Fluorescein Anigography of Stargardt's

- ❖ Features:
 - » Silent Choroid
 - » Increased contrast of retinal vessels

Course and Outcome

- ◆ Tremendous variability occurs in course and outcome

- ◆ Visual acuity ranges from 20/50 to 20/400
 - ❖ Depends on degree of macular atrophy
- ◆ Many patients retain 20/70 to 20/100 vision in at least one eye
- ◆ No known treatment exists

State of the Art – Retinal Prostheses

Prototype Human Retinal Prosthesis

Retinal Prosthesis in use
2nd Generation Device - in trials
Simulated Artificial Vision

Cell Based Therapy: Two Approaches
Three Questions for Stem cell Treatment in GA:

Mesenchymal Stem Cells

CNTO 2476 Preserves Visual Function And Retinal Architecture

CNTO 2476: Phase 1 in Subjects with Advanced RP

Micro-catheter Delivery System

Surgical Site

Using the WTC

Ultrasound to Confirm Peripheral Bleb
Inclusion Criteria

- ❖ Confirmed diagnosis of bilateral GA: total GA area in each eye must be at least 2.6mm²
- ❖ GA must involve the fovea and central fixation
- ❖ BCVA no better than 20/200 in the treatment eye
- ❖ GA must not be contiguous with any areas of peripapillary atrophy

Initial Experience - No view

Surgery Video
Interim Results
Conclusions

- ◆ Pediatric Retina – Challenges

- ◆ Anatomic Differences
- ◆ Inability to remove all the vitreous
- ◆ Importance of retaining lens – prevention of amblyopia (lazy eye)
- ◆ Visual system under construction
- ◆ High stakes – many years of vision ahead
- ◆ Aggressive diseases with guarded prognosis – need for optimism!!

Thank You

Electrophysiology of Smooth Muscle: Excitation, Contraction



New Concepts in Pediatric Retina



Michael A. Samuel, MD

Blinding Diseases in Children

- ♦ Retinopathy of Prematurity
- ♦ Trauma
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Problems in Pediatrics: Post-operative

- ♦ Follow-up examinations are challenging
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Dealing with Family

- ♦ Establishing an early positive relationship with the parents is important
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Electrophysiology of Smooth Muscle: Excitation, Contraction



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- In-Utero Retina Avascular – 4 months
- Vessels Extend from Optic Disc to Periphery
- Nasal Retina – 36wks
- Temporal Retina – 40wks
- At Premature Birth the Vasculature Stops
- Terry & Kinsey – 1942
- Most Common Cause of Childhood Blindness
- 1950s – Relationship: Supplemental Oxygen
- Improved Neonatology > Resurgence of ROP
- Mechanisms of ROP: Controversial

ROP Classification

- ROP Begins: Junction of Avascular & Vascular Retina
- Stage I – Demarcation Line
- Stage II – Ridge
- Stage III – Fibrovascular Proliferation
- Stage IV – Retinal Detachment A&B
- Stage V – Total RD
- Zone I
- Zone II
- Zone III
- Plus Disease

ROP Classification

Stage 1 demarcation line

Avascular retina

Stage 2

plus disease

ROP Zones

Severe plus disease with stage 1 in zone 2

Timing of Treatment

Revised Indications for the Treatment of Retinopathy of Prematurity

Results of the Early Treatment for Retinopathy of Prematurity Randomized Trial

Early Treatment for Retinopathy of Prematurity Randomized Trial

- Type 1 ROP (High-risk Pre-threshold):
 - zone I; any stage w/plus
 - zone I, stage 3 w/o plus
 - zone II, stage 2 w/plus

Treat

Timing of Treatment

Revised Indications for the Treatment of Retinopathy of Prematurity

Results of the Early Treatment for Retinopathy of Prematurity Randomized Trial

Early Treatment for Retinopathy of Prematurity Randomized Trial

- Type 2 ROP:
 - zone I, stage 1 or 2 w/o plus
 - zone II, stage 2 w/o plus

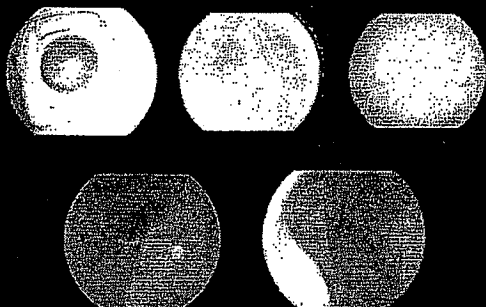
Watch & Wait

Treat if progression to Type 1 or threshold

Electrophysiology of Smooth Muscle: Excitation, Contraction



Case 1: Intolerance of Breaks



Surgical Options in ROP Detachment

- ♦ Lens-Sparing Vitrectomy
- ♦ Pars-Plicata 3-Port Vitrectomy - Lensectomy
- ♦ Scleral Buckle
- ♦ Scleral Buckle with Vitrectomy
- ♦ Open-Sky Vitrectomy



Lens-Sparing Vitrectomy

- ♦ Described by Maguire and Trese in '92
- ♦ Two-port iris-root approach with 20 gauge end-irrigating instruments
- ♦ Limited zone of free instrument movement bounded by lens and ridge
- ♦ Anatomic success around 90% for ideal 4A detachments
- ♦ Dry retinal detachment, lens relatively free of membranes
- ♦ Posterior disease, macular traction
- ♦ Fellow eye phakic



20 vs. 25-Gauge Vitrectomy

20-g Disadvantages

- ♦ Disproportionately Large
- ♦ Difficult to Insert
- ♦ Corneal Striae
- ♦ High Flow Rates at desired suction
- ♦ Transient Hypotony
- ♦ Chamber Collapse



25-g Advantages

- ♦ Smaller sclerotomies - 0.5 vs. 0.9 mm
- ♦ 6X - Lower flow at given suction
- ♦ Safer dissection between ridge and lens
- ♦ Better stability - high vacuum - maintaining globe
- ♦ Faster recovery - less traumatic
- ♦ Less flow - ↓ late cataract

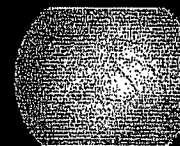
Lens Sparing Vitrectomy: Technical Pearls

- ♦ Enter 1 mm posterior to limbus
- ♦ Relief Traction: 4 Primary Vectors
 - ridge to nerve
 - ridge to lens & ciliary body
 - ridge to ridge
 - circumferential
- ♦ Anterior Hyaloidal Dissection
- ♦ Err on side of damaging lens



Recurrent question?

- ♦ Given advances in vitrectomy technique...
- ♦ Is there a role for scleral buckle in contemporary ROP surgery?
- ♦ Potential roles of Scleral Buckle:
 - Primary therapy, used alone
 - Combined with LSV
 - Re-operation after failed LSV



Electrophysiology of Smooth Muscle. Excitation, Contraction



Scleral Buckle

Advantages

- Technically simpler than LSV
- Low rate of complications
- Can temporize – allows later vitrectomy
- Does not induce proliferation
- Uniformly lens-sparing

Disadvantages

- Re-attachment rate 70% - LSV 90%
- Axial and Lenticular Myopia -11D
- Refractive Amblyopia
- Inadequate relief of all the traction vectors
- High incidence of macular folds, ectopia
- Anterior segment crowding
- May need second procedure to divide

Preferred technique

- Encircle or segmental radial if pathology isolated
- 240 or 41 band placed at level of ridge
- Imbrication 1.5 to 2 mm using h. mattress – minimize myopia
- 4-0 Vicryl clove hitch (no migration when examined years later) – avoid second procedure
- External drainage posterior to buckle
- Additional laser or cryotherapy to untreated retina



Scleral Buckle:

- Which cases are not appropriate for SB?

Zone 1 detachment

Dry well ablated detachment where ridge well away from lens and traction vectors well visualized

Lack of familiarity with LSV is not an appropriate indication for SB



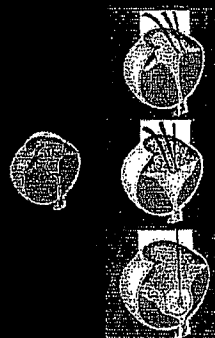
Treatment Options in ROP

- Pre-detachment - Laser
- Detachment Stage IV A or B -
 - Late-Sparing Vitrectomy
 - Pre-Flap, 240°
 - Vitrectomy - Endoscopy
 - Scleral Buckle
 - Scleral Buckle 340°
 - 240°
- Detachment Stage V
 - Vitrectomy
 - Endoscopy
 - Pre-Flap, Vitrectomy



Open Sky Vitrectomy

- 1980: Schepens (GRT with rolled flap)
 - Discouraged by failure (PVR and retinocorneal membrane)
- 1970s: Hirose and Schepens (297 cases)
- Lost art
- Procedure of choice in a minority of cases
 - Funnel closed anteriorly
 - Flat anterior chamber
 - Corneal opacity
- Older child that missed screening



Open Sky Vitrectomy

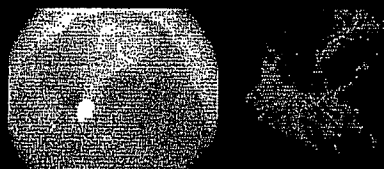
- Indications for Open Sky
 - Ret. PVR, trams, atretic PVR
- Eyes in which entering anteriorly would result in retinal dialysis
- Membrane too tough to cut with 20g instruments
- Retinal reattachment
 - 32% (Hirose and Schepens, 1981)
 - 35% (Tasman et al 1987)
- Improved vision
 - 16% (Hirose and Schepens, 1981)





Electrophysiology of Smooth Muscle. Excitation, Contraction

Post-op photo



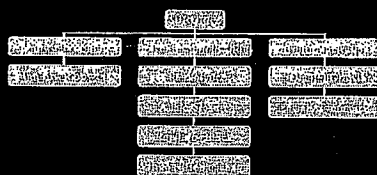
- ◊ Never doubt the mind's ability to see.
- ◊ Any retinal attachment can be useful

Persistent Hyperplastic Primary Vitreous (PHPV)

- ◊ Failure of the fetal lenticular vascular system to regress
- ◊ Features
 - Small eye
 - Cataract
 - Retrolental mass of fibrovascular tissue
 - Unilateral 90%
 - Full term
 - 3 Forms
- ◊ Intralenticular blood vessels
- ◊ Elongated Ciliary Processes
- ◊ Spectrum of clinical severity varies widely



Surgical Indications for PHPV



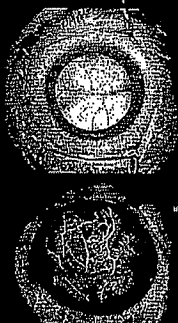
Surgical Management: Techniques

- ◊ Limbal entry anterior to iris
- ◊ Complete removal of lens and capsule
- ◊ Diathermy and transection of hyaloid artery
- ◊ Open-sky technique where the membrane is very dense



Coats Disease

- ◊ Young males (>75%)
- ◊ Occurs in the first 2 decades of life
- ◊ Mean age at diagnosis - 5 years (range 1 month - 63 yrs)
- ◊ >95% of cases - unilateral
- ◊ No racial predilection



Clinical Features: Posterior Segment

- ◊ Vascular changes
 - Peripheral retinal telangiectasia -
 - » Capillary and small vessel dilatation and tortuosity
 - » Small aneurysms
 - Located in equator and ora serrata
 - Inferotemporal location most common
 - Macula uncommonly involved

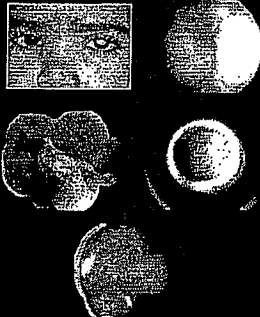


Electrophysiology of Smooth Muscle: Excitation, Contraction



Differential Diagnosis

- Retinoblastoma
- Persistent fetal vasculature (PFV)
- Ocular toxocariasis
- Familial exudative vitreoretinopathy (FEVR)
- Retinal capillary hemangiomas (VHL)



Case Presentation:

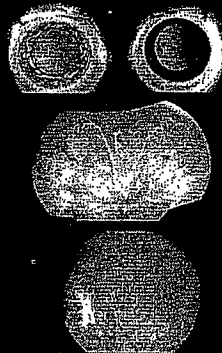
- Five year old healthy boy with blurred vision OD.
- NLP with Abnormal light reflex
- Born at term uncomplicated pregnancy
- No past medical or family history
- Left eye normal



Case Presentation

♦ Diagnosis??

- ♦ Progressed to painful, inflamed eye with Neovascular glaucoma
- ♦ Enucleation



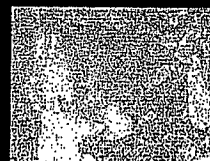
- ♦ Intraretinal mass extend from ora to ora
- ♦ Subretinal fluid
- ♦ Exudate within viable tumor mass
- ♦ Areas of necrosis with prominent vascularity
- ♦ No choroidal or optic nerve involvement



- ♦ Area of necrosis with prominent vascularity
- ♦ Vitreous seedings at the pars plana near ora serrata region



- ♦ NVI
- ♦ Prominent rubeosis iridis with ectropion uvea



- ♦ tumor mass arising from the retina
- ♦ Exudate within viable tumor mass
- ♦ Vitreous seeds



- ♦ Undifferentiated, diffuse Retinoblastoma
- ♦ Scanty cytoplasm
- ♦ Mitotic figures

Electrophysiology of Smooth Muscle: Excitation, Contraction



Diffuse Infiltrating Retinoblastoma

- ♦ 1 to 2% retinoblastoma
- ♦ Vitreous/anterior segment seed (Pseudohypopyon)
- ♦ Older patient (presumed slow growing)
- ♦ Low incidence of calcification
- ♦ Retrolaminar optic nerve invasion is uncommon



Case Presentation -2

- ♦ 1 month old male, presents with leukocoria OD.
- ♦ Full term
- ♦ No family history, No medical problems



Case Presentation -2

- ♦ Diagnosis????

PHPV

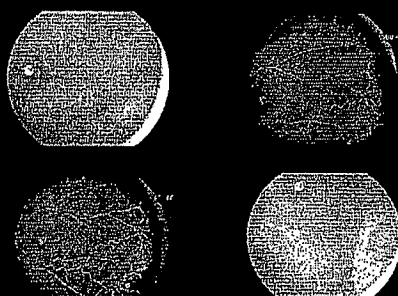


Case 3

- ♦ HPI: 9 yo wm, failed school test.
- ♦ No previous complaints. No trauma, no pain.
- ♦ POH: NL
- ♦ FH: NL



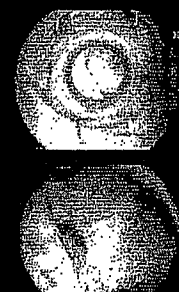
Case 3



Coats Disease

Case Presentation 4

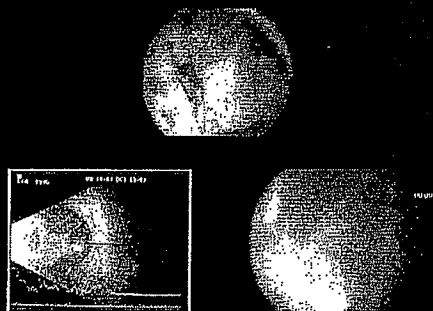
- ♦ 7 year old Hispanic male, hit in eye with ball.
- ♦ VA: 20/20 OD / NLP OS
- ♦ T - 34 OS
- ♦ SLE: NVI, Shallow AC
- ♦ FMH - None
- ♦ PMH - WNL



Electrophysiology of Smooth Muscle: Excitation, Contraction

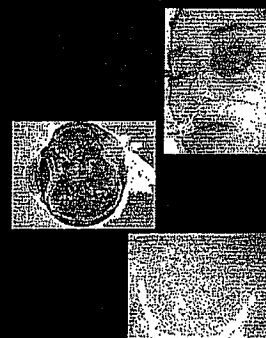


B-Scan and FA



Case Presentation 4

- Placed on multiple glaucoma medications.
- Told to follow up next day.
- Two Months Later
- Painful OD
- VA - NLP
- T - 43



Case 5

- 8 yo - shadow in his eye
- B-scan - no calcium
- Ciliary Body Tumor
- Biopsy - Leiomyoma

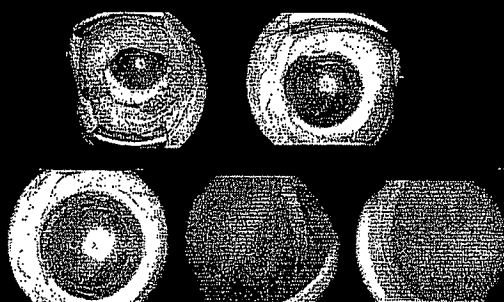


Case Presentation 6

- 3 yo, red eyes for several months.
- Can't see well



Case Presentation 6



Munchausen By Proxy

- Fabrication of Disease for Attention
- Mother - Outwardly concerned, knowledgeable
- Mother is only witness
- Only gets "Sick" in her care
- Usually less than 2
- Cannot Verbalize









Symptoms of RP

- In adolescence, patients typically develop night blindness and difficulty with the mid-peripheral visual field
- Loss of blue vision and far peripheral field
- Then loss of central vision

Progression of retinitis pigmentosa

- | | |
|--|--|
|  |  |
| <ul style="list-style-type: none"> • Fine dust-like pigmentation • Arteriolar attenuation | <ul style="list-style-type: none"> • Perivascular "honey-suckle" pigmentation • Initially mid-peripheral |
|  |  |
| <ul style="list-style-type: none"> • Anterior and peripheral spread • Unmasking of large choroidal vessels | <ul style="list-style-type: none"> • Optic disc pallor • Maculopathy |

[illegible]

- Patients should continue to follow up with an eye care provider
- Visual field exams can help determine the rate of progression and help patients plan for future disability
- Substantial refractive errors are often present
- Low vision aids may allow patients to work longer than otherwise possible
- Tinted lenses for some patients may provide better contrast enhancement

Electrophysiology of Smooth Muscle: Excitation, Contraction



Stargardt's

Frequency of Stargardt's disease is approximately 1 in 60,000.

Onset of symptoms generally occurs in the first or second decade of life. Patients often complain of decrease in central visual acuity.

Early in the course of Stargardt's disease, the central macula demonstrates symmetric atrophic RPE changes. The changes often appear as "beaten bronze" accompanied by adjacent surrounding yellow-white pisciform "flecks."



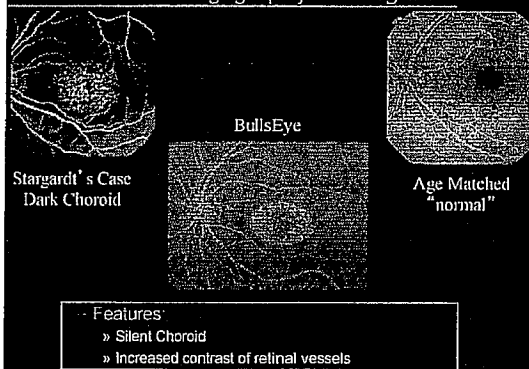
Stargardt's Disease

- ♦ Most prevalent inherited macular dystrophies
 - » Accounts for 7% of all retinal dystrophies
 - » Defined by the characteristic flecks that accumulate at the level of the RPE
- ♦ Atrophic Macular Dystrophy with Flecks
- ♦ Fundus Flavimaculatus:
 - Flecks distributed throughout the fundus
 - Onset in adulthood
- ♦ Stargardt's Disease:
 - Flecks are confined mostly to the posterior pole
 - Presents earlier in life

Genetics

- ♦ Usually inherited as an autosomal recessive trait
- ♦ Affected families that are autosomal dominant have been described
- ♦ Autosomal recessive form
 - Mapped to short arm of chromosome 1
- ♦ Autosomal dominant form
 - Mapped to chromosome 13q

Fluorescein Angiography of Stargardt's



Course and Outcome

- ♦ Tremendous variability occurs in course and outcome
- ♦ Visual acuity ranges from 20/50 to 20/400
 - Depends on degree of macular atrophy
- ♦ Many patients retain 20/70 to 20/100 vision in at least one eye
- ♦ No known treatment exists

State of the Art - Retinal Prostheses

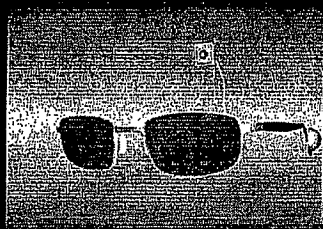
- Epiretinal and Subretinal at Investigational Device Exemption Stage
- Epiretinal - encouraging results, but better technology required
- Subretinal - No direct evidence demonstrating functional electrical stimulation, but patients report subjective improvements in vision



Electrophysiology of Smooth Muscle. Excitation, Contraction



Prototype Human Retinal Prosthesis



Implanted Feb. 2002

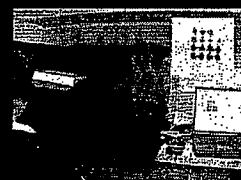


Implanted August 2002



Implanted March 2003

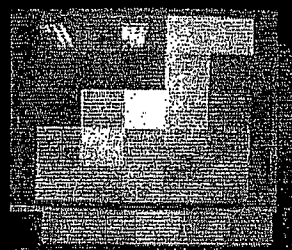
Retinal Prosthesis in use



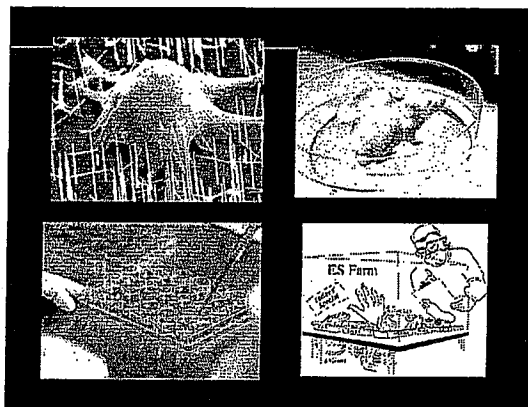
2nd Generation Device - in trials



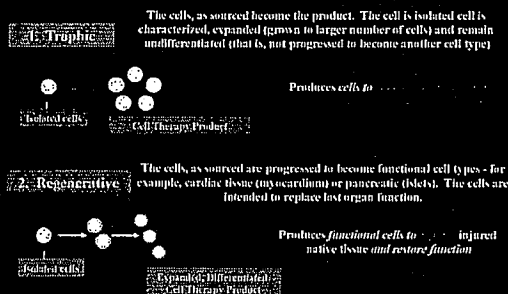
Simulated Artificial Vision



Electrophysiology of Smooth Muscle. Excitation, Contraction



Cell Based Therapy: Two Approaches



Three Questions for Stem cell Treatment in GA:

1. How do you determine efficacy?
2. How do you place the cells in the target area?
3. Which cells do you use?



Mesenchymal Stem Cells



- Criteria:
- Avoid Embryonic Stem Cell Controversy
 - Robust Biologic Activity
 - Low immunogenicity

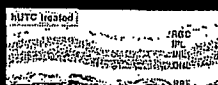
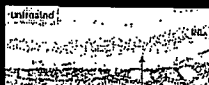
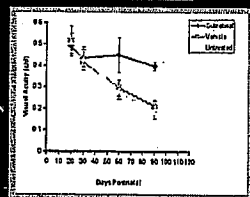
Raw Material

Live mesenchymal stem cells, known for their star-like shape are isolated from amniotic fluid. These valuable fetal cells can not create all tissues in the body, as can embryonic stem cells, but they are able to create many tissues needed for surgery, without the ethical controversy associated with embryonic stem cells

CNT0 2476 Preserves Visual Function And Retinal Architecture

Royal College of Surgeons (RCS) Rat Model

Single injection of 20K CNT0 2476 preserves visual function and retinal architecture



CNT0 2476, Phase I in Subjects with Advanced RP

- Open-label study in subjects with advanced Retinitis Pigmentosa
- Objectives: safety, immunogenicity and changes in retinal structure and visual function
- Seven subjects enrolled, treated with 47,000 to 476,000 cells
- Results
 - * Of 7 subjects, 2 had fractional retinal detachments requiring surgical intervention
 - * There was no evidence for immunogenicity
 - * 2 subjects had evidence for potential improvement



Electrophysiology of Smooth Muscle. Excitation, Contraction



Micro-catheter Delivery System

A comprehensive evaluation study of variables and alternative delivery methods resulted in the development of a microcatheter delivery method

Used extensively in pre-clinical studies to develop this delivery technology

Surgical Site

WTC: Touch down between vessels.
Maintain Healon flow
Light pressure on surface

Using the WTC

Wire extends ~50um beyond poly tube

Healon flow creates peripheral bleb

Ultrasound to Confirm Peripheral Bleb

Inclusion Criteria

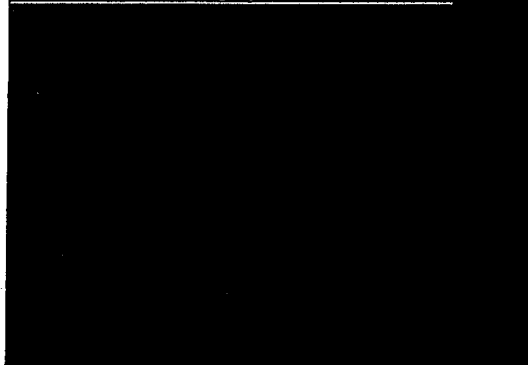
- Confirmed diagnosis of bilateral SA. Total SA area in each eye must be at least 2.5mm²
- SA must involve the lower and central fraction
- BCVA no better than 20/200 in the treatment eye
- SA must not be contraindicated with any areas of pupillary atrophy

Initial Experience - No view

Electrophysiology of Smooth Muscle. Excitation, Contraction



Surgery Video



Interim Results

- Phase 1 enrollment complete
 - 13 patients enrolled; 12 patients treated
- Safety – SAEs
- Surgical Procedure
 - Refractions
 - Visualization
 - When/Where to inject cells
- Clinical Response
 - 3 line loss of vision
 - 3 line gain of vision
 - 6 line gain of vision

Conclusions

- ♦ Pediatric Retina – Challenges
- ♦ Anatomic Differences
- ♦ Inability to remove all the vitreous
- ♦ Importance of retaining lens – prevention of amblyopia (lazy eye)
- ♦ Visual system under construction
- ♦ High stakes – many years of vision ahead
- ♦ Aggressive diseases with guarded prognosis – need for optimism!!

Mike Samuel, MD
Chief Medical Director

Dr. Samuel is a nationally renowned clinician, surgeon and researcher. He received his MD from Meharry Medical College and his ophthalmology residency training from the Henry Ford Hospital. He was awarded and completed the first fellowship in pediatric retinal surgery at the prestigious Children's Hospital of Los Angeles. Dr. Samuel completed a second fellowship in vitreoretinal surgery fellowship at the Doheny Retina Institute, University of Southern California.



Upon completion of his two fellowships, Dr. Samuel accepted an academic position at Wills Eye Institute in Philadelphia, an internationally recognized eye hospital. He was a member of the Retina Service and an Assistant Professor of Ophthalmology for three years. Here, Dr. Samuel trained numerous residents and retina fellows in surgical and medical retinal diseases in one of the largest and most highly regarded programs in the nation.

Along with Dr. Chang, Dr. Samuel was part of the team that performed the world's first surgical implantation of stem cell treatment for dry macular degeneration, which was in collaboration with the Johnson & Johnson Stem Cell organization.

Dr. Samuel has published over 25 peer-reviewed research articles, a number of book chapters for medical text, and is a section editor for the *Retina Times Magazine*, a publication of the American Society of Retinal Specialists. He has also authored the leading book, *Macular Degeneration: A Complete Guide for Patients and Their Families*.

Dr. Samuel specializes in the diagnosis and treatment of various retinal diseases, including diabetic retinopathy, age-related macular degeneration, macular hole, epiretinal membrane, and retinal vascular diseases. He is certified by the American Board of Ophthalmology and is a member of the American Academy of Ophthalmology, American Medical Association, and the American Society of Retinal Specialists.

He is consistently named as one of the "Best Doctors in the USA" and has won numerous surgical teaching awards. He also serves as the chairman of the executive committee of the Retina Institute of California as well as the Chief Scientific Officer of the California Center for Clinical Research.

800-898-2020



Biography

Mike Samuel, MD

800-898-2020

msamuel@retina2020.com

Cell: 626-319-6464

EDUCATION

- 1995 Bachelor of Arts, Capital University, Columbus, OH
1999 Medical degree, Meharry Medical College, Nashville, TN

PROFESSIONAL TRAINING

- 1999-2000 Transitional Year, Mount Carmel Medical Center, Columbus, OH
2000-03 Resident, Ophthalmology, Henry Ford Health System, Detroit, MI
2003-04 Pediatric Vitreoretinal Surgery & Ocular Oncology, Children's Hospital Los Angeles, University of Southern California
2004-05 Vitreoretinal Surgery at Doheny Retina Institute/University of Southern California


BOARD CERTIFICATION

- 2004 American Board of Ophthalmology

PROFESSIONAL AFFILIATIONS

- > Retina Institute of California
- > American Academy of Ophthalmology
- > American Society of Retinal Specialists
- > The Association for Research in Vision and Ophthalmology
- > University & Hospital Positions
- > Nationwide Children's Hospital, Columbus, OH
- > Attending Retina Service, Wills Eye Hospital, Philadelphia, PA
- > Assistant Professor of Ophthalmology, Thomas Jefferson University, Philadelphia, PA
- > Clinical Affiliate, Children's Hospital of Philadelphia, Philadelphia, PA
- > Central Montgomery Medical Center, Lansdale, PA
- > Montgomery Hospital, Norristown, PA

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee P114:51

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Retinal Emergencies</u>	Course Presentation Date <div style="border: 1px solid black; display: inline-block; padding: 2px;">10/02/2016</div>
---	--

Course Provider Contact Information

Provider Name <div style="display: flex; justify-content: space-between;"> <u>Christina</u> (First) <u>Seyri</u> (Last) _____ (Middle) </div>	
Provider Mailing Address Street <u>100 E. California Blvd</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <div style="display: flex; justify-content: space-between;"> <u>Michael</u> (First) <u>DAVIS</u> (Last) _____ (Middle) </div>	
License Number <u>A111866</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>mdavis@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Retinal Emergencies

Discussed genetic testing and eye vitamins for macular degeneration. Certain patients with specific genetic markers progress with the use of vitamins containing zinc. Therefore in these patients it is recommended to use an AREDS formulation without Zinc.

Michael Davis, MD.

Retinal Emergencies

- Floaters / Posterior Vitreous Detachment
- Retinal Tears
- Retinal Detachment
- Submacular Hemorrhage
- Vitreous Hemorrhage
- Endophthalmitis
- Vascular Occlusions
- Retained Lens
- Dislocated IOL
- Trauma
- Floaters / PVD
- What to do???
- Dilated fundus exam of both eyes with scleral depression
- Acute PVD
- Assume there is a RT
 - RT in 8-10% of acute symptomatic PVDs
- If no RT, re-evaluate in 2-4 weeks after initial symptoms
- If there is a definite or possible RT, refer to Retina Specialist
 - Timely referral: 1-2 days
- PVD – Reasons for Referral
- Retinal break
- Pigment in the anterior vitreous (“tobacco dust”; Shafer’s sign)
 - 70-80% RT risk
- Vitreous, retinal or pre-retinal hemorrhage
- Lattice degeneration
- Operculum (free or attached)
- Retinal detachment
- If no RT/RD at time of initial exam for acute symptomatic PVD...
- a warning describing RD symptoms must be given
- schedule a follow-up exam in 2 to 4 weeks
- Patients should not be dismissed from care until full separation of the vitreous has occurred (which can be as long as several months).
- RD may occur from an incompletely separated PVD even though no RT is found at the time of examination.

The 2 months following the onset of symptoms is the most likely period for a detachment to occur.

- Vitreous hemorrhage

- (VH)
- VH Etiologies
- PDR (31-54%)
- RT (11-44%)
- BRVO/CRVO (4-16%)
- Other causes of retinal neovascularization
- PVD
- Trauma
 - most common cause in young adults
- Pars planitis and congenital retinoschisis
 - children
- Wet AMD breakthrough VH (4%)
 - elderly
- VH
- DDx: vitritis, RD
- Blood itself is not toxic in vitreous cavity
- On DFE...
 - Is the retina attached?
 - Is there a RT?
- If trauma: r/o ruptured globe
- If PDR suspected...
 - Is there NVI? Is there NVA on gonioscopy? Elevated IOP with NVI/NVA – suspect NVG – needs urgent treatment (intravitreal avastin + PRP or PPV if no view)
- If no view, need B-Scan ultrasound
- endophthalmitis
- Endophthalmitis
- Intraocular inflammatory disorder resulting from infection of the vitreous cavity
- Hallmark is progressive vitritis
- Histologically
 - Massive infiltration of the vitreous cavity with inflammatory cells
- Types of Endophthalmitis
- Exogenous
 - Acute Postoperative
 - Chronic Postoperative
 - Filtering Bleb-Associated
 - After Intravitreal Injections
 - Traumatic
- Endogenous
 - Septicemia
- Acute Postoperative Endophthalmitis
- Most common form of infectious endophthalmitis
- Present within 1-2 weeks after surgery
- Rapidly progressive
- Acute Postoperative Endophthalmitis
- Symptoms

- Pain
- Red eye
- Ocular discharge
- Decreased VA
- Lid swelling
- Conjunctival and corneal edema
- Anterior chamber cells
- Hypopyon
- Vitritis
- Retinitis
- Evaluation
- Suspect in any eye with inflammation greater than the usual postoperative course
- Associations:
 - Wound leak or dehiscence
 - Suture abscess
 - Vitreous incarceration in the wound
 - Eroding scleral sutures used to fixate IOLs
- Microbiological Characteristics
- Bacteria are the most common infecting agents
 - Periocular flora
 - Introduced during surgery
 - GP organisms are most common
 - Staph epi
- Endophthalmitis Vitrectomy Study
- Determined the management of patients who presented with post-op endophthalmitis
 - LP vision
 - PPV
 - HM or better vision
 - Tap and Inject
 - Vancomycin and ceftazidime
- Chronic Postoperative Endophthalmitis (> 6 weeks)
- Manifests several weeks or months after surgery
- Less common than acute variety
- Organisms are less virulent
 - 63% P acnes
 - 16% S epidermidis
 - 16% Candida parapsilosis
- Chronic Postoperative Endophthalmitis
- Pain or discomfort may not be present
- Inflammation can be initially steroid responsive but recurrent after steroid taper
 - Fungal infections paradoxical worsening with steroids
- Hypopyon is often absent
- Granulomatous uveitis with large precipitates on cornea or IOL

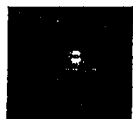
- White intracapsular plaque with P acnes
- Stringy white infiltrates and “fluff balls” or “pearls-on-a-string” near the capsular remnant are characteristic but not pathognomonic for fungal
- Chronic Postoperative Endophthalmitis
- Treatment for Chronic Cases
- Obtain A/C and vitreous samples
 - Identification of infectious organism is key in management of these infections
- Intravitreal antibiotics
- Treatment of P. acnes infection often requires PPV and removal of capsular bag
- Post-Trabeculectomy Endophthalmitis
- Filtering Bleb-Associated Endophthalmitis
- Pathogenic organisms gaining entry to intraocular tissue through the conjunctival filtering bleb
- Average time is 19 months after surgery
 - Range 3-9 years
- 0.2 – 9.6% of glaucoma filtering procedures
- Increased incidence with use of antifibrotic agents
 - Thin, cystic, avascular conjunctiva
- Blebitis – if no uveitis or vitritis
- Treatment
- Blebitis
 - Systemic and topical antibiotics
 - Frequent exams of vitreous
- Endophthalmitis
 - Tap and Inject
 - Possible benefits from PPV
 - EVS findings are not directly attributable
- Endophthalmitis after Intravitreal Injection
- Coagulase-negative staphylococci is the most common cause
- No infectious agent is identified in many cases
- Triamcinolone acetate crystals can migrate into A/C and mimic hypopyon
- 1.4%/injection for IVK
- 0.2%/injection for ranibizumab
- Traumatic Endophthalmitis
- Traumatic Endophthalmitis
- Approximately 25% of endophthalmitis cases
- 7% chance of developing endophthalmitis after an open globe
- Risk factors include:
 - IOFB
 - Dirty wounds
 - Delayed time to presentation
 - Rupture of lens capsule
 - Age > 50
- Traumatic Endophthalmitis
- Bacillus and Staphylococcus are common in penetrating trauma with IOFB

- Primary repair and removal of IOFB as soon as possible
- Exclude the possibility of occult, retained IOFB
 - CT scan with thin 1mm cuts
- Obtain cultures
- Intravitreal Vanco and Ceftaz
 - Some advocate Gent + Clinda for synergistic effect against Bacillus and Staph
- Some advocate early PPV
- Bacillus Endophthalmitis
- Traumatic Endophthalmitis
- Endogenous Endophthalmitis
- Endogenous Endophthalmitis
- Originates from sources within the body
- 2-8% of endophthalmitis cases
- Patients usually have underlying disease or are immunosuppressed
 - Indwelling catheters
 - Chemotherapy
- Management of Endogenous Endophthalmitis
- Vitreous sample should be obtained in all cases
- ID of causative organism is made by systemic culture of blood, urine or CSF in 75-80% of cases
- In contrast to postoperative endophthalmitis, systemic antibiotics are central to the treatment of endogenous endophthalmitis
- Focal chorioretinitis and associated mild vitritis can respond to systemic therapy alone
- Serial dilated fundus exams
- Vascular Occlusions
- Arterial obstruction
- Ophthalmic artery
- Cilioretinal artery
- CRAO
- BRAO
- Ocular ischemic syndrome
- CWS
- Emboli
- Seen in about 20% of cases of CRAO
- Cholesterol (Hollenhorst plaque)
 - Most common
 - Carotid disease
 - Refractile
- Fibrin/platelet
 - Coagulopathies
 - Carotid disease
 - Dull/gray white
- Calcium
 - Cardiac disease

- Chalky white
- Etiology/Work-up
- GCA
 - STAT ESR, CRP, CBC
 - Temporal artery biopsy within 1 to 2 weeks
 - Steroids
- Embolic
 - ocular massage, AC paracentesis, IOP lowering gtts
 - Carotid doppler, cardiac echo
- Systemic work-up
 - BP, BMP, CBC, coagulation panel
- Vein Occlusions
- CRVO
- HRVO
- BRVO
- Timely referral
- check BP
- check IOP
- rarely an emergency
- Avastin injections
- Trauma
- Hyphema
- Ruptured globe
- Choroidal rupture
- Intraocular foreign body
- Retrobulbar hemorrhage
- Hyphema
- Management
- Rule-out open globe
- Gentle exam
- Bscan to rule-out retained IOFB
- Sick cell screen if African-American
 - No Diamox
 - More aggressive IOP and inflammation control
- PF, IOP control, dilation
- AC washout if nonresolving
- Ruptured Globe
- Signs/Symptoms
- Severe/bullous conjunctival hemorrhage
- Shallow AC
- Hyphema
- Limitation of EOMs
- Dislocated/subluxed lens
- Low IOP
- Irregular pupil
- Iridodialysis/cyclodialysis

- Periorbital ecchymosis
- Commotio retinae
- Choroidal rupture
- Retinal breaks
- VH
- Traumatic optic neuropathy
- Intraocular Foreign Body
- Management
- type of FB?
 - severe rxn: iron, steel, copper, vegetable matter
 - mild rxn: nickel, aluminum, mercury, zinc
 - inert: carbon, glass, rubber, lead, stone, ...
- perforation?
- CT Brain and Orbits
 - Avoid MRI and Bscan if metallic FB is suspected
- Culture
- Shield
- Tetanus
- NPO
- Antibiotics
- Retrobulbar Hemorrhage
- Management
- Lateral canthotomy and cantholysis
- Diamox
- IOP lowering drops
- mannitol (hyperosmotic agent)

Retinal Emergencies



Examination of the Eye

Disclosures

- We have no financial interest in any topics discussed in this lecture

Examination of the Eye

Outline

- Floaters / PVD / Retinal Tears
- Retinal Detachment
- Submacular Hemorrhage
- Vitreous Hemorrhage
- Endophthalmitis
- Vascular Occlusions
- Retained Lens
- Dislocated IOL
- Trauma
- Herpetic Necrotizing Retinitis

Examination of the Eye

Floaters / Posterior Vitreous Detachment

- Failure to diagnose retinal detachment is the second most common cause of large liability claims involving optometrists
- Missed diagnosis of glaucoma is #1 liability claims



Examination of the Eye

Dilated Exam with Scleral Depression

- If a patient presents with symptoms indicative of retinal detachment, a dilated fundus examination must be performed with scleral depression



Examination of the Eye

PVD

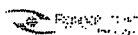
- Assume there is a tear
 - 8-10% of acute symptomatic PVDs have a retinal tear
- If no tear, re-evaluate in 2-4 weeks after symptoms initially started
- Must do scleral depressed exam
- If there is a tear, or not sure, refer to Retina Specialist as if there is a tear
- Timely referral: 1-2 days



Examination of the Eye

PVD – Reasons for Referral

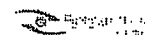
- Retinal Break
- Pigment in the anterior vitreous (tobacco dust)
- Vitreous, retinal or pre-retinal hemorrhage
- Lattice degeneration
- Operculum (free or attached)
- Retinal detachment



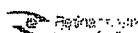
Tobacco Dust (Shaffer's Sign)



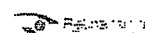
70-80% risk of retinal tear
Retina referral necessary



Hemorrhagic PVD or VH = High Risk of Retinal Tear



For purposes of litigation, the most important type of detachment is acute onset, symptomatic posterior vitreous detachment



Retinal detachment may occur (from an incompletely separated PVD) even though no tear is found at the time of examination; the 2 months following the onset of symptoms is the most likely period for a detachment to occur

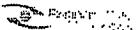


If a patient with acute onset, symptomatic PVD does not have a tear or detachment at the time of examination, a warning describing the symptoms of detachment must be given and the patient scheduled for a follow-up examination in 2 to 4 weeks. Patients should not be dismissed from care until full separation of the vitreous has occurred (which can be as long as several months)



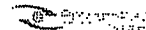
Medico-legal Case Example

- A military retiree in his 60s was examined by the base OD because of the acute onset of "spots" in one eye. A dilated fundus exam with BIO revealed PVD. Seven weeks after the exam while climbing a ladder the man experienced a bright flash in the eye. He called and made an appointment, but for 6 days later. Retinal detachment involving the macula was found.
- A lawsuit was filed, alleging negligence and breach of informed consent, with the patient averring he had not been warned of the symptoms of detachment. At the trial, the doctor's records were the key: he had written "PVD. Reassure. RTC PRN"



Documentation

- All warnings should be noted in the patient record or documented through the use of a signed form
- Handwritten entries do not need to be lengthy, but must:
 - describe the risk ("warned patient of the signs and symptoms of retinal detachment")
 - what to do if the risk occurs ("patient to RTC immediately for DFE if S & S occur"), and
 - the consent obtained ("patient understood and agreed")

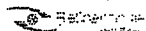


RETINAL TEARS

Retinal Tear

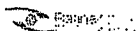


- Incidence of retinal breaks is 6–11% in adult eyes at autopsy
- 1.8% of patients develop a retinal tear that was not visualized on initial examination but was noted with follow-up.
- Features associated with delayed-onset diagnosis or development of retinal break associated with PVD include vitreous hemorrhage at initial examination, hemorrhage in the peripheral retina at initial examination, or new symptoms.
- Annual incidence of retinal detachment is 12 per 100,000 per year.

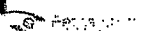


Retinal Tears – Clinical Pearls

- Most common location is superotemporal
- Look extensively for tear in symptomatic patients with following risk factors:
 - High Myopia (>6D)
 - Increased age
 - Lattice degeneration
 - Hemorrhagic PVD
 - History of intraocular surgery, including cataract surgery (esp. 6 mo after), YAG laser
 - Trauma (look for retinal dialysis)
 - History of retina break or RRD in the fellow eye
 - Family history
 - Stickler syndrome



Retinal Tears



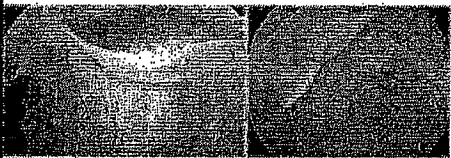
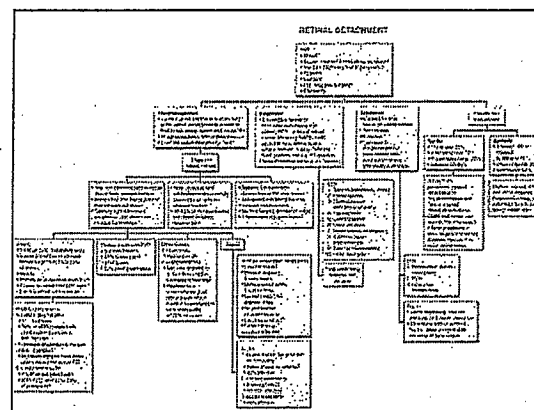
Type of Lesion	Treatment*
Acute symptomatic horseshoe tears	Treat promptly ^{1,2,3,4,5,6,11}
Acute symptomatic operculated tears	Treatment may not be necessary ^{2,3}
Traumatic retinal breaks	Usually treated ^{4,7,9}
Asymptomatic horseshoe tears	Usually can be followed without treatment ^{2,4,11}
Asymptomatic operculated tears	Treatment is rarely recommended ^{2,7,9}
Asymptomatic atrophic round holes	Treatment is rarely recommended ^{2,4,11}
Asymptomatic lattice degeneration without holes	Not treated unless PVD causes a horseshoe tear ^{4,11}
Asymptomatic lattice degeneration with holes	Usually does not require treatment ^{2,7,9}
Asymptomatic dialysis	No consensus on treatment and insufficient evidence to guide management
Eyes with atrophic holes, lattice degeneration, or asymptomatic horseshoe tears where the fellow eye has had a retinal detachment	No consensus on treatment and insufficient evidence to guide management

PVD = posterior vitreous detachment

*There is insufficient evidence to recommend prophylaxis of asymptomatic retinal lesions for patients undergoing cataract surgery


RETINAL DETACHMENT

Failure to diagnose retinal detachment is the second most common cause of large liability claims involving optometrists

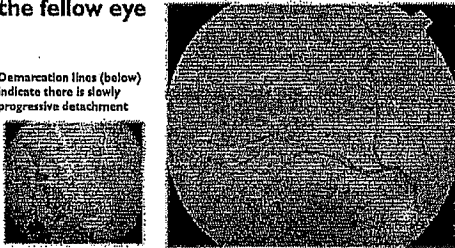
Retinal Detachment

- 40-50% of all patients with detachments have myopia
- 30-40% have undergone cataract removal
- 10-20% have encountered direct ocular trauma
 - Traumatic detachments are more common in young persons, and myopic detachment occurs most commonly in persons aged 25-45 years

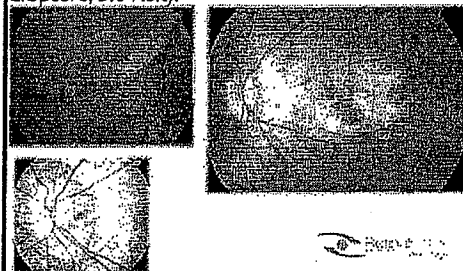


History of previous detachment—if the detachment is from a non-traumatic cause, there may be a significant risk of detachment in the fellow eye

Demarcation lines (below) indicate there is slowly progressive detachment



High myopia—the thin, stretched retina of high myopic eyes is at risk for tears (greater than 5 diopters 2% risk, greater than 10 diopters, 5% risk).



Pseudophakia—cataract surgery results in detachment in up to 2% of cases, depending on the technique used.

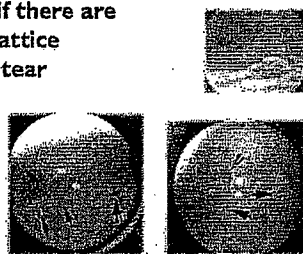
The 6 months following surgery is when the eye is most at risk.



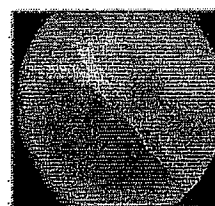
YAG capsulotomy also creates up to a 3% risk of detachment.



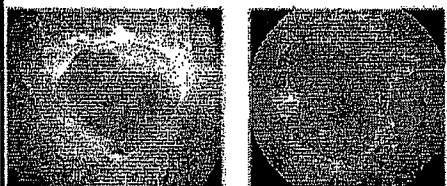
Lattice degeneration—is thinning of the retina with liquified vitreous above the retina and adhesion to the retina at the lattice margins, which can result in detachment if there are holes at the lattice margins or a tear caused by posterior vitreous detachment.



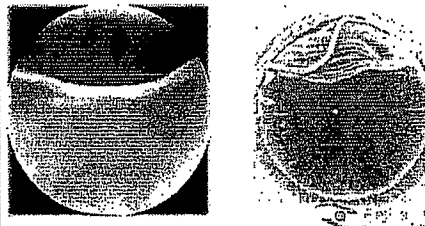
Open-angle glaucoma treated with strong miotics—high drug concentrations (6% pilocarpine) may cause intense miosis that leads to retinal stretching in high myopic eyes and a resultant tear.



Proliferative retinopathy—diabetes, vein occlusion, sickle cell, and other conditions cause neovascularization, which results in bleeding, fibrosis, and ultimately a tractional retinal detachment (TRD).



Blunt trauma—the most common detachment is retinal dialysis, which occurs at the ora serrata and is slowly progressive, taking an average of 4 months to involve the macula.

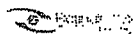


Referrals for Retinal Detachment

- Location, Location, Location
- Macula-on vs. Macula-off
- Superior vs. Inferior vs. Nasal/Temporal

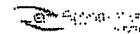


- Mac-on superior RD
- Perhaps one of the only true retinal emergencies
- Same day referral

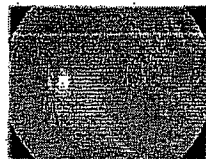


Retinal Detachment (RD) Surgery Timing

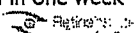
- "Timing of Acute Macula-on Rhegmatogenous Retinal Detachment Repair" – Ehrlich et al. (Retina January 2013 - Volume 33 - Issue 1 - p 105-110)
- This retrospective review included 114 patients presenting with acute, macula-on rhegmatogenous retinal detachment and treated with small-gauge vitrectomy. Among them, 62 had surgery on the day of presentation; 46, the day after and in six surgery was delayed from two to five days. Retinal reattachment was achieved in 95.6 percent, with 80 percent requiring only one procedure.
- Time to surgery was not found to effect final anatomical outcome ($P = 0.56$). No statistically significant association was observed between change in visual acuity and time to surgery ($P = 0.99$).
- Conclusion: Modest delay in timing of surgery for macula-on rhegmatogenous retinal detachment did not adversely impact patients' outcome.



Mac-off Retinal Detachment



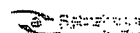
- "The horse is out of the barn"
- Once the macula is detached, there is no statistical difference in vision between operating immediately or with in one week



RD Surgery Timing

- Repair of macula-off retinal detachments may be delayed up to one week
- Investigators report on the one year visual outcome of 291 cases of primary macula-off rhegmatogenous retinal detachments.
- Two-year, multicenter, Scottish retinal detachment study.
- A majority successfully repaired with one operation and achieved a visual acuity of 6/18 or better at final follow-up.
- Duration of macular detachment of 58 days showed a continuing improvement in vision for up to one year. However, patients whose surgery was delayed longer than eight days failed to show significant improvement in vision after the first postop visit at six weeks.

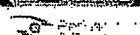
British Journal of Ophthalmology, February 2013



SUBMACULAR HEMORRHAGE

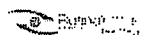
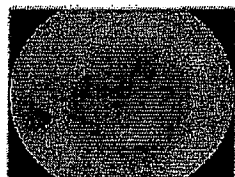
Submacular Hemorrhage (SMH)

- Multiple etiologies, most common: AMD, macroaneurysm, trauma
- SMH can cause irreversible visual loss even within 24 hours
- Mechanisms of retinal damage:
 - Fibrin clot contraction → shearing of RPE and retina
 - Iron → direct toxic effect
 - Mechanical barrier → reduces nutrition to retina

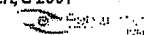
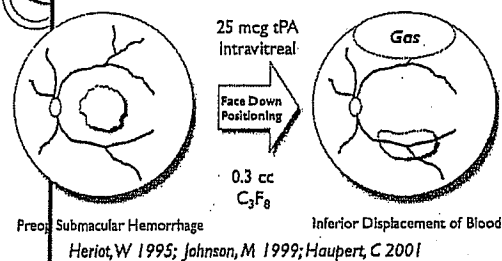


Management Options: Large Sub-Retinal Hemorrhage

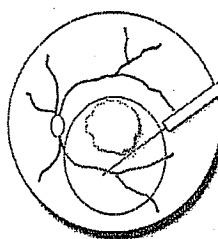
1. Observation
2. Anti-VEGF alone
3. Pneumatic displacement
4. Pneumatic displacement + tPA
5. Sub-macular tPA



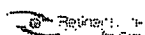
Pneumatic Displacement



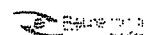
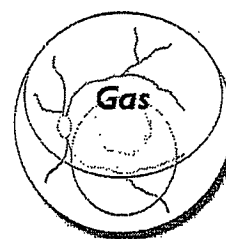
Sub-Retinal tPA Injection with Pneumatic Displacement



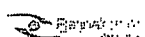
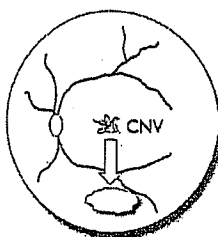
Direct injection
of tPA solution
under retina,
raising large
inferior bleb



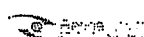
Sub-Retinal tPA Injection with Pneumatic Displacement

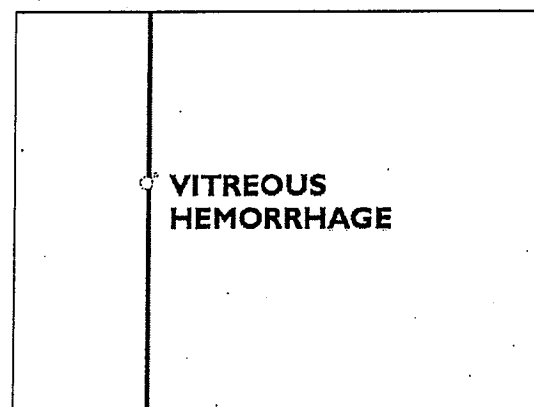
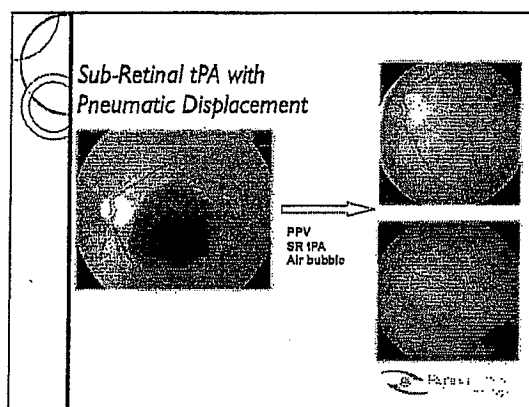


Sub-Retinal tPA Injection with Pneumatic Displacement



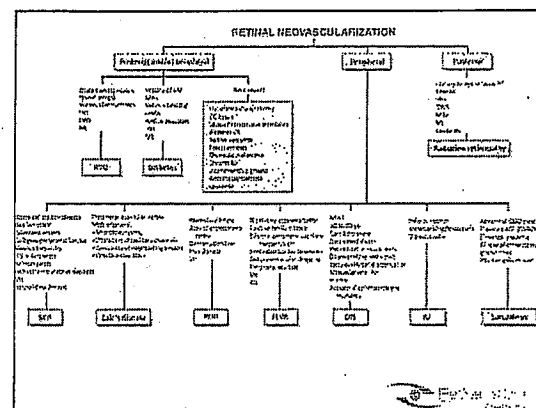
Surgical Technique





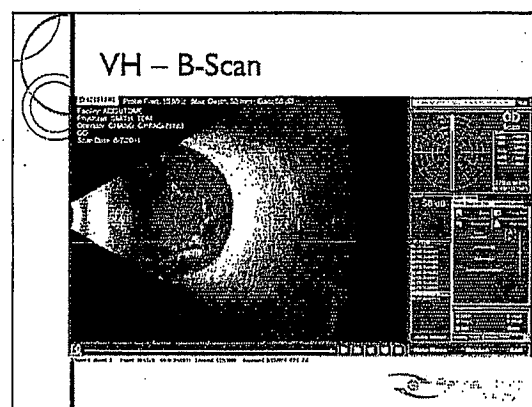
Etiology of VH

- #1 - PDR (31-54%)
- #2 - Retinal Tear (11-44%)
- #3 - BRVO/CRVO (4-16%)
- Other causes of retinal neovascularization
- In young adults – trauma is most common cause
- In children → Pars planitis and congenital retinoschisis
- Elderly white patients – not uncommon to have Wet AMD → breakthrough VH (4%)



Vitreous Hemorrhage

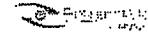
- DDx: Vitritis, Retinal Detachment
- Blood itself is not toxic in vitreous cavity
- Is the retina attached?
- Is there a tear?
- If trauma – need to rule out ruptured globe
- If suspect PDR – Is there NVI? Is there NVA on gonioscopy? Elevated IOP with NVI/NVA – suspect NVG – needs urgent treatment (intravitreal avastin + PRP, PPV if no view)
- If no view, need to get B-Scan ultrasound



• ENDOPHTHALMITIS

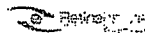
Endophthalmitis

- Serious intraocular inflammatory disorder resulting from infection of the vitreous cavity
- Progressive vitritis is the hallmark of any form of endophthalmitis
- Histologically: massive infiltration of the vitreous cavity with inflammatory cells



Types of Endophthalmitis

- Exogenous
 - Acute Postoperative
 - Chronic Postoperative
 - Filtering Bleb-Associated
 - After Intravitreal Injections
 - Traumatic
- Endogenous



Exogenous

• Microorganism directly introduced from environment

• Usually occurs following surgery: i.e. post-operative endophthalmitis or trauma i.e. post-traumatic or keratitis

• Mainly bacterial

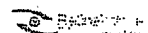
Endogenous

• Hematogenous spread of organisms as a metastatic infection

• Structural defect of eye is not necessary

• Mainly fungal

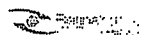
• Common predisposing factors are immunocompromised status, septicemia or IV drug abuse



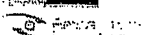
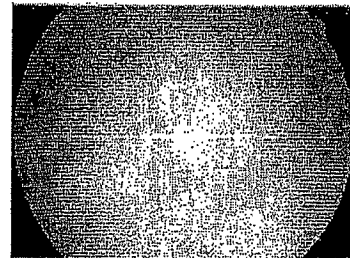
Acute Postoperative Endophthalmitis



- Refers to infectious endophthalmitis
- Shortly after ocular surgery
- Most present within 1-2 weeks
- Initial sx's: rapidly progressive, including pain, red eye, ocular discharge, and blurring
- Common signs: decreased VA, lid swelling, conj and corneal edema, A/C cells + fibrin, hypopyon, vitreous inflammation, retinitis, and blunting of red reflex



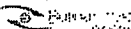
Retinal Periphlebitis – earliest sign



Acute-onset endophthalmitis following cataract surgery



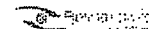
Left: Conjunctival congestion, hypopyon, fibrin in anterior chamber, and visual acuity reduced to hand motions on postoperative day 6. The patient was treated with a vitreous tap and injected with intravitreal antibiotics. Right: The vitreous specimen showed coagulase-negative staphylococcus. Following treatment, visual acuity improved to 20/25.



Acute-onset endophthalmitis following cataract surgery

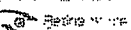


Left: Marked conjunctival congestion, fibrin in the pupil and anterior chamber, hypopyon, and visual acuity reduced to light perception on postoperative day 1. The patient was treated with pars plana vitrectomy and injected with intravitreal antibiotics. Right: The vitreous culture isolated *Serratia marcescens*. The final visual acuity improved to 20/50 but was limited by cystoid macular edema.



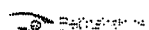
Endophthalmitis Vitrectomy Study (EVS)

- Symptoms:
 - 94.3% reported blurred vision
 - 82.1% red eye
 - 74% pain
 - 34.5% swollen lid
- Signs:
 - 85% hypopyon
 - 79% hazy media
 - 26% LP vision only



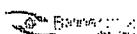
Epidemiology

- Acute postoperative endophthalmitis is the **most common** form of endophthalmitis
- Following cataract surgery 0.08% - 0.68%
- Rates increasing since clear corneal incisions
- Highest risk after 2ndary IOL (0.2-0.367%), and lowest after PPV (0.03-0.046%)

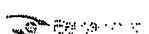


Evaluation

- Suspect in any eye with inflammation greater than the usual postop course
- Associations:
 - Wound leak or dehiscence
 - Suture abscess
 - Vitreous incarceration in the wound
 - Eroding scleral sutures used to fixate IOLs

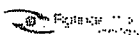


Vitreous wicking syndrome



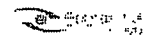
HM vs. LP - Important

- When measuring VA, the technique of differentiating LP vs. HM vision is most important
- HM should be determined no closer than 2 feet (approx 60cm) from the pt with light illumination originating from behind the patient
- Measuring at shorter distance → erroneously attribute HM to an eye that is LP only, and may result in improperly withholding vitrectomy from an eye that might benefit from it



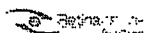
DDx of Acute Endophthalmitis

- Occult retention of lens cortex or nucleus
- Hypopyon uveitis (Behcet's or rifabutin)
- Blebitis
- Keratitis
- Toxic anterior segment syndrome (TASS)
 - Rapid onset (w/ 12-24 hours, limbus to limbus corneal edema)



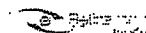
Ultrasound Evaluation

- Should be performed if significant media opacification prevents adequate view of the fundus
- Findings c/w endophthalmitis:
 - Dispersed vitreous opacities with vitritis
 - Choriorretinal thickening
- Rule out: RD or choroidals, dislocated lens material, retained foreign bodies



Microbiological Characteristics

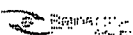
- Bacteria are the most common infecting agents
- Causative organisms represent bacteria from pt's own periocular flora, introduced during surgery
- In the EVS, 94.2% of culture-confirmed cases involved GP bacteria
 - 70% were GP, coag-negative staph (Staph epi)



Pars Plana Vitrectomy

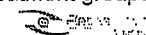


- **Advantages:** reduction of infecting organisms, toxins, inflammatory materials, and opacities. Allows collection of samples
- **Disadvantages:** Need for sophisticated equipment and the need for an OR.
- Vitrectomized eyes have more rapid clearance of intravitreal antibiotics



Immediate PPV vs. Tap & Inject

- In the EVS, patients who presented with LP only visual acuity had a significant, threefold improved chance of obtaining 20/40 vision after immediate vitrectomy (33%) compared to tap and inject (11%)
 - 56% of obtaining 20/100 or better after immediate PPV compared to 30% after tap
- HM or better vision → no significant difference between the treatment groups in final visual acuity



Tap & Inject Procedure



EVS Limitations

- Results may not apply to endophthalmitis after other ocular surgeries
 - Such as bleb related endophthalmitis or chronic postoperative endophthalmitis
- Pts with NLP or significant opacification of A/C obscuring iris tissue were excluded from the study. Therefore severe infections or virulent organisms excluded
 - Unknown whether PPV is superior in these circumstances

Intravitreal Antibiotics

- Current recommendations for empirical therapy (bacterial)
 - Vancomycin 1.0 mg/0.1 mL
 - Cefazidime 2.25 mg/0.1 mL
- 4th generation fluoroquinolones — unclear
 - 400 ug/0.1 mL of gatifloxacin or moxifloxacin
- Fungal: Amphotericin B 5-10 ug/0.1 mL

Systemic Antibiotics

- Usually too slow to enter the eye in adequate concentrations
- In the EVS, there was no difference in VA or media clarity with or without intravenous antibiotics (amikacin plus cefazidime or amikacin plus ciprofloxacin) when given in addition to intravitreal antibiotics
- However, did not have available newer 4th generation fluoroquinolones with better ocular penetration

Outcomes and Risk Factors for Poor Outcomes

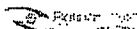
- The most common cause of visual loss in the EVS was attributed to macular abnormalities, such as ERM, macular edema, pigmentary degeneration, and ischemia
- Strongest predictor of poor visual outcome was light perception only vision
- Other risk factors: older age, DM, corneal infiltrate or ring ulcer, compromised PC, low or high IOP, APD, rubeosis, and absent red reflex

Chronic Postoperative Endophthalmitis (> 6 weeks)

- Usually manifest several weeks or months after surgery
- Less common than acute variety
- Organisms isolated are less virulent bacteria and fungal
 - 63% P acnes, 16% S epidermidis, 16% Candida parapsilosis

Chronic Postoperative Endophthalmitis

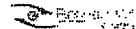
- Pain or discomfort may not be present
- Inflammation can be initially steroid responsive but recurrent after steroid taper
 - Fungal Infections → paradoxical worsening with steroids
- Frank hypopyon is often absent
- Granulomatous uveitis with large precipitates on cornea or IOL
- White intracapsular plaque with *P. acnes*
- Stringy white infiltrates and "fluff balls" or "pearls-on-a-string" near the capsular remnant are characteristic but not pathognomonic for fungal



Chronic Postoperative Endophthalmitis



Left: This patient presented with granulomatous uveitis, vitritis, and a white plaque within the capsular bag, which is characteristic of infection caused by *Propionibacterium acnes*.
Right: Marked granulomatous keratic precipitates are occasionally seen in endophthalmitis caused by *P. acnes*.

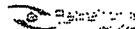


Chronic Postoperative Endophthalmitis



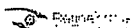
Treatment for Chronic Cases

- Obtain A/C and vitreous samples
 - Identification of infectious organism is key in management of these infections
- Intravitreal antibiotics
- However, Vanco is often inadequate for *P. acnes*
 - Often need PPV and removal of capsule with IOL

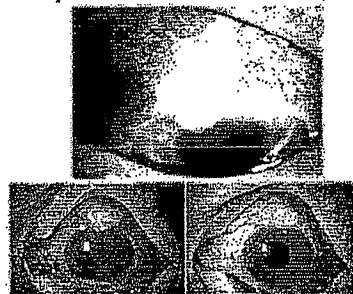


Filtering Bleb-Associated Endophthalmitis

- Occurs as a result of pathogenic organisms gaining entry to intraocular tissue through the conjunctival filtering bleb
- Mean time b/w surgery and endophthalmitis is 19.1 months (range 3-9 years)
- 0.2 – 9.6% of glaucoma filtering procedures
- Increased incidence with use of antifibrotic agents
 - Thin, cystic, avascular conjunctiva
- Blebitis – If no uveitis or vitritis

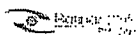


Post-Trabeculectomy Endophthalmitis



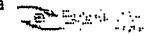
Treatment

- If only blebitis → conservative tx with systemic and topical fortified antibiotic therapy
- If the vitreous is clear, examine these pts frequently, treating for endophthalmitis if vitritis or acute hypopyon develops
- Needle aspiration of the bleb is not advised
- Studies suggest possible benefit from PPV



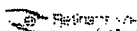
Endophthalmitis after Intravitreal Injection

- Increasing use of these agents, therefore concern for risk of endophthalmitis
- Like acute postop endophthalmitis, coagulase-negative staphylococci is the most common cause
- No infectious agent is identified in many cases
- Triamcinolone acetonide crystals can migrate into A/C and mimic hypopyon
- 1.4%/injection for IVK
- 0.2%/injection for ranibizumab
- Intravitreal triamcinolone may play a role in endophthalmitis potentiation

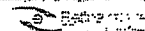


Traumatic Endophthalmitis

- Approximately 25% of endophthalmitis cases
- After open globe injury, chance of developing endophthalmitis is approx 7%
- Injuries including IOFB have higher rates
- Other risk factors: dirty wound, lens capsule rupture, age > 50, delayed presentation of more than 24 hours after injury

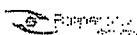


Traumatic Endophthalmitis

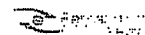


Traumatic Endophthalmitis

- Bacillus and Staphylococcus are common in penetrating trauma with IOFB
- Primary repair and removal of IOFB as soon as possible
- Exclude the possibility of occult, retained IOFB
 - CT scan with thin 1mm cuts
- Obtain cultures
- Intravitreal Vanco and Ceftaz
 - Some advocate Gent + Clinda for synergistic effect against Bacillus and Staph
- Some advocate early PPV



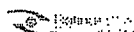
Bacillus Endophthalmitis



Traumatic Endophthalmitis

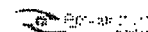


Left: Marked purulence around an intraocular foreign body
Right: Marked periphlebitis



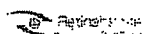
Prophylaxis after Penetrating Trauma

- Clinical evidence not established
- Some authors advocate intravitreal antibiotic administration in all cases of penetrating trauma
- Others recommend administration in the presence of risk factors (2 of 3: dirty wound, lens breach, or delay in closure over 24 hours)
- Systemic antibiotics: Intravenous cefazolin (1g every 6 hours for 48-72 hours) followed by an oral agent such as gatifloxacin or moxifloxacin for 7 days

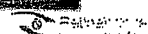
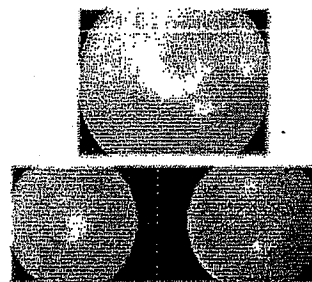


Endogenous Endophthalmitis

- Originates from sources within the body
- 2-8% of endophthalmitis cases
- Pts usually have underlying disease: DM, HIV, IV drug abuse, renal failure on dialysis, cardiac disease, malignancy, immunosuppressive therapy, or indwelling catheters
- Liver abscess is the most common extraocular foci of infection, followed by pneumonia, endocarditis, soft tissue infection

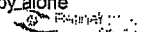


Candida Endophthalmitis



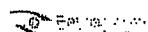
Management of Endogenous Endophthalmitis

- Cultures are essential and may be lifesaving
- Vitreous sample should be obtained in all cases
- ID of causative organism is made by systemic culture of blood, urine or CSF in 75-80% of cases
- In contrast to postoperative endophthalmitis, systemic antibiotics are central to the treatment of endogenous endophthalmitis
- Focal chorioretinitis and associated mild vitritis can respond to systemic therapy alone



Same Day Referrals

- Mac-on RD
- Endophthalmitis (hours count)



Michael J. Davis, MD
Retina Institute Surgeon

Dr. Davis completed his undergraduate and medical degrees through an accelerated BS/MD program at Kent State University and the Northeastern Ohio Universities College of Medicine.

During the undergraduate program, he spent a semester studying abroad in Geneva, Switzerland, where he interned at the International Federation of the Red Cross/Red Crescent. He worked on a project through the Relief Health Department designed to strengthen the Red Cross organizations in Africa.

He graduated summa cum laude with a bachelor of science degree from Kent State University. During medical school, he was active in numerous committees, earning him the Service to College award. He was inducted into the prestigious Alpha Omega Alpha National Honor Society during his junior year of medical school. He graduated with an MD in 2004 at the top of his class and was selected by his peers to serve as the commencement speaker at his medical school graduation.



After earning his medical degree, Dr. Davis completed his internship and his ophthalmology residency at Rush University Medical Center in Chicago. During his residency he served as Chief Resident. After residency, he completed a two-year vitreoretinal surgical fellowship with Illinois Retina Associates and Rush University Medical Center, where he trained under nationally and internationally respected clinicians and surgeons.

Dr. Davis' research interests include treatment of diabetic retinopathy, retinal detachment surgery, ocular infections, and retinal imaging. He has published several peer-reviewed articles in journals, such as *RETINA* and the *Archives of Ophthalmology*. He has presented his work at national and international meetings including the Association of Research in Vision and Ophthalmology Annual Meeting, the American Society of Retina Specialists Retina Congress and the International Conference on Ocular Infections. He has also published a book chapter and co-reviewed articles for several journals. He is a member of the Alpha Omega Alpha Honor Society, the American Academy of Ophthalmology, the American Society of Retina Specialists, the Ocular Microbiology and Immunology Group, and the Association for Research in Vision and Ophthalmology.

800-898-2020



Biography

Michael J. Davis, MD

800-898-2020

mdavis@retina2020.com

Cell: 626-298-5118

EDUCATION

- 2000 Bachelor of Science, Kent State University, Kent, OH
2004 Medical degree, Northeastern Ohio Universities College of Medicine, Rootstown, OH

PROFESSIONAL TRAINING

- 2004-05 Surgical Internship, RUSH University Medical Center, Chicago, IL
2005-08 Ophthalmology Residency, RUSH University Medical Center, Chicago, IL

FELLOWSHIPS

- 2008-10 Vitreoretinal Surgery Fellowship, Illinois Retina Associates/RUSH, Chicago, IL

BOARD CERTIFICATION

- 2010 American Board of Ophthalmology

PROFESSIONAL AFFILIATIONS

- › Retina Institute of California
- › Alpha Omega Alpha (AOA) National Medical Honor Society
- › American Society of Retina Specialists (ASRS)
- › American Academy of Ophthalmology (AAO)
- › Association for Research in Vision and Ophthalmology (ARVO)
- › American Society of Cataract and Refractive Surgeons (ASCRS)
- › Chicago Ophthalmologic Society
- › Illinois Association of Ophthalmology

UNIVERSITY & HOSPITAL POSITIONS

- 2005-08 Ophthalmology Representative, Housestaff Association, RUSH University Medical Center, Chicago, IL
2007-08 Chief Resident, Ophthalmology, RUSH University Medical Center, Chicago, IL

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>R.I.P. Blepharoplasty</u>	Course Presentation Date <u>10/02/2014</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) (Middle)		
Provider Mailing Address Street <u>100 E. California Blvd</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>		
Provider Email Address <u>KSEYFI@Retina2020.com</u>		
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO	

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Lily</u> (First) <u>Lee</u> (Last) (Middle)		
License Number <u>AB7024</u>	License Type <u>MD</u>	
Phone Number <u>(800) 898-2020</u>	Email Address <u>lily@lilyleemd.com</u>	

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider

Date

12/21/14



**Retina Research Foundation
of California**

Date: 10/02/2016

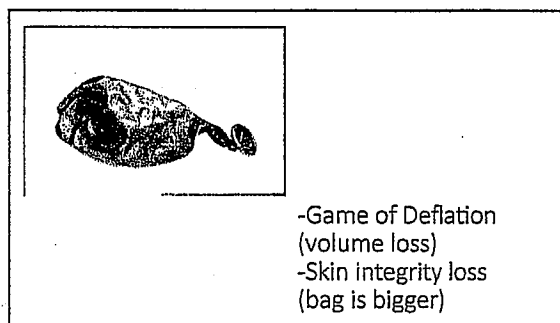
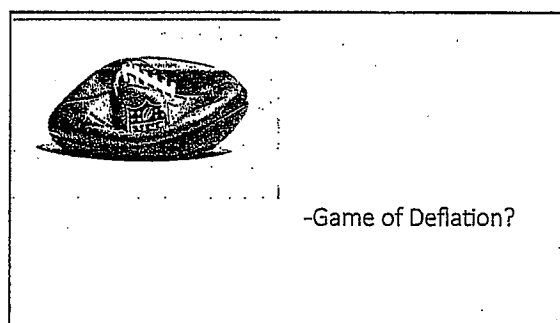
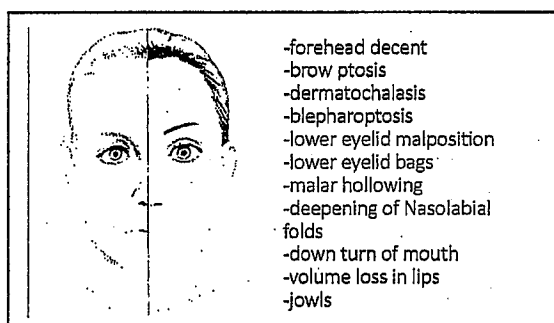
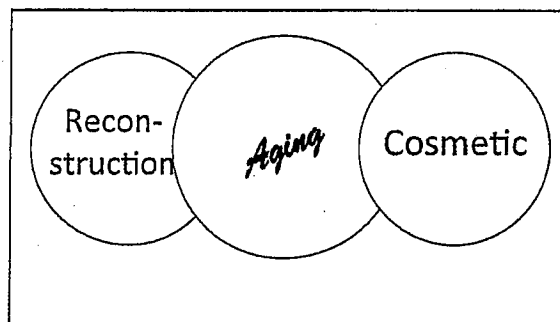
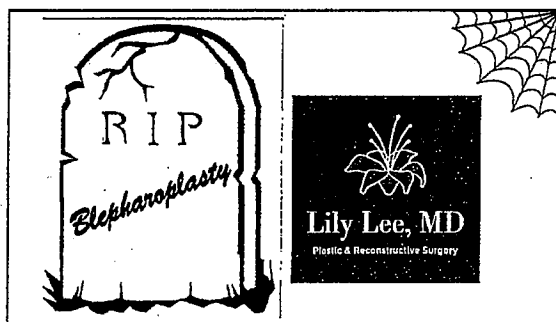
R.I.P. Blepharoplasty

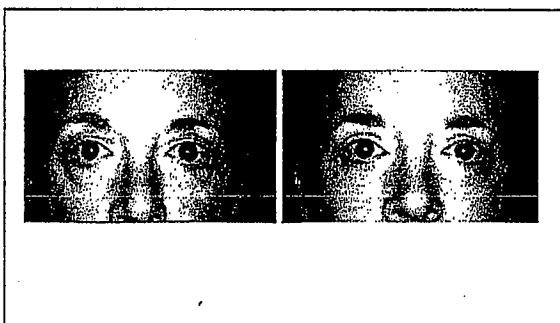
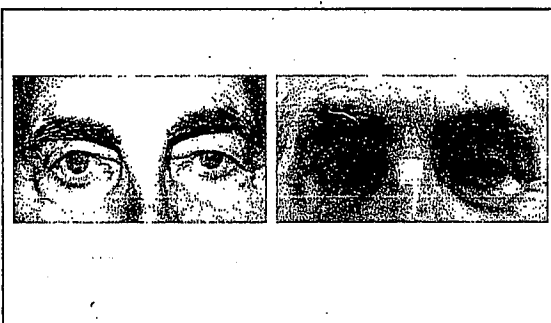
My lecture had to do with deciphering the difference between true ptosis of the upper eyelid versus dermatochalsis, which is often called pseudoptosis. In addition the diagnosis, surgical technique and pre/post op management were discussed in detail as well.

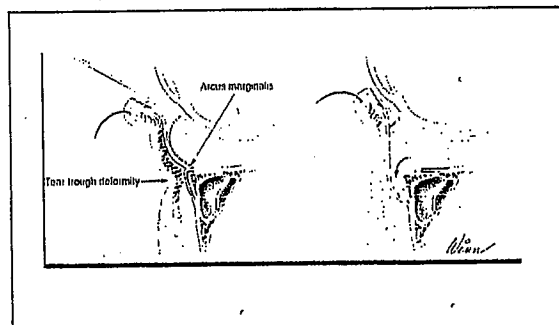
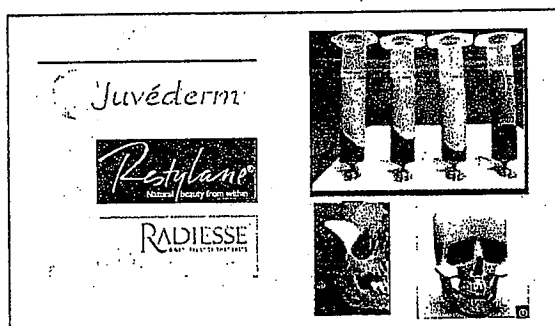
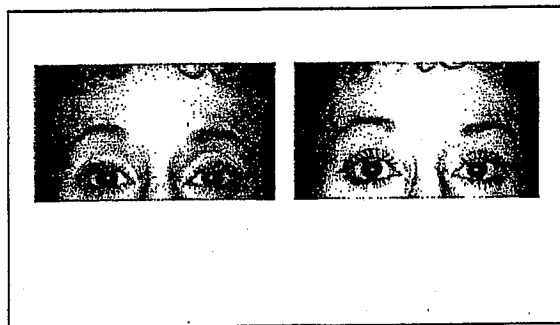
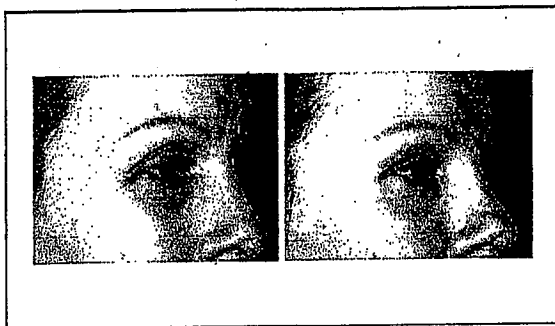
Lily Lee, M.D.

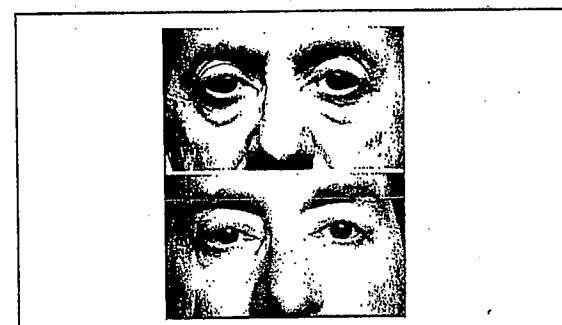
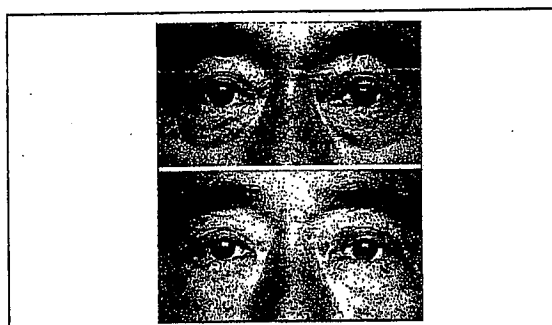
R.I.P. Blapheroplasty

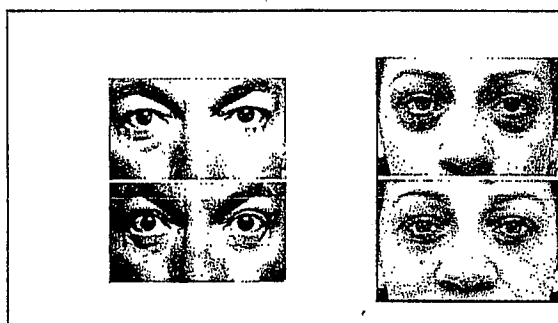
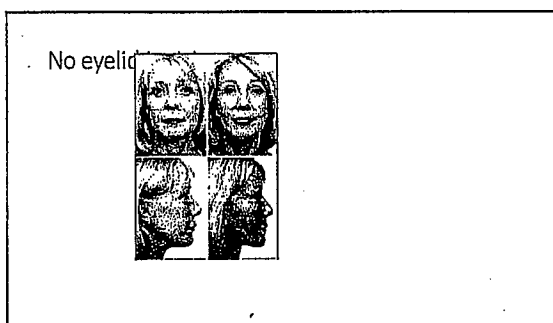
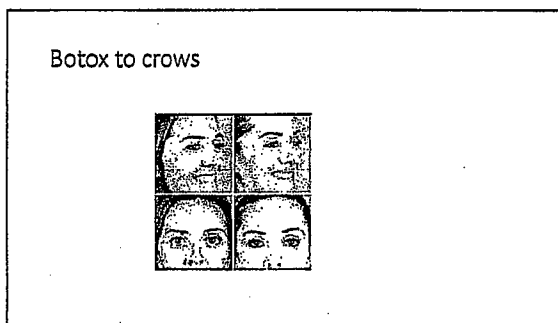
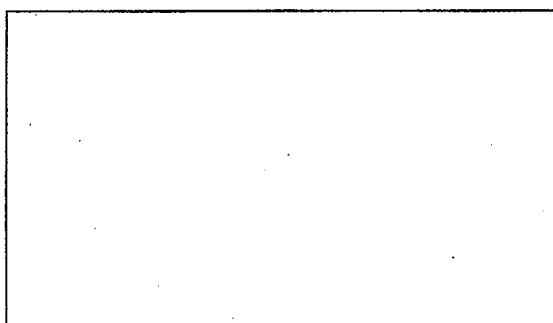
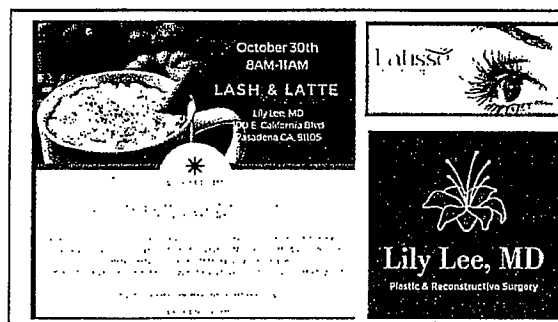
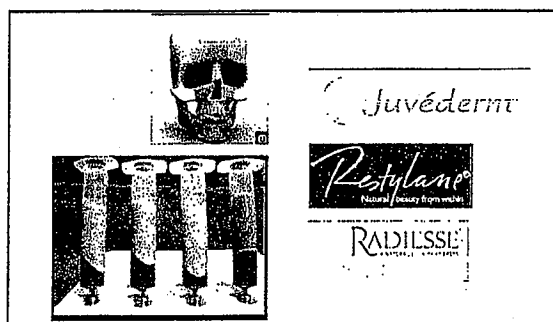
- -Forehead decent
- -brow ptosis
- -Dermatochalasis
- -Blepharoptosis
- -Lower eyelid malposition
- -Lower eyelid bags
- malar hollowing
- -Deepening of Nasolabial folds
- -Down turn of mouth
- -Volume loss in lips
- -jowls
- -Game of Deflation?
 - -Game of Deflation (volume loss)
 - -Skin integrity loss (bag is bigger)
- Fat compartments
- Fat compartments
- Botox to crows
- No eyelid incisions











8/11/16





Lily Lee, MD

Plastic & Reconstructive Surgery

Tel: 626-817-0818 Fax: 626-574-7188

www.LilyLeemd.com

207 S. Santa Anita Street Suite P-25
San Gabriel, CA 91776

73-180 El Paseo
Palm Desert, Ca 92260

CURRICULUM VITAE

A. PERSONAL INFORMATION

Name Lily Feng Lee, M.D.

Business Name LILY LEE, MD. INC

Business Address 207 S. Santa Anita St. Ste P25
San Gabriel, CA 91776

Business Address 73-180 El Paseo
Palm Desert, CA 92260

Business Telephone (626) 817-0818

(760) 773-0099

Home Address 1344 Hillcrest Avenue.
Pasadena, CA 91106

Mobile Telephone (626) 676-2373

Date of Birth March 16, 1976

Place of Birth Elyria, OH

Citizenship U.S.A.

Email lily@lilyleemd.com

B. EDUCATION

High School Stratford High School, 1994
Houston, TX

University Case Western Reserve University



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Cleveland, OH
B.A. Psychology, Anthropology
Magna Cum Laude, 1998

Medical School Case Western Reserve University
Cleveland, OH
M.D., 2002

Internship Intern in General Surgery

Los Angeles County + University of Southern
California Medical Center

Los Angeles, CA
2002 - 2003

Residency Junior Resident in General Surgery

Los Angeles County + University of Southern
California Medical Center

Los Angeles, CA
2003 - 2005

Resident in Plastic Surgery

Los Angeles County + University of Southern
California Medical Center
Los Angeles, CA
2009-2012

Research Developmental Biology
Childrens Hospital Los Angeles
Saban Research Institute
Los Angeles, CA
2005 - 2006

Wound Healing/ Hair Regeneration
USC Division of Plastic Surgery
Hoffman Medical Research Center
Los Angeles, CA
2007 - 2009

Fellowship Burn Surgery



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73-180 El Paseo
Palm Desert, Ca 92260

Los Angeles County + University of Southern
California Medical Center
Los Angeles, CA
2006 - 2007

Licensure State of California, 2004, #A87024

Certification Basic Life Support, 2002
Advanced Certification Life Support, 2011
Advanced Trauma Life Support, 2005
Advanced Burn Life Support, 2007

C. PROFESSIONAL BACKGROUND

Honors and Awards

- President's Scholarship, Case Western Reserve University, 1994 (4 year full tuition).
- Michael E. DeBakey Summer Surgery Program, 1995
- Leon Levy Archaeological Expedition, Ashkelon, Israel 1996 (\$1500 one time)
- Alice C. Seagraves Travel Research Award, Tokyo, Japan 1997 (\$2000 one time)
- American Society of Hematology Summer Research Fellowship Award, 1999 (\$2000 one time)
- NIH Ruth L. Kirschstein National Research Service Award (NRSA) F32 Research Awardee (2007-2009)
- Plastic Surgery Educational Foundation Basic Grant Awardee (2008-2009)

Other employment

- Resident Director, Norton House, Case Western Reserve University, 1998-1999.
- Teaching Assistant, Human Anatomy, Case Western Reserve University, Martin J. Rosenberg, Ph.D., 2000 – 2001
- Aerobics/Pilates/Tai Chi Instructor, Bally's Fitness Corporation, 1999-2002.

Committee membership

- Department of Surgery, GME Committee, 2002 – 2005

SOCIETY MEMBERSHIP

- Phi Beta Kappa Honor Society, elected 1997.
- American Medical Student Association, secretary 1998-2002.
- Christian Medical & Dental Society, president 1998-2002
- Women in Medicine, president 2001-2002.

OPTOMETRY

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Preparing the ocular surface for cataract and refractive eye surgery</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@reina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Mitchell</u> (First) <u>Shultz</u> (Last) (Middle)	
License Number <u>079168</u>	License Type <u>MD</u>
Phone Number <u>(800) 898-2020</u>	Email Address <u>lzapeyes@gmail.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



**Retina Research Foundation
of California**

Date: 10/02/2016

Preparing the Ocular Surface for Cataract And Refractive Eye Surgery

This lecture discussed the preparation of the ocular surface and managing the ocular surface. Screening candidates for refractive surgery was described in detail. Dry eye patients need careful counseling and pre-treatment. Methods that will be useful for providers to identify meibomian gland dysfunction versus aqueous deficiency or combination was also discussed in detail along with common conditions that are observed.

Mitchell Shultz, MD.

PREPARING THE OCULAR SURFACE
FOR CATARACT & REFRACTIVE EYE SURGERY

- Managing the Ocular Surface
Refractive Eye Surgery & Dry Eye Disease
- Screening Candidates
- Refractive Eye Surgery
- Dry Eye Patients:
 - careful counseling and pre-treatment
- Need to identify meibomian gland dysfunction
 - vs. aqueous deficiency or combination
- Tear Film Composition
- Major etiological causes of dry eye
- The Path to Diagnosing Dry Eye
- Inflammatory Dry Eye
- Screening Candidates
- Dry Eye Patients:
- Aqueous Deficiency
 - Restasis (start 3-6 weeks prior to LASIK)
 - Steroid drops if inflammatory
 - Refresh Optive Sensitive or PF Systane Ultra
 - Look for evidence of MGD too
 - *Consider Punctal Plugs if above not satisfactory or to help expedite process
- Formulation Features
- BAK=benzalkonium chloride; ppm=parts per million.
- **LOTEMAX® GEL**
- **Mucoadhesive technology**
- Engineered to adhere to the ocular surface¹⁻³
- **Adaptive viscosity technology**
- A gel at rest and a viscous liquid under shear stress (ie, blinking)⁴
- **Dose uniformity**
- No shaking necessary to resuspend drug⁵
- **Lower preservative concentration**
- 30 ppm BAK—70% less than LOTEMAX® (loteprednol etabonate ophthalmic suspension) 0.5%²
- **Inclusion of moisturizers**
- Proprietary (patented) combination of 2 known moisturizers—glycerin and propylene glycol²
- **Closer to physiologic pH**
- Buffer keeps pH centered at 6.5²
- **Adaptive Viscosity**
- cps=centipoise; LE=loteprednol etabonate.

- *LE formulation was diluted 1:3 with Hank's balanced salt solution (HBSS).
- **LOTEMAX® GEL**
- A Product of Design
- IOP=intraocular pressure.
- **Loteprednol Etabonate**
- **Retrometabolic drug design**
- Prednisolone derivative—C-20 ester-based corticosteroid with potent anti-inflammatory activity
 - Position 20 ester group replaces the ketone group^{1,2}
- Designed to undergo rapid and predictable degradation by local esterases to an inactive metabolite after exerting its effects¹
 - Less potential for adverse events^{1,2}
 - Decreased incidence of significant IOP increase (ie, ≥ 10 mm Hg) compared to prednisolone acetate^{2,3}
- Mean (\pm SD) IOP Measures by Visit
- 1/203 patients (0.50%) in each group had an increase from baseline IOP ≥ 10 mm Hg
- 1/206 patients (0.49%) in the LOTEMAX® GEL treatment group had an increase from baseline IOP ≥ 10 mm Hg
 - Occurred in both eyes, not considered related to study drug
- **Safety: Intraocular Pressure**
- RESTASIS® can help appropriate moderate patients to make more of their own real tears
- RESTASIS® patients had a statistically significant increase in real tear production¹
- Goblet Cell Density
- Patient Reliance on Artificial Tears
- Prepare RESTASIS® patients for benefits that continue with continued use
- Patients' own real tear production increases over time¹
 - Patients may not realize the effects of RESTASIS® for several months. Therefore, it is important to encourage continuous use for continued benefits¹⁻⁵
- When Is It More than Dry Eye?
- **Sjögren's syndrome is an autoimmune disease characterized by immune cells infiltrating moisture-producing glands, such as the salivary and lacrimal glands, and leading to cell death^{1,2}**
- Sjögren's syndrome is also often associated with³:
 - Female gender
 - Joint pain
 - Dry mouth
 - Family history of autoimmune disease
 - External signs of orbital inflammation
 - Chemosis
- Sjögren's Syndrome Symptoms
- The Sjögren Specimen Collection Kit Difference:

Early Detection of Sjögren's Syndrome¹⁻³

- **Includes 4 traditional and 3 proprietary biomarkers**
- Ig=immunoglobulin.
- Meibomitis
- Screening Candidates

- Evaporative Dry Eye Patients:
 - Meibomian Gland Dysfunction (MGD)
 - lid scrubs, hot compress, eyelid massage,
 - Omega 3,
 - Retaine MGD, Soothe XP or Systane Balance
 - Evaluate Blink Rate and Lagophthalmos
 - Lipiflow Treatment *
- MGD Therapy Options
- Omega 3 Supplements
- Meibomography
 - Lipiflow Treatment
 - Prokera Ring
- **Prevent Further Damage:**
HC-HA/PTX3 Can Stop the Adult Scarring Process
- **HC-HA/PTX3 Orchestrates the Regenerative Healing Process**
- **A UNIQUE MATRIX**
- **CRYOTEK® Regenerative Healing**
- **Understanding the Significance of the Processing Method**
- Preserves meaningful quantities of all extracellular matrix components, including HC-HA/PTX3
- Breaks down HC-HA/PTX3 to pro-inflammatory low molecular weight HA; the structural integrity is lost.
- Amniograft for Pterygium
- Reservoir Restoration for CCh

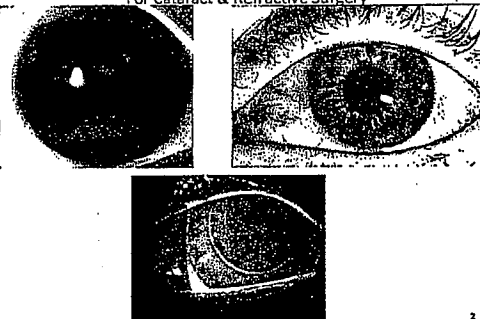
PREPARING THE OCULAR SURFACE FOR CATARACT & REFRACTIVE EYE SURGERY

Mitch Shultz, M.D.

CALIFORNIASM
LASIK CENTER

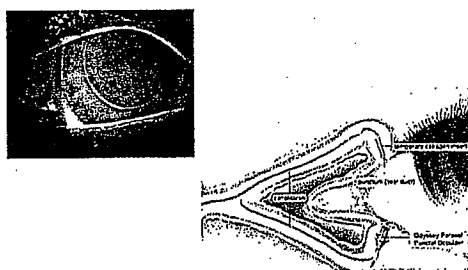
Preparing the Ocular Surface

For Cataract & Refractive Surgery



Managing the Ocular Surface

Refractive Eye Surgery & Dry Eye Disease



Screening Candidates

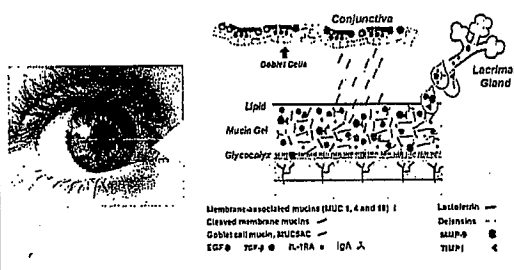
Refractive Eye Surgery

Dry Eye Patients:
careful counseling and pre-treatment

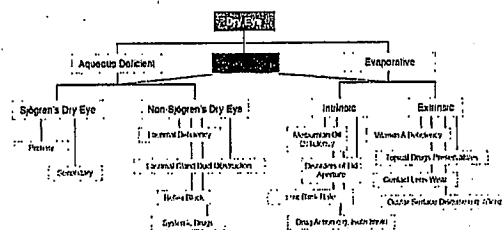
need to identify meibomian gland dysfunction
vs aqueous deficiency or combination

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Tear Film Composition

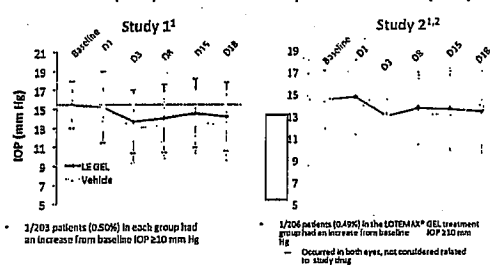


Major etiological causes of dry eye



American Academy of Ophthalmology Clinical Guidelines Panel, Preferred Practice Patterns® Guidelines, Dry eye syndrome, San Francisco, CA: American Academy of Ophthalmology; 2015.

Safety: Intraocular Pressure

Mean (\pm SD) IOP Measures by Visit

• 3/203 patients (0.50%) in each group had an increase from baseline IOP ≥ 10 mm Hg

• 1/204 patients (0.49%) in the LOTEMAX OEL treatment group had an increase from baseline IOP ≥ 10 mm Hg

— Occurred in both eyes, not considered related to study drug

1. Rajpal RK et al. J Cataract Refract Surg. 2013;39:153-167.
2. Fong R et al. Clin Ophthalmol. 2013;6:1113-1124.

RESTASIS® can help appropriate moderate patients to make more of their own real tears

- Dry Eye is believed to have an inflammatory component, even if not clinically evident!^{1,2}
- Inflammation is present in all severity levels and can cause decreased tear production!¹⁻⁵



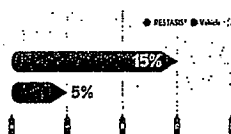
Indications and Usage: RESTASIS® ophthalmic emulsion is indicated to increase tear production in patients whose tear production was presumed to be suppressed due to ocular inflammation associated with keratoconjunctivitis sicca. Increased tear production was not seen in patients currently taking topical and/or systemic anti-inflammatory drugs or using punctal plugs.

Important Safety Information: Contraindications: RESTASIS® is contraindicated in patients with active ocular infections and in patients with known or suspected hypersensitivity to any of the ingredients in the formulation.

Please see additional Important Safety Information on slides 4 and 5.

RESTASIS® patients had a statistically significant increase in real tear production¹

Percentage of Patients With Increase in Schirmer Score of ≥ 10 mm (6 Months)

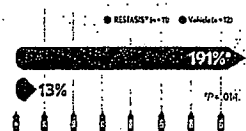


- At 6 months:
 - 15% of RESTASIS® patients had an increase in Schirmer score ≥ 10 mm¹
 - 3 times more tears were produced in the RESTASIS® group (n = 293) compared to vehicle (n = 292)²

1. RESTASIS® Prescribing Information; 2. OAS 1024; Section 8.6.13 Table 8.4 Integrated Summary of Efficacy 1995.

Goblet Cell Density

Increase in Goblet Cell Density From Baseline

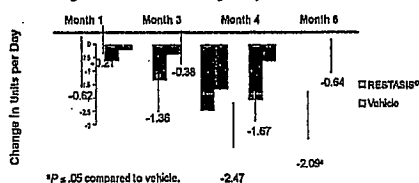


1. OAS 1024; Section 8.6.13 Table 8.4 Integrated Summary of Efficacy 1995.

Patient Reliance on Artificial Tears

Patients in all study groups were allowed to instill REFRESH® Artificial Tears as needed throughout the trials. Mean baseline use in the RESTASIS® group was 6.25 times per day. At month 6, mean use decreased 2.09 times per day from baseline to 4.16 times per day¹

Change From Baseline in Average Daily Use of Artificial Tears



*P $\leq .05$ compared to vehicle.

- At month 6, patients treated with RESTASIS® decreased their artificial tear use by 33%

1. OAS 1024; Section 8.6.13 Table 8.4 Integrated Summary of Efficacy 1995; 2. S. S. et al. Ophthalmology. 2005.

Prepare RESTASIS® patients for benefits that continue with continued use

- 1 month: Patients' eyes may begin producing more of their own real tears
- 3 months: Patients may begin to notice an increase in tear production
- 6 months: Patients may experience a significant increase in tear production and may rely less on artificial tears



- Patients' own real tear production increases over time¹
 - Patients may not realize the effects of RESTASIS® for several months. Therefore, it is important to encourage continuous use for continued benefits¹⁻⁶

1. Brown et al. J Ocul Dis. 2005; 2. Brown et al. J Ocul Dis. 2005; 3. OAS 1024; Section 8.6.13 Table 8.4 Integrated Summary of Efficacy 1995; 4. Brown et al. J Ocul Dis. 2005; 5. Brown et al. J Ocul Dis. 2005; 6. Brown et al. J Ocul Dis. 2005.

When Is It More than Dry Eye?

• Sjögren's syndrome is an autoimmune disease characterized by immune cells infiltrating moisture-producing glands, such as the salivary and lacrimal glands, and leading to cell death^{1,2}

• Sjögren's syndrome is also often associated with³:

- Female gender
- Joint pain
- Dry mouth
- Family history of autoimmune disease
- External signs of orbital inflammation
- Chemosis



1. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 2. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 3. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334.

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Sjögren's Syndrome Symptoms

Sicca Symptoms^{1,4}

Dry eye

Dry mouth

Episodic inflammation of salivary glands

Skin dryness

Vaginal dryness

Organ-specific Manifestations^{2,4}

Autoimmune thyroiditis

Chronic obstructive pulmonary disease

Gastrointestinal disorders

Renal disease

Arthritis

Raynaud's phenomenon

General Symptoms^{3,4}

Sleep disturbance
Anxiety/depression
Chronic fatigue
Chronic pain (arthralgia/myalgia)
Vasculitis (palpable purpura)



1. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 2. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 3. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 4. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334.

24

The Sjö® Specimen Collection Kit Difference: Early Detection of Sjögren's Syndrome¹⁻³

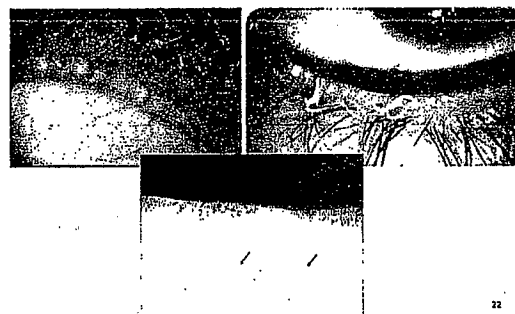
Includes 4 traditional and 3 proprietary biomarkers

Biomarker	Diagnostic Characteristics
Sjögren's Protein 1 (SP1) (pH 10.5-11.5)	Protein with specificity and sensitivity for early Sjögren's syndrome
Chronic Autoimmune 6 (CA6) (pH 10.5-11.5)	Other medium-sized protein for an early response
Protein Secretory Protein (PSP) (pH 10.5-11.5)	Expressed early in disease course
SP1A (pH 10.5-11.5)	Expressed in early stages of disease
SP1B (pH 10.5-11.5)	Expressed in early stages of disease
SP1C (pH 10.5-11.5)	Expressed in early stages of disease
SP1D (pH 10.5-11.5)	Expressed in early stages of disease
SP1E (pH 10.5-11.5)	Expressed in early stages of disease
SP1F (pH 10.5-11.5)	Expressed in early stages of disease

1. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 2. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334. 3. Korman H and Macgregor H. Arch Intern Med. 2002;162(12):1325-1334.

25

Meibomitis



26

Screening Candidates

Evaporative Dry Eye Patients:

Meibomian Gland Dysfunction (MGD)
lid scrubs, hot compress, eyelid massage,
Omega 3,

Retaine MGD, Soothe XP or Systane Balance

Evaluate Blink Rate and Lagophthalmos

Lipiflow Treatment*



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MGD Therapy Options



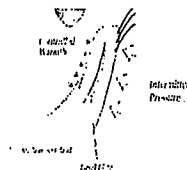
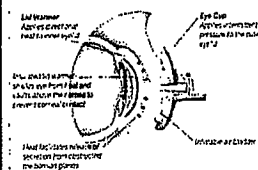
27

Lipiflow Treatment



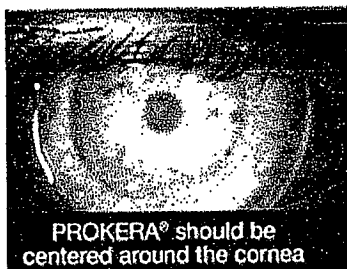
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Lipiflow Treatment



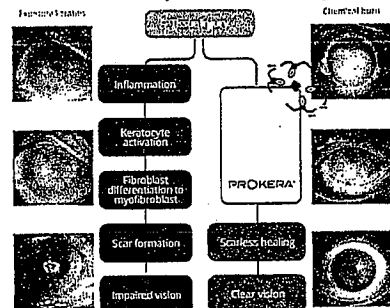
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STATE CENTER

Prokera Ring

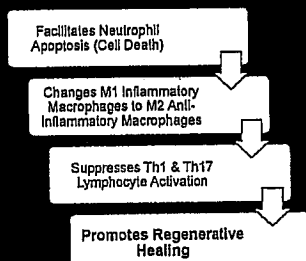


31

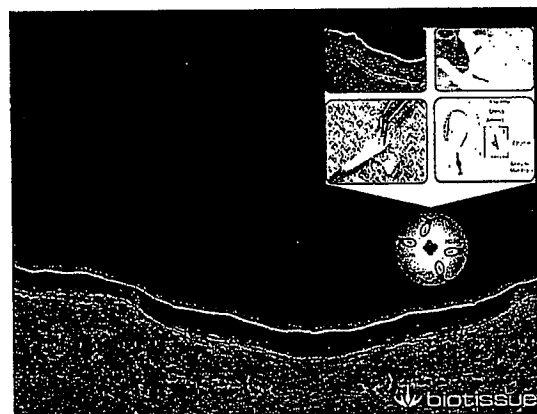
Prevent Further Damage: HC-HA/PTX3 Can Stop the Adult Scarring Process



↓ biotissue



biotissue



bioRxiv preprint doi: <https://doi.org/10.1101/000000>; this version posted January 1, 2016. The copyright holder for this preprint (which was not certified by peer review) is the author/funder, who has granted bioRxiv a license to display the preprint in perpetuity. It is made available under aCC-BY-NC-ND 4.0 International license.



CRYOTEK® Regenerative Healing
 BY PRESERVING THE HC-HA/PTX3, THE CATALYST FOR QUALITY HEALING, OUR PRODUCTS
 PROMOTE THE FOLLOWING BIOLOGIC ACTIONS:

CRYOTEK ADVANTAGE

- ANTI-SCARRING
- ANTI-INFLAMMATION
- ANTI-ANGIOGENESIS
- WOUND HEALING

AMNIOGRAFT®
 BIOLOGIC TRANSPLANTATION GRAFT

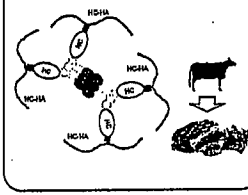
PROKERA®
 BIOLOGIC CORNEAL BANDAGE

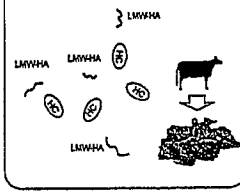
bio tissue

Understanding the Significance of the Processing Method
Many things start off the same...

Cryotek Advantage
 * Preserves meaningful quantities of all extracellular matrix components, including HC-HA/PTX3



Dehydration
 * Breaks down HC-HA/PTX3 to pro-inflammatory low molecular weight HA; the structural integrity is lost.



Prokera Indications

Dry Eye Disease

Anterior Basement Membrane Dystrophy

Corneal Erosion

Filamentary Keratopathy

Neurotrophic Corneal Ulcers

Infectious Keratitis

Chemical Burns

Post PRK Haze

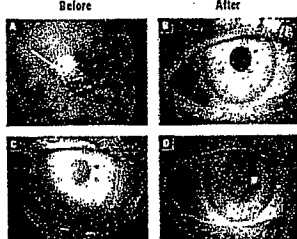
39

Prokera Indications

Dry Eye Disease

Dry Eye Syndrome, Exposure Keratopathy

Before After



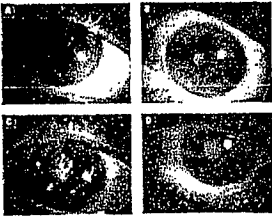
40

Prokera Indications

Filamentary Keratopathy

Filamentary Keratitis

Before After



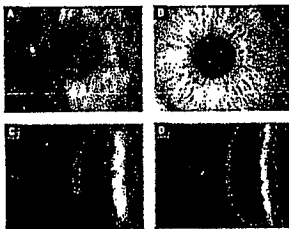
41

Prokera Indications

Post PRK Haze

Post-PRK Haze

Before After

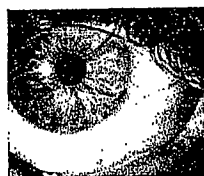


42

Amniograft for Pterygium



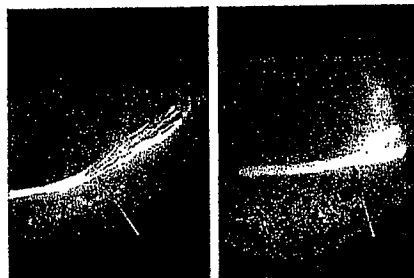
Pterygium *before*
AmnioGraft[®] treatment



Pterygium *after*
treatment

43

Reservoir Restoration for CCh



Left: Image of patient with CCh before Reservoir Restoration Procedure
Right: Image of patient after Reservoir Restoration Procedure

44

Thank You

Mitch Shultz MD

izapeyes@gmail.com
(818)517-3803 mobile

CALIFORNIA
EYE CENTER

Mitchell C. Shultz, MD
Medical Director



Dr. Shultz is a fellowship-trained, board-certified refractive surgeon, expert in the most advanced techniques of vision correction surgery. Having graduated with Provost Honors from the University of California San Diego, Dr. Shultz went on to receive his doctor of medicine degree with Alpha Omega Alpha honors from New York Medical College. He completed his internship at University of California, Los Angeles, and residency in ophthalmology at the University of California, Irvine where he was also honored as chief resident. Dr. Shultz completed his fellowship in refractive surgery at the world-renowned Instituto Zaldivar in Argentina.

Dr. Shultz has received many honors throughout his 20-year career. He was voted viewer's choice 2010 & 2011 Best Ophthalmologist in Southern California by KCAL9/ KCOP Best of LA TV, one of LA's Top Docs 2011 & 2012 and one of America's Top Ophthalmologists for more than ten years running.

Having served as peer review editor of *Cataract and Refractive Surgery Today* (2007-2013), Dr. Shultz continues to publish articles on the most cutting edge technologies and techniques in laser refractive and cataract surgery. Dr. Shultz's reputation is known industry wide, and he is often invited to lecture locally and abroad. Dr. Shultz both lectures and conducts ongoing investigations for AMO Surgical, Bausch & Lomb Surgical and Pharmaceuticals and Allergan. He also continues to perfect the clinical care of LASIK and cataract patients alike. His FDA-regulated investigations on the latest innovations in the field have included: PermaVision™ corneal inlays, custom cornea and Wavefront LASIK, hyperopic LASIK, multifocal cataract surgery, Wavefront cataract surgery, Intacs for Keratoconus, and the Artisan phakic IOL.

Having undergone LASIK himself, Dr. Shultz is uniquely qualified to counsel his patients from both their perspective and that of an accomplished surgeon.

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CALIFORNIA
LASIK CENTER

Mitchell C. Shultz, MD

818-517-3803

mitchell.shultz@californialasikcenter.com

Education

- 1988 | BA, Biology and Political Science
University of California, San Diego, CA
- 1992 | MD
New York Medical College, New York, NY

Residency

- 1993-1996 | Ophthalmology, University of California, Irvine, UC
Irvine Medical Center, Irvine, CA

Fellowships

- 1996 | Refractive Surgery & Phacoemulsification,
Instituto Zaldivar, Mendoza, Argentina
- 1997 | Ophthalmic Plastic & Reconstructive Surgery,
David P. Tenzel, MD, Miami, FL

Board Certification

- 1993 | National Board of Medical Examiners
- 1998 | American Board of Ophthalmology

Society Affiliations

American Academy of Ophthalmology, Fellow
American Society of Cataract and Refractive Surgery, Member
American College of Ophthalmic Surgeons, Founding Member
Southern California College of Optometry, Preceptor
Alpha Omega Alpha, Medical Honors Society

Academic Position

UCLA, Jules Stein Eye Institute- Assistant Clinical
Professor of Ophthalmology

Hospital Affiliations

Northridge Hospital Medical Center (Active)
Freedom Vision Surgery Center

Awards

- 2011 | LA's Top Docs 2011
- 2001-Present | America's Top Ophthalmologists
- 2010 | Best Ophthalmologist Southern California
- 2010 | KCAL9, KCOP 13 Best of LA TV


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Mitchell C. Shultz, M.D
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18350 Roscoe Blvd., Suite 101 ♦ Northridge, CA 91325 ♦ Phone: (818) 349-8300 ♦ Fax: (818) 349-2214

WWW.SHULTZ-CHANG.COM

Occupation: Ophthalmologist
Specialty: Cataract & Refractive Surgery

Practice Locations: 18350 Roscoe Blvd., Suite 101, Northridge, CA 91325
100 E. California Ave, Pasadena CA 91105

Board Certification: American Board of Ophthalmology, 1998 (renewal 2018)
National Board of Medical Examiners, 1993

Society Affiliations: American Academy of Ophthalmology, Fellow
American Society of Cataract and Refractive Surgery, Member
American College of Ophthalmic Surgeons, Founding Member
Southern California College of Optometry- Preceptor
Alpha Omega Alpha, Medical Honors Society

Board Memberships: Cataract & Refractive Surgery Today Editorial Board
Freedom Vision Surgery Center, Board Member
Medical Director California LASIK Center, Pasadena CA

Journal Affiliations: Cataract & Refractive Surgery Today Editorial Board & Peer
Review Editor

Consulting Appointments:
Bausch & Lomb Surgical, Consultant and KOL
Valeant Pharmaceuticals, Consultant and KOL
AMO Consultant on Tecnis Toric IOL
Allergan, KOL/Speakers Bureau
Alcon, KOL/Speakers Bureau

Academic Position: UCLA, Jules Stein Eye Institute- Assistant Clinical Professor of
Ophthalmology

Hospital Staff: Northridge Hospital Medical Center (Active)
 Chief of Ophthalmology Division, NHMC July 2008 – 2010
 Freedom Vision Surgery Center
 California LASIK Center

Fellowships: **Instituto Zaldivar**
 Refractive Surgery & Phacoemulsification
 July 1996 – December 1996
 Mendoza, Argentina

David P. Tenzel, M.D.
 Ophthalmic Plastic & Reconstructive Surgery
 Jan 1997- July 1997
 North Miami, Florida

Pioneering Research: Synthetic Keratophakia, Anamed (Revision Optics)
 Intacs for Keratoconus, Keravision Inc
 Calibrated LASIK blade technology, Medlogics Inc
 Baikoff Phakic IOL design modifications, Chiron Vision

Research Experience: Consultant- Anamed, Permavision Synthetic Keratophakia
 Consultant- Med-Logics, Calibrated Keratome blades
 Co-Investigator- Presby Corp, SRP Study
 Co-Investigator- Ophtec, Artisan Lens for High Myopia
 Co-Investigator- Keravision, INTACS for Myopia
 Co-Investigator- VISX, LASIK Hyperopia± Astigmatism
 Co-Investigator- VISX, LASIK Mixed Astigmatism
 Consultant- Pfizer-Parmacia, Technis Lens
 Consultant- Alcon, Higher Order Aberration Lens
 Consultant- Ista Pharmaceuticals
 Consultant- AMO Tecnis Toric IOL (phase 4)
 Investigator – B&L Trulign Toric IOL (phase 4)

Awards: LA's Top Docs 2011
 America's Top Ophthalmologists 2001- present
 Best Ophthalmologist Southern California 2010, KCal 9, KCOP 13
 Best of LA TV.
 Long Beach Research Foundation Small Grant, 1996

Major Medical Meeting Presentations:

ASCRS 2016, Enhanced Depth of Focus with single piece monofocal hydrophobic acrylic IOL
ASCRS 2016 Effective phaco time in FLACS vs Traditional Cataract surgery with venturi based phacoemulsification.
AAO 2015 Las Vegas, Speaker for B&L Surgical Booth Presentation
AAO 2015 Las Vegas, Optimal Outcomes Summit B&L Surgical Instructor, Panelist.
Hawaiian Eye Society, Sept 2015 Guest Lecturer
Bausch & Lomb Surgical, Speaker at Annual Sales Meeting 2015
ISTA and B&L SAGE meeting participant/consultant 2011, 2012, 2013
Jules Stein Meeting 2012, Management of Complex Cataracts
Jules Stein Meeting 2011, Management of Complex Cataracts: Surgical Video Presentations on: Pediatric Cataracts, Mature White Cataracts, Pseudoexfoliation Syndrome and Scleral Fixation of IOLs. The use of Malyugin Rings, Capsule Tension Rings and Micro surgical instruments for improved outcomes.

ASCRS 2002, Corneal Implant Session: Intacs for Keratoconus, Case study.

ASCRS 2002, Corneal Implant Session: Visual Outcomes and patient satisfaction with Keravision Intacs for Myopia -1.0 to -3.00 SE.

ISRS Summer Symposium 2001, Refractive Surgery Session: Best Paper of Session (BPOS), "*PermaVision™ Intraström Corneal Implant: Biocompatibility Study 12-Month Results*" ISRS Summer Symposium, Orlando, July 28, 2001.

ASCRS 2001, Refractive Surgery Session: Best Paper of Session (BPOS), "*PermaVision™ Intraström Corneal Implant: Biocompatibility Study 12-Month Results*" ASCRS Symposium, San Diego, April 29, 2001.

ISRS 2000, Refractive Surgery Session: Best Paper of Session (BPOS), "*PermaVision™ Intraström Corneal Implant: Biocompatibility Study 6-Month Results*" ISRS Symposium, Dallas, October 21, 2000.

ASCRS 1997, Refractive Surgery Session:

Best Paper of Session (BPOS), "*Intraocular lens power calculations for eyes with extreme myopia*" ASCRS Symposium, Boston, April 28, 1997.

ASCRS 1997, Refractive Surgery Session:
Best Paper of Session (BPOS), "*LASIK vs. PRK using the Nidek EC-5000 to treat myopia and astigmatism*" ASCRS Symposium, Boston, April 28, 1997.

Lecturing Experience (Local, Regional and National non meeting events):

Alcon Surgical Speakers Bureau Lectures Given (Local):
Restor 3.0 the benefits of improved intermediate vision
Alcon IQ Toric the benefits of Toric IOLs over LRIs
Refractive IOLs, Lens selection and Happy Patients

Allergan Speakers Bureau Lectures Given (Regional):
Dry eye management, How to achieve success with Restasis
Optimizing Refractive Surgical outcomes with Restasis

Ista Speakers Bureau Lectures Given (National & Regional):
Xibrom, Bromday & Prolensa the benefits of pretreatment for reduced ocular pain and inflammation post operatively

Bausch & Lomb Speakers Bureau (National & Regional):
Prolensa & Lotemax gel the benefits of pretreatment for reduced ocular pain and inflammation post operatively
Premium Vision Surgery with Victus, Trulign, Crystalens, enVista and Stellaris platforms.

Education:

Residency
UNIVERSITY OF CALIFORNIA, IRVINE
Ophthalmology, 1993-1996
UC Irvine Medical Center

Honors: Chief Resident, July 1995- June 1996

Internship
UNIVERSITY OF CALIFORNIA, LOS ANGELES
Internal Medicine, 1992-1993
UCLA Center for Health Sciences

Medical School
NEW YORK MEDICAL COLLEGE
Medical Doctor (M.D.), 1992

Honors: Alpha Omega Alpha Medical Honors Society,
Inducted October 1991

College
UNIVERSITY OF CALIFORNIA, SAN DIEGO
Bachelor of Arts, General Biology and Political Science, 1988

Honors: Provost Honors, 1987-88

Presentations & Publications:

(Current through March 2013. Additional Articles available upon request)

1. Update on Laser Cataract Surgery, Mitchell Shultz, MD, Peer Review, CRST March 2013
2. Multifocal IOLs Are Ideal for Patients Who Cannot Wear Spectacles, Mitchell Shultz MD, CRST January 2013.
3. Intraoperative Floppy Iris Syndrome: Update 2012, Peer Review CRST, October 2012.
4. Current Techniques and Novel Treatments in Ocular Surface Reconstruction, Peer Review, CRST April 2012.
5. Presbyopia Update 2012: New Technologies and Novel Treatments. Peer Review, CRST February 2012.
6. Minimally Invasive Glaucoma Surgery, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, November 2011.
7. Abstinence From Contact Lenses Prior to Refractive Surgery, S Dell MD, M Kontos MD, C Kraff MD, L Probst MD, J Lehr OD, D Holsted OD, J Strum OD, M Shultz MD and K Stonecipher, CRST October 2011.
8. Spectacle Independence After IOL Surgery, M Konos MD, J Pepose MD, M Shultz MD, S Updegraff MD, J Whitman MD, T Woodham MD, CRST August 2011.
9. Update on Femtosecond Technology, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, July 2011
10. Endothelial Replacement, Descemet's Membrane Endothelial Keratoplasty, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, April 2011.
11. Descemet's Stripping Automated Endothelial Keratoplasty, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, March 2011.
12. Is the Assault on LASIK Justified? By Robert K. Maloney, MD; Jay S. Pepose, MD, PHD; Louis E. Probst, MD; Mitchell C. Shultz, MD; and J. Trevor Woodhams, MD, CRST November 2010.

13. Treating Ocular Surface Disease, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, November 2010.
14. Corneal Collagen Cross-Linking: a Review, Malaika David, Mitchell C. Shultz MD, CRST Peer Review, October 2010.
15. Postoperative Endophthalmitis, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, August 2010.
16. Assessing Post RK Eyes: How do you determine the keratometric value and calculate IOL power in eyes with previous RK?
By Steven J. Dell, MD; Douglas D. Koch, MD; Richard J. Mackool, MD; Samuel Masket, MD; Mitchell C. Shultz, MD; and J. Trevor Woohams, MD, CRST, July 2010.
17. Peer Review: 2010 Dry Eye Update, Malaika David, Mitchell C. Shultz, MD, CRST Peer Review, July 2010
18. Success Rates of Combined Phacotrabeculectomies Versus Separately Performed Procedures, Malaika David, Mitchell C. Shultz, M.D. CRST Peer Review Section, May 2010.
19. Retinal Detachment Rates After Cataract or Presbyopic Lens Extraction, Malaika David, Mitchell C. Shultz, M.D. CRST Peer Review Section, April 2010.
20. Toric IOLs, Malaika David, Mitchell C. Shultz, M.D. CRST Peer Review Section, February 2010.
21. Presbyopia Correcting IOLs, Malaika David, Mitchell C. Shultz, M.D. CRST Peer Review Section, January 2010.
22. Accomodating IOLs, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, October 2009.
23. Corneal Collagen Cross-linking for Keratoconus and Ectasia, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, August 2009.
24. Intracorneal Implants for Keratoconus and Ectasia, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, July 2009.
25. Ectasia after LASIK, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, May 2009.
26. Phakic IOLs, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, April 2009.
27. NSAIDS, CME and Cataracts Surgery, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, January 2009.
28. The Role of Diet and Nutritional Supplements in preventing Cataracts, Julia T. Lewandowski, Mitchell C. Shultz, M.D. CRST Peer Review Section, September 2008.
29. Femtosecond Lasers and Corneal Transplant, Mitchell C. Shultz, M.D. CRST Peer Review Section, July 2008.
30. Indocyanine Green and Healon5, Combining Capsular dye and viscoelastic can minimize the risk of corneal toxicity when creating a capsulorhexis in cases of mature cataracts,
31. Recurrent Regression after Hyperopic LASIK. Mitchell C. Shultz, M.D. CRST, June 2002, p.45-46.

32. Sutureless Synthetic Keratophakia: The dawn of a new horizon in refractive surgery. Mitchell C. Shultz, M.D. CRST Nov/Dec 2001, p.26-28.
33. PermaVision™ Intrastromal Corneal Implant: Biocompatibility Study 12-Month Results. Mitchell C. Shultz, MD. Presented at ISRS Summer Symposium, Orlando, July 28, 2001.
34. PermaVision™ Synthetic Keratophakia: Early International Results for Hyperopia +1.00 to +6.00. Mitchell C. Shultz, MD. Presented at ASCRS Symposium, San Diego, May 1, 2001.
35. PermaVision™ Intrastromal Corneal Implant: Biocompatibility Study 12-Month Results. Mitchell C. Shultz, MD. Presented at ASCRS Symposium, San Diego, April 29, 2001.
36. Calibrated LASIK Blades help raise performance bar. Mitchell Shultz, M.D. Ophthalmology Times Vol 26:8, p. 105.
37. PermaVision™ Intrastromal Corneal Implant: Biocompatibility Study 6-Month Results. Mitchell C. Shultz, MD. Dallas: ISRS Winter Symposium; 2000.
38. Shultz, M: Additive Refractive Surgery: Products and Techniques. "Prospective non-randomized investigation of Intacs vs. LASIK initial 6 month results". Boston: Ophthalmology Interactive; 2000. (CD-ROM)
39. Intraocular lens power calculations for eyes with extreme myopia. Roberto Zaldivar MD, Mitchell Shultz MD, Johnathan Davidorf MD, Jack Holladay MD. JCRS Vol 26:5, pp. 668-74.
40. PermaVision™ Intrastromal Corneal Implant: A new surgical approach to hyperopia. Mitchell Shultz MD. Boston: May 2000 ASCRS, Abstract 254.
41. Prospective non-randomized investigation of Intacs vs. LASIK initial 6-month results. Mitchell Shultz, MD, Joseph Flemming, MD, Dan Tran, MD. Boston: May 2000 ASCRS, Abstract 762.
42. Intacs Co-Management for Optometry with Wet-lab. Course given at Aris Laser Vision Institute, Encino: August, September & October 1999.
43. Expanding Optometry's Role Beyond LASIK: Intrastromal Ring and Phakic IOL's. Course given at Aris Vision Institute, Santa Monica, February & March 1999.
44. Alternative Surgical Techniques for Vision Correction, Presented at Northridge Hospital Medical Center Health Speak, March 1999.
45. Laser Vision Correction Alternatives, Presented at Northridge Hospital Medical Center Health Speak, December 1998.
46. Laser in-situ Keratomileusis for Low Myopia and Astigmatism with a Spot Scanning Excimer Laser. Mitchell Shultz MD, Roberto Zaldivar MD, Jonathan Davidorf MD. JRS Vol 13:7, pp. 614-19.
47. Intraocular lens power calculations for eyes with extreme myopia. Mitchell Shultz MD, Roberto Zaldivar, Johnathan Davidorf MD. Presented at ASCRS 1997, abstract 378.
48. LASIK versus PRK using the Nidek EC 500 to treat myopia and astigmatism. Roberto Zaldivar MD, Jonathan Davidorf MD, Mitchell Shultz MD. Submitted to JCRS. Presented at ASCRS 1997, abstract 50.

49. Intraoperative complications of LASIK after the learning curve: A prospective study of 200 eyes. Jonathan Davidorf MD, Roberto Zaldivar MD, Mitchell Shultz MD. Submitted to JCRS. Presented at ASCRS 1997, abstract 280.
50. LASIK for high myopia and astigmatism: Report of 133 eyes treated with the Nidek EC-5000. Roberto Zaldivar MD, Jonathan Davidorf MD, Mitchell Shultz MD. Submitted to JCRS. Presented at ASCRS 1997, abstract 137.
51. Correction of hyperopia and mixed astigmatism using the Chiron Technolas Keracor 117 PlanoScan. Mitchell Shultz MD, Roberto Zaldivar MD, Jonathan Davidorf MD. Presented at ASCRS 1997, abstract 237.
52. Phakic IOL (ICL) to correct myopia and hyperopia: 3.5-year follow-up. Roberto Zaldivar MD, Jonathan Davidorf MD, Mitchell Shultz MD. Presented at ASCRS 1997, abstract 335.
53. LASIK the patient's perspective. Presented at ISRS Symposium, Buenos Aires, August 1996.
54. The role of phototherapeutic keratectomy in the treatment of acanthamoeba keratitis. Mitchell Shultz MD, Alice Cheng-Bennett MD, PhD, Mary Cote MD, Ronald Gaster MD, Richard Keates MD. Presented at UC Irvine Resident Research day, 1996.
55. Capsulotomy by high frequency radiowave endodiathermy. Mitchell Shultz MD, Debra Tennen MD, Greg Feinerman, Richard Keates MD. Presented at UC Irvine Resident Research day, 1995.
56. Comparison of capsulotomy techniques by high frequency radiowave endodiathermy, Nd-YAG and capsulorhexis. Mitchell Shultz MD, Michael Sheaty, Mary Davidian MD, Richard Keates MD. Presented at UC Irvine Resident Research day, 1994.
57. The role of novel cytochrome P450 dependent arachidonic acid metabolites, 12(R)-HETE and 12(R)-DH-HETE, in mediating corneal inflammation by causing edema and neovascularization. Michael Connor, Mitchell Shultz, Michal Schwartzman PhD, Michael Dunn MD. Presented ARVO, 1992.
58. Irreversible translocation of protein kinase C in response to phorbol esters and calcium. Lawrence Brunton PhD, Louis Speizer PhD, Michael Thompson, Joan Kanter, Mitchell Shultz. Submitted to Journal of Biology, Presents at ARVO 1988.



OPTOMETRY

STATE BOARD OF OPTOMETRY
2450 DEL PASO ROAD, SUITE 105, SACRAMENTO, CA 95834
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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>OCT-Tung Baby! Part Deux</u>	Course Presentation Date <u>10/02/2016</u>
---	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) _____ (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@Retina2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Kristie</u> (First) <u>Lin</u> (Last) _____ (Middle)	
License Number <u>A114433</u>	License Type <u>MD</u>
Phone Number (800) <u>898-2020</u>	Email Address <u>KLIN@retina2020.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

[Signature]
Signature of Course Provider

12/21/16
Date



Retina Research Foundation
of California

Date: 10/02/2016

OCT-Tung Baby! Part Deux

My talk was about OCT angiography. I reviewed the definition and clinical applications. In particular how it differs from standard OCT and also fluorescein angiography. I also reviewed how OCT angiography works and the science behind the acquisition of images. I then reviewed clinical applications with case studies for macular degeneration, diabetic retinopathy, central serous chorioretinopathy.

Kristie Lin, MD.

OCT-Tung Baby! Park Deux

- Conventional OCT
- Once in a Blood Red Moon
- Oct Angiography- What?
 - Definition
- Fluorescein Angiography
 - Initially described in 1961
 - Rapidly became the most important imaging technique in retina
 - Allows identification and classification of various retinal and choroidal disorders
 - Invasive, intravenous use of a needle
 - Special dye, fluorescein is injected into the veins
 - Risk of allergic reaction that may potentially be fatal
- OCT Angiography
 - Non-invasive
 - Fast
 - Can potentially measure flow
 - Depth resolution
- Approaches to OCT Angiography
 - Phase Doppler or Phase Variance Based
 - Uses Doppler shift or "phase" information to capture image.
 - Magnitude or Amplitude based
 - Uses variance of OCT magnitude signal or "decorrelation" to capture image
 - Complex: Combination of both
- Acquisition Methods for OCT Angiography
 - Spectral Domain high-resolution OCT
 - Swept Source ultra-high resolution OCT
- Color Coded For Depth
 - Anterior to posterior = red, green, blue
- Retinal and Choroidal Vasculature: FA vs. OCT-A
- Depth Resolved Imaging
- OCT Angiography in Dry AMD
- OCT Angiography in Wet AMD
- OCT Angiography in Diabetic Retinopathy
- Foveal Avascular Zone
 - 10 minutes vs. 4 seconds
- OCT Angiography of NVD
- Conclusion:
 - Potential and significant advance in retinal imaging

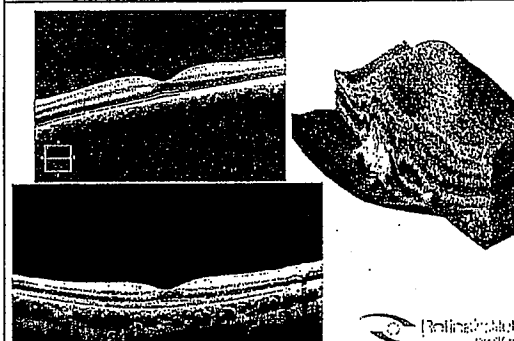
- Non-invasive method for detailed analysis of retinal and potentially choroidal micro-circulation
- May open the door to automated and quantitative analysis of retinal microvasculature

OCT-Tung Baby! Part Deux

Kristie L. Lin, MD
Okularfest 2016



Conventional OCT



Once in a Blood Red Moon

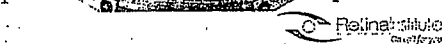


OCT Angiography



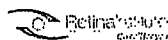
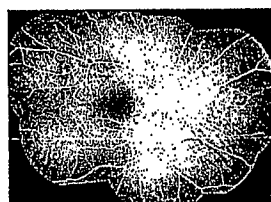
- Definition: A non-invasive method of obtaining OCT images without the need for contrast agents.

ction of
n OCT
ed image
ed image
techniques



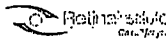
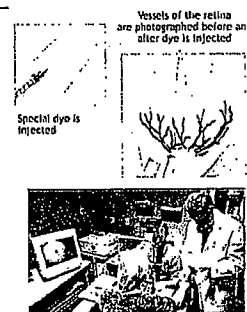
Fluorescein Angiography

- Initially described in 1961
- Rapidly became the most important imaging technique in retina
- Allows identification and classification of various retinal and choroidal disorders



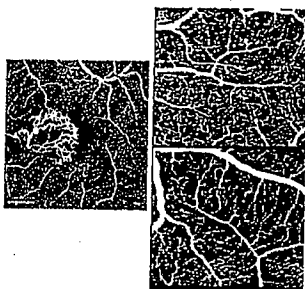
Fluorescein Angiography

- Invasive, intravenous use of a needle
- Special dye, fluorescein is injected into the veins
- Risk of allergic reaction that may potentially be fatal



OCT Angiography

- Non-invasive
- Fast
- Can potentially measure flow
- Depth resolution



Retinal Institute
Baltimore, MD

Approaches to OCT Angiography

1. Phase Doppler or Phase Variance Based
 - Uses doppler shift or "phase" information to capture image



2. Magnitude or Amplitude Based
 - Uses variance of OCT magnitude signal or "decorrelation" to capture image



3. Complex: combination of both

Retinal Institute
Baltimore, MD

Acquisition Methods for OCT Angiography

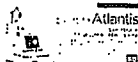
1. Spectral Domain high-resolution OCT



vs



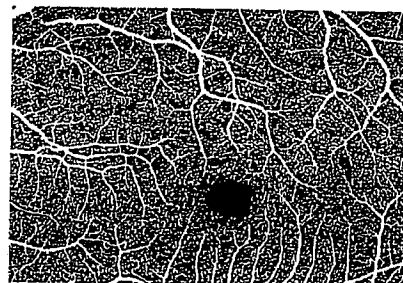
2. Swept Source ultra-high resolution OCT



Retinal Institute
Baltimore, MD

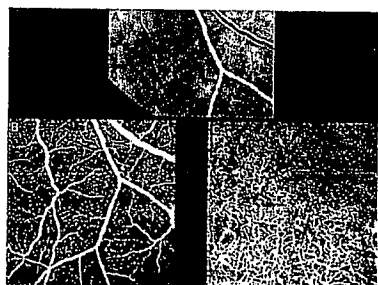
Color Coded for Depth

(anterior to posterior = red, green, blue)



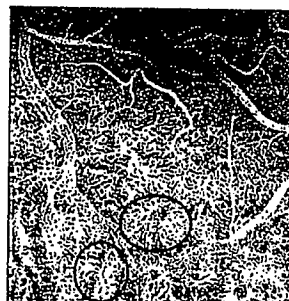
Retinal Institute
Baltimore, MD

Retinal and Choroidal Vasculature: FA vs. OCT-A



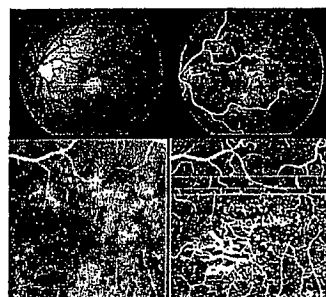
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Depth Resolved Imaging



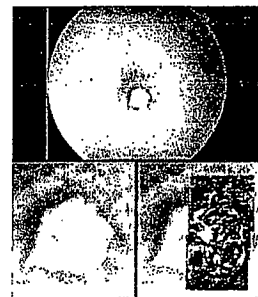
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OCT Angiography in Dry AMD



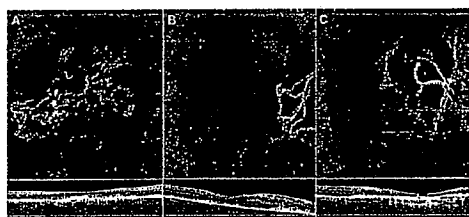
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OCT Angiography in Wet AMD



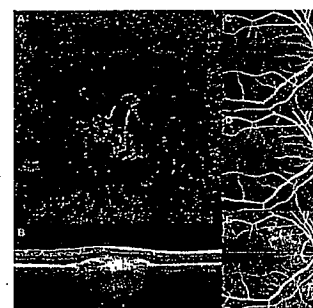
Retina@St Luke's
Care@St Luke's

OCT Angiography in Wet AMD



Retina@St Luke's
Care@St Luke's

OCT Angiography in Wet AMD



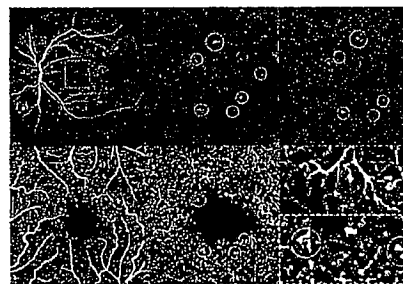
Retina@St Luke's
Care@St Luke's

OCT Angiography in Diabetic Retinopathy



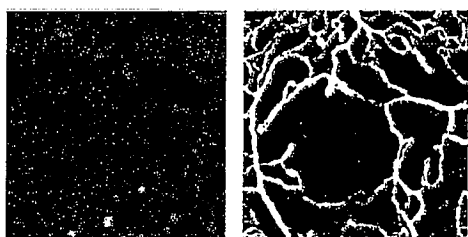
Retina@St Luke's
Care@St Luke's

OCT Angiography in Diabetic Retinopathy



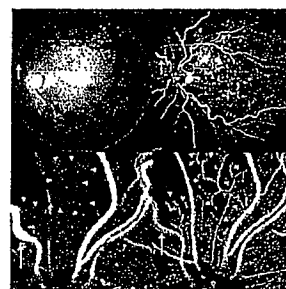
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Foveal Avascular Zone: 10 minutes vs. 4 seconds



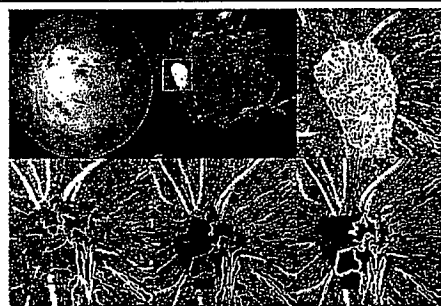
RetinalVue
6/10/15

OCT Angiography in Diabetic Retinopathy



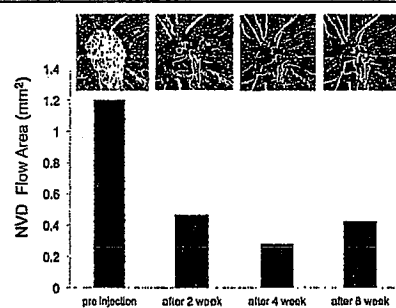
RetinalVue
6/10/15

OCT Angiography of NVD



RetinalVue
6/10/15

OCT Angiography of NVD



RetinalVue
6/10/15

Conclusion

- Potential and significant advance in retinal imaging
- Non-invasive method for detailed analysis of retinal and potentially choroidal micro-circulation
- May open the door to automated and quantitative analysis of retinal microvasculature

"To boldly go where no man has gone before."
—Captain James T. Kirk



RetinalVue
6/10/15

Kristie Lin, MD

Retina Institute Surgeon

Dr. Kristie Lin is a second generation American of Chinese descent. She graduated with honors in microbiology from the University of California at Davis. She went on to receive her medical degree from the highly prestigious Johns Hopkins University School of Medicine, which has consistently been ranked one of the nation's top medical schools by U.S. News and World Report.



During her ophthalmology residency at New York Medical College, St. Vincent's, Hospital, she was chosen to be Chief Resident. In this position, Dr. Lin led the residents in their tasks for the needs of the department and the community. Dr. Lin was then awarded the privilege of training in vitreoretinal surgery as a fellow at Harvard Medical School, Massachusetts Eye and Ear Infirmary. She trained with the world-renowned Dr. Tatsuo Hirose and Dr. Arnold Kroll, pioneers of surgical and pediatric retina.

Prior to relocating back to her native California, Dr. Lin was practicing surgical retina in New Haven, Connecticut where she was also an attending physician at Yale-New Haven Hospital. She was actively teaching Yale medical students and worked with the Yale ophthalmology residents and fellows.

Dr. Lin received various research fellowships including the Chinese American Medical Society Scholarship, Albert Schweitzer Fellowship, Soros Service for Community Health Fellowship, Margaret and Robert Weiss, MD Endowed Scholarship, and Johns Hopkins University School of Medicine Dean's Research Scholarship.

Dr. Lin has published many peer-reviewed articles and has presented at conferences throughout the nation. Her clinical expertise includes complex retinal detachment repair, pediatric retina including retinopathy of premature and revision surgery for macular hole and other retinal disorders. She was known in the Yale community as the surgeon among surgeons and specialized in second opinions.

Dr. Lin is board-certified by the American Academy of Ophthalmology and is a member of the American Society of Retina Specialists, American Academy of Ophthalmology, Women in Ophthalmology, and the Chinese American Medical Society. She is also fluent in Cantonese, Spanish and Mandarin.

800-898-2020



Biography
Kristie Lin, MD

800-898-2020

klin@retina2020.com

Cell: 626-272-4408

EDUCATION

1999 Bachelor of Science, University of California, Davis, CA
2004 Medical Degree, Johns Hopkins University School of Medicine, Baltimore, MD

PROFESSIONAL TRAINING

2004-05 Internship, Greater Baltimore Medical Center
Department of Internal Medicine, Baltimore, MD
2005-08 Residency, St. Vincent's Hospital, Department of Ophthalmology,
New York Medical College, Manhattan, NY

FELLOWSHIPS

2009 Massachusetts Eye and Ear Infirmary, Harvard Medical School, Cambridge, MA

BOARD CERTIFICATION

2009 American Board of Ophthalmology

PROFESSIONAL AFFILIATIONS

- > American Academy of Ophthalmology
- > Association for Research in Vision and Ophthalmology
- > Connecticut Society of Eye Physicians
- > New York State Ophthalmological Society
- > Massachusetts Medical Society
- > Women in Ophthalmology
- > Contact Lens Association of Ophthalmologists
- > American Medical Association
- > Chinese American Medical Society

UNIVERSITY & HOSPITAL POSITIONS

- > 2008-09 Massachusetts Eye and Ear Infirmary, Harvard Medical School,
Assistant in Ophthalmology, Associate Staff
- > 2009-11 Yale-New Haven Hospital, Yale University School of Medicine,
Assistant Clinical Professor of Ophthalmology, Attending Physician

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CONTINUING EDUCATION COURSE APPROVAL APPLICATION

\$50 Mandatory Fee

Pursuant to California Code of Regulations (CCR) § 1536, the Board will approve continuing education (CE) courses after receiving the applicable fee, the requested information below and it has been determined that the course meets criteria specified in CCR § 1536(g).

In addition to the information requested below, please attach a copy of the course schedule, a detailed course outline and presentation materials (e.g., PowerPoint presentation). Applications must be submitted 45 days prior to the course presentation date.

Please type or print clearly.

Course Title <u>Minimally Invasive Glaucoma Surgery</u>	Course Presentation Date <u>11/02/2016</u>
--	---

Course Provider Contact Information

Provider Name <u>Christina</u> (First) <u>Seyfi</u> (Last) <u></u> (Middle)	
Provider Mailing Address Street <u>100 E. California Blvd.</u> City <u>Pasadena</u> State <u>CA</u> Zip <u>91105</u>	
Provider Email Address <u>KSEYFI@retna2020.com</u>	
Will the proposed course be open to all California licensed optometrists?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO
Do you agree to maintain and furnish to the Board and/or attending licensee such records of course content and attendance as the Board requires, for a period of at least three years from the date of course presentation?	<input checked="" type="checkbox"/> YES <input type="checkbox"/> NO

Course Instructor Information

Please provide the information below and attach the curriculum vitae for each instructor or lecturer involved in the course. If there are more instructors in the course, please provide the requested information on a separate sheet of paper.

Instructor Name <u>Gerald</u> (First) <u>Schultz</u> (Last) <u></u> (Middle)	
License Number <u>G14295</u>	License Type <u>MD</u>
Phone Number <u>(760) 342-9991</u>	Email Address <u>geraldschultzmd@aol.com</u>

I declare under penalty of perjury under the laws of the State of California that all the information submitted on this form and on any accompanying attachments submitted is true and correct.

Signature of Course Provider [Signature]

Date 12/21/16



**Retina Research Foundation
of California**

Date: 10/02/2016

Minimally Invasive Glaucoma Surgery

This lecture provided information on minimally invasive glaucoma surgery. Canuloplasty and Trabectome were discussed. MIGS is effective, safe, can be combined with phaco-cataract extraction. In addition, it does not obviate future glaucoma procedures and is non-penetrating (low complications). Clinical results were shared to support the information provided in addition to drawbacks and alternative methods to each method discussed.

Gerald Schultz, MD.

Minimally Invasive Glaucoma Surgery
(MIGS)

- Conventional Sequence
- Topical glaucoma solutions
- Laser trabeculoplasty (Argon or SLT)
- Minimally Invasive Glaucoma Surgery (MIGS)
 - Canuloplasty
 - Trabectome
- Filtration procedures
 - Trabeculectomy
 - Express stent
 - Baerveldt, Molteno, Ahmed tube shunts/valve
- Conventional Sequence
- Topical glaucoma solutions
- Laser trabeculoplasty (Argon or SLT)
- Minimally Invasive Glaucoma Surgery (MIGS)
 - Canuloplasty
 - Trabectome
- Filtration procedures
 - Trabeculectomy
 - Express stent
 - Baerveldt, Molteno, Ahmed plates
- Why Consider MIGS?
- Effective, safe, minimally-invasive
- May achieve goal of 14 – 17 mm Hg
- Blebless – eliminates FB feeling & risk of late onset endophthalmitis
- Can be combined with phaco - cataract extraction
- Does not obviate future glaucoma procedures
- Non-Penetrating – low complications
 - Eliminates post-op flat chambers seen with trabeculectomies
 - Considerations
- What is the extent of aqueous flow circumferentially in Schlemm's Canal and does it change in glaucoma?
- How much resistance to aqueous flow occurs distal to Schlemm's Canal? Effect of collector channels?
- What is the effect of surgical trauma to SC and the subsequent wound response?
- Why Consider Canaloplasty?
- Post Op care is similar to cataract surgery
- No reported sight threatening complications in 3 Year FDA data
- Sustained IOP reduction- 3 year data
- Cataract progression less than reported for trabeculectomy
- VA loss of 0-2 lines is recovered quickly

- MIGS Patient Selection

Indications

- Open-Angle Glaucoma (OAG)
- First-line option prior/after laser surgery
- Non-compliant or intolerant to meds
 - Reduce or eliminate eye medication for glaucoma
 - Useful in developing countries with inadequate access to affordable glaucoma medication
- Exfoliative glaucoma
- Failed trabeculectomy in fellow eye
- Failing SLT or ALT
- Pigmentary glaucoma
- MIGS Patient Selection

Contraindications

- Neovascular glaucoma
- Angle-closure glaucoma
- Angle recession / Peripheral Anterior Synechiae (PAS)
- Prior trabeculectomies and ALT are OK
 - could be more challenging (not a great first case)
- Purpose and mechanism
- Canaloplasty
 - Opens a collapsed Schlemm's canal 360 degrees with a suture
- Trabectome
 - Opens the canal by removing a section of the wall (trabecular meshwork)
- Gives the aqueous access to the collection channels
- Does not create a filtration bleb
- Disadvantages of Canaloplasty
- Learning curve
 - Finding the canal can be difficult
 - 360 catheterization may be blocked by PAS or may go into collector channels
- Surgery requires vigorous attention to details
- Best to have experienced canaloplasty surgeon or company representative during initial cases
- Micro-catheters are disposable and expensive
 - Robert Stegmann's original procedure in rural areas was viscocanaloplasty – using Healon without the disposable catheter and 9-0 prolene suture
- Considerations
- What is the extent of aqueous flow circumferentially in Schlemm's Canal and does it change in glaucoma?
- How much resistance to aqueous flow occurs distal to Schlemm's Canal? Effect of collector channels?
- What is the effect of surgical trauma to SC and the subsequent wound response?
- Interventional Ophthalmology

World's smallest composite microcatheter

- 200 – 350 microns

Atraumatic micro-needle access device for aspiration and infusion of fluids to the subretinal space

- 125 microns

Access to a wide range of previously inaccessible anatomical structures:

- Schlemm's canal
- Sub-retinal space
- Suprachoroidal space

- Canaloplasty Microcatheter
- Viscoelastic dilates the canal and collectors
- Passes tensioning suture through canal
- Benefits of Bleb-free IOP Reduction
- Trabeculectomy blebs associated with:
 - Bleb manipulations in 78.2% within 1 yr
 - - 49% massage
 - - 49% suture removal
 - - 31.1% > 1 5FU injection
 - - 25.2% > 1 needling + 5FU
- Endophthalmitis incidence of 1.3%/yr
- Bleb, leak, blebitis, or endophthalmitis incidence of 4.4%/yr
- Late hypotony incidence of 4.0% to 8.5%/yr
- Bleb revision rate of 1.7% to 2.9%/yr
- Bleb dysesthesia rate of 7.6% over 3yrs
- Trabectome
- Purpose
 - Remove a segment of the trabeculum by striping and cauterization
- Trabectome
- Purpose and Mechanism
 - Give the aqueous access to the collection by removing a section of the trabecular meshwork by striping and cauterization
 - No external filtration bleb
 - Medications
- Pre-op – in the OR
- Post- op Pilocarpine 1 – 2 % once a day for about 2 weeks
- Antibiotics qid pre-op and post-op
- Topical steroids as needed to reduce inflammation
- Glaucoma medications as needed
- Trabectome
- Summary – Clinical Results
 - PO duration: 1 – 14 months
 - Combined cataract & trabectome: 14/25
 - Pressure reduction 2 or more mm: 16/25
 - Increase pressure: 5/25

- Achieved target pressure of 14-17 mm Hg: 14
 - Literature – 2-7+ Year Results
 - IOP reduced by 33%
 - Medication reduced in 33- 67%
 - Mosaed, S: European Ophthalmic Review: 2014;8(2):113-9
 - Honkanen, R, Schuman, JS, Loewen, NA: Review and eta-analysis of ab interno trabulectomy outcomes: B J Ophthalmol 2016;**100**:594-600
- Our patients benefited from the procedure, but not even close to these results
- Drawbacks - Trabectome
 - Identification of trabecular meshwork with gonioscopy
 - Piercing and stripping the trabeculum with the trabectome
 - Cost - approximations
 - Console – about 40,000 USD
 - Disposable procedure pack – 413 – 685 USD
 - Handpiece
 - Tubes
 - Keratome
 - Alternative
 - Strip trabecular meshwork with 27 G 1 ½ inch needle with bent tip and side port infusion (AC maintainer)
 - Drawbacks
 - Not as easy to strip as with thermal ablation
 - Without cauterization the trabeculum may regenerate or be replaced with scar tissue
 - Conclusion
 - The Trabectome is a quick, effective instrument to reduce moderately elevated IOP in non-compliant patients and patients intolerant to topical medications
 - The Trabectome eliminates the need for a filtration bleb
 - Filtration blebs
 - Subjects the patient to intra-ocular infections
 - Irritating

Minimally Invasive Glaucoma Surgery (MIGS)

Gerald R. Schultz, MD, FRCOphth
Associate Clinical Professor
Loma Linda School of Medicine

Conventional Sequence

- Topical glaucoma solutions
- Laser trabeculoplasty (Argon or SLT)
- Minimally Invasive Glaucoma Surgery (MIGS)
 - Canuloplasty
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- Filtration procedures
 - Trabeculectomy
 - Express stent
 - Baerveldt, Molteno, Ahmed tube shunts/valve

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Why Consider MIGS?

- Effective, safe, minimally-invasive
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- Can be combined with phaco - cataract extraction
- Does not obviate future glaucoma procedures
- Non-Penetrating – low complications
 - Eliminates post-op flat chambers seen with trabeculectomies



PO day one – flat chamber after cataract extraction
combined with trabeculectomy

Considerations

- What is the extent of aqueous flow circumferentially in Schlemm's Canal and does it change in glaucoma?
- How much resistance to aqueous flow occurs distal to Schlemm's Canal? Effect of collector channels?
- What is the effect of surgical trauma to SC and the subsequent wound response?

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- Cataract progression less than reported for trabeculectomy
- VA loss of 0-2 lines is recovered quickly

MIGS Patient Selection

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 - Reduce or eliminate eye medication for glaucoma
 - Useful in developing countries with inadequate access to affordable glaucoma medication
- Exfoliative glaucoma
- Failed trabeculectomy in fellow eye
- Failing SLT or ALT
- Pigmentary glaucoma

MIGS Patient Selection

Contraindications

- Neovascular glaucoma
- Angle-closure glaucoma
- Angle recession / Peripheral Anterior Synechiae (PAS)
- Prior trabeculectomies and ALT are OK
 - could be more challenging (not a great first case)

Purpose and mechanism

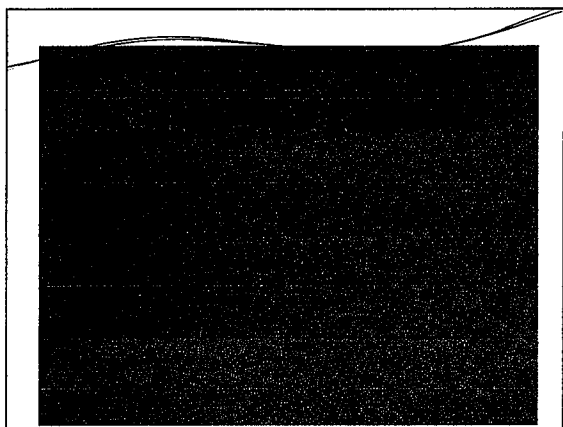
- Canaloplasty
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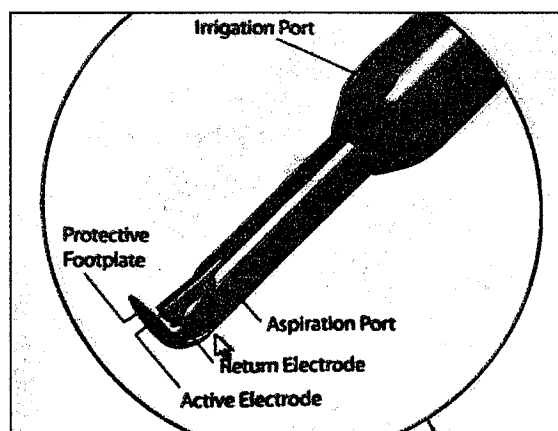
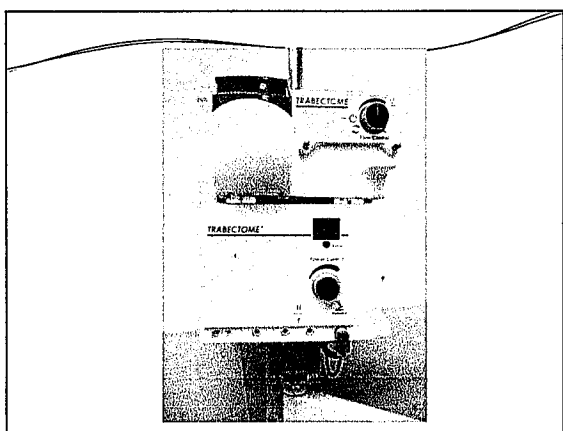
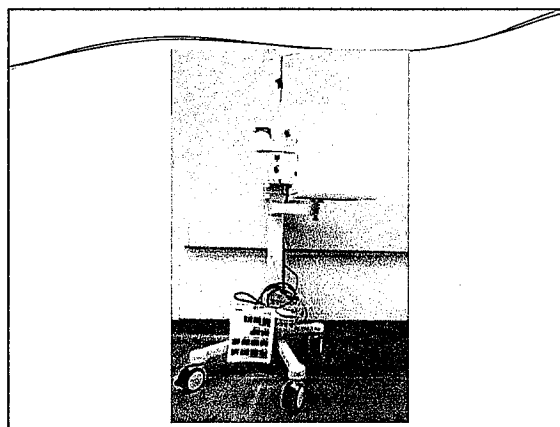


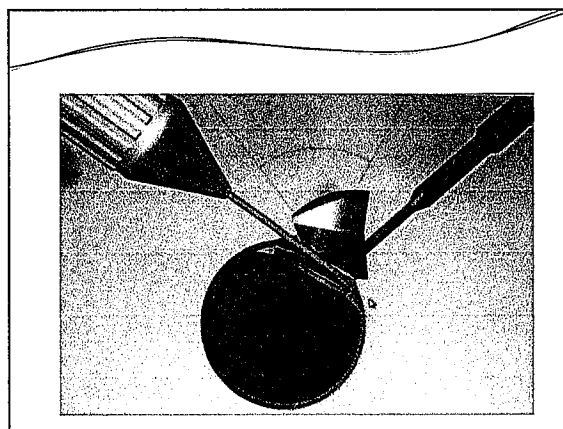
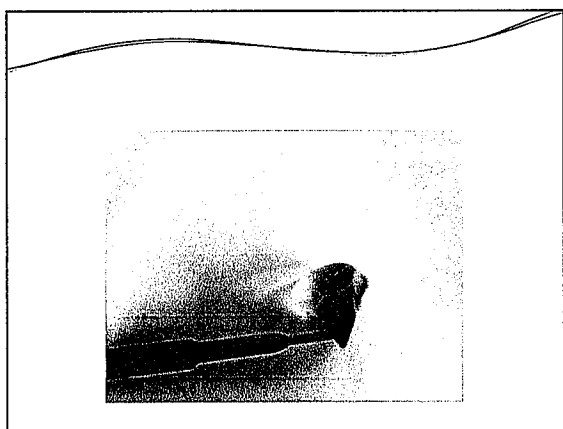
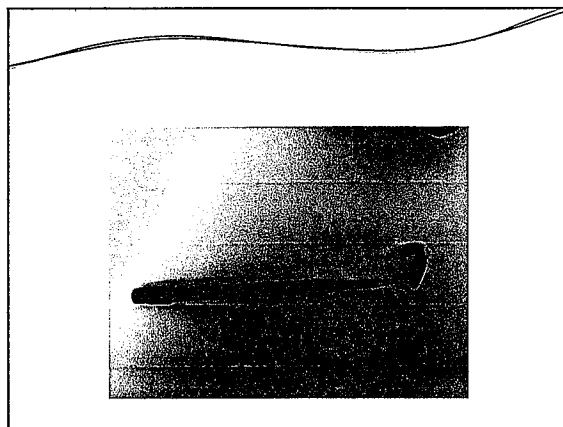
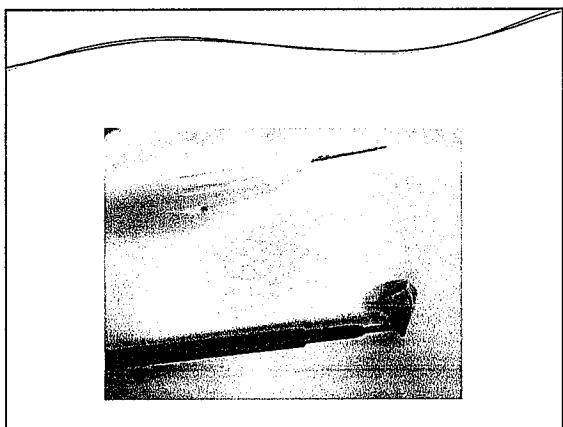
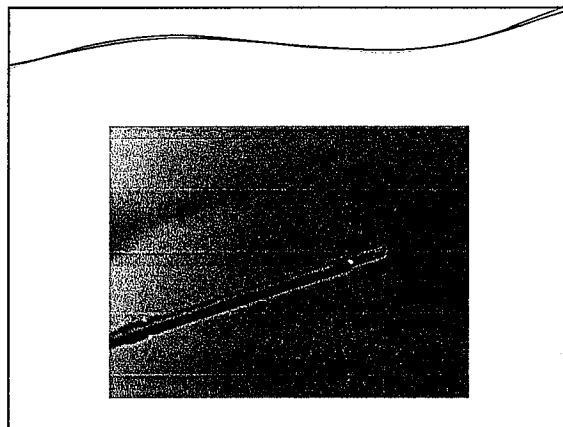
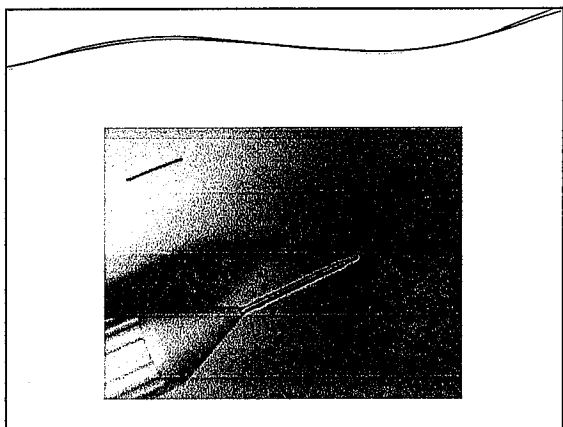
Trabectome

- Purpose
 - Remove a segment of the trabeculum by stripping and cauterization
- X
- X
- X
- x

Trabectome

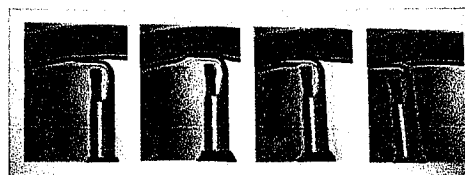
- Purpose and Mechanism
 - Give the aqueous access to the collection by removing a section of the trabecular meshwork by stripping and cauterization
 - No external filtration bleb



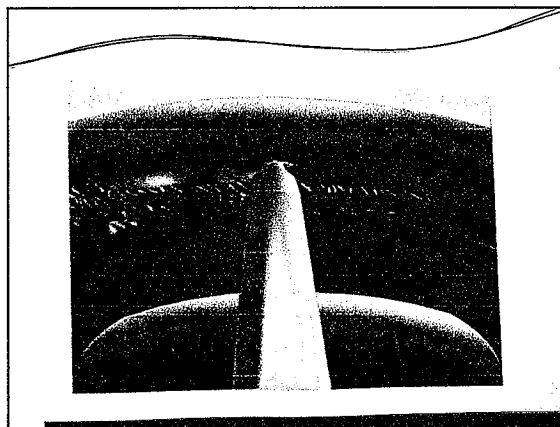
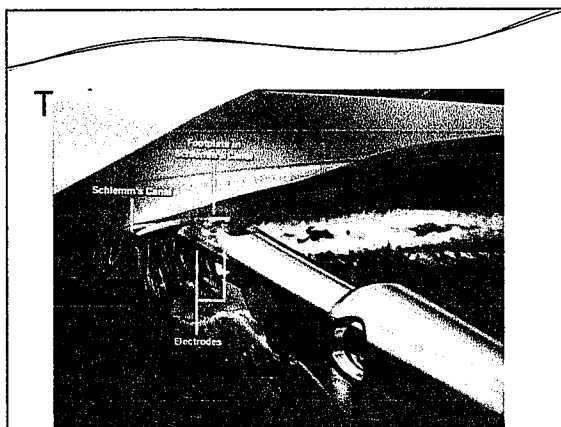


Medications

- Pre-op – in the OR
- Post- op Pilocarpine 1 – 2 % once a day for about 2 weeks
- Antibiotics qid pre-op and post-op
- Topical steroids as needed to reduce inflammation
- Glaucoma medications as needed



- 1) Penetrate the fibers of the trabecular meshwork with needle tip
- 2/ Power: 0.8 to 1.1 watts
- 3) Timing of sweep: 5 – 10 seconds per clock hour (30 degrees)
- 4) 4 clock hours (120 degrees) ideal. 2 clock hours to the left, 2 to the right

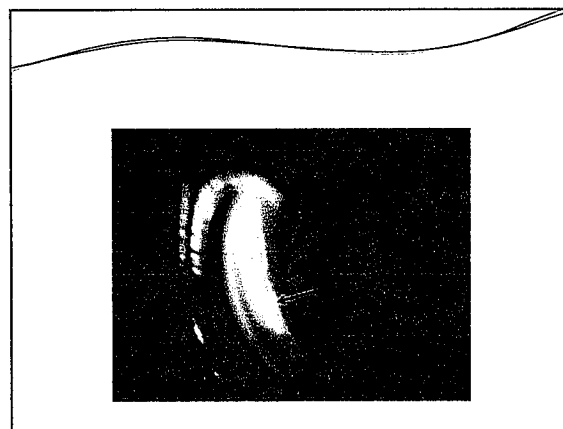
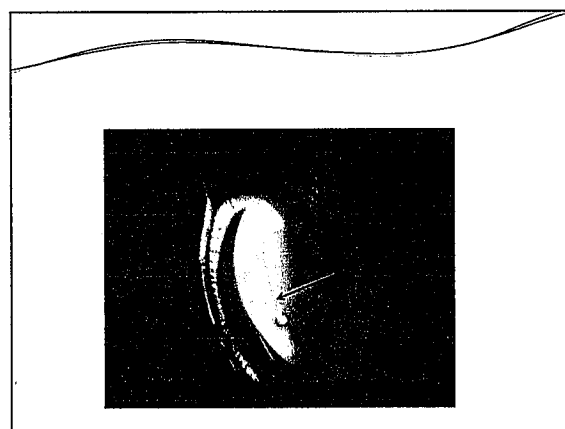
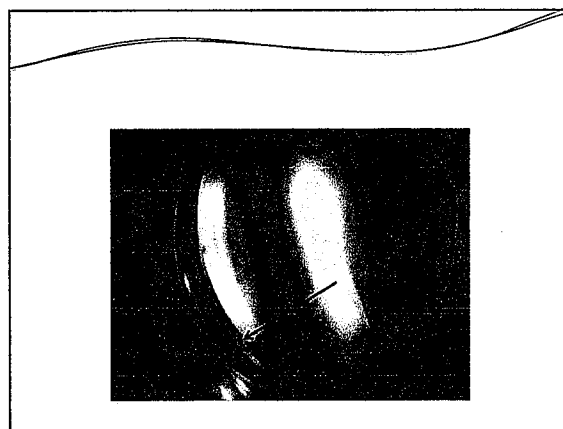
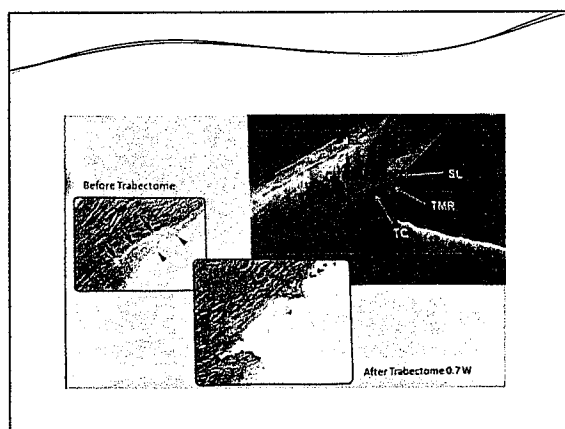
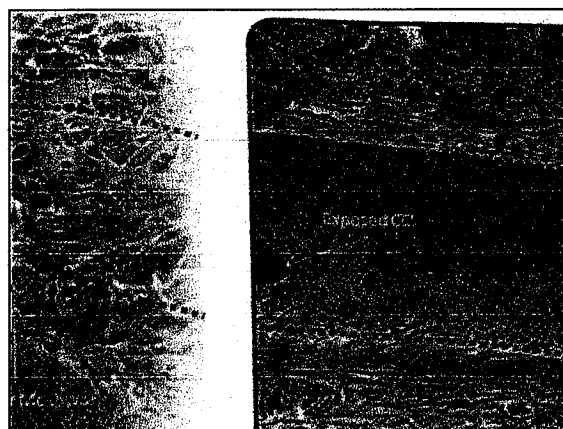
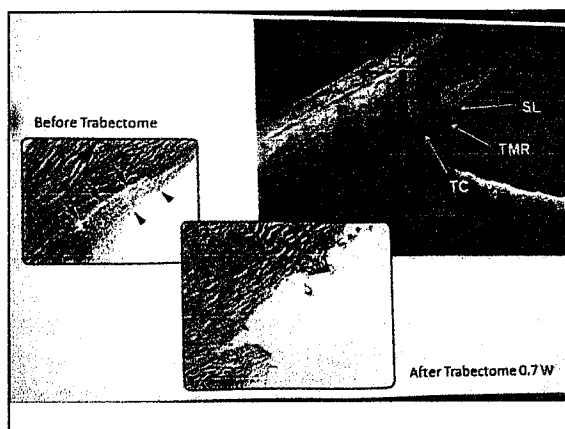


Video

- [Animation](#)

Video

- [Surgery](#)





Clinical Results

Patient	Age	Combined	Pre-op IOP	Post-op IOP PO Months
1	87	Yes	20	15 - no meds - 5 months
2	87	Yes	20	19 - no meds - 6 months
3	88	No	14	10 - no meds - 3 months
4	85	No	19	14 - 1 med - 1 month
5	64	No	16	10 - 1 med - 2 months
6	80	No	15	13 - 1 med - 1 month
7	78	Yes	14	19 - 1 med - 1 month
8		Yes	13	15 - no meds - 4 months

Clinical Results

Patient	Age	Combined	Pre-op IOP	Post-op IOP PO Months
9	73	Yes	18	13 - two meds - 2 months
10	85	Yes	16	18 - two meds - 1 month
11	71	Yes	17	12 - two meds - 7 months
12	76	Yes	28	12 - 1 med - 1 month
13	83	Yes	15	14 - no meds - 3 months
14	83	No	19	18 - 1 med - 4 months
15	76	Yes	15	13 - two meds - 2 months
16	83	Yes	26	8 - one med - 4 months

Clinical Results

Patient	Age	Combined	Pre-op IOP	Post-op IOP PO Months
17	84	Yes	20	17 - one med - 4 months
18	68	Yes	17	12 - two meds - 2 months
19	80	Yes	29	18 - three meds - 1 month
20	88	No	22	27 - two meds - 1 month
21	66	No	26	19 - two meds - 1 month
22	74	No	24	28 - two meds - 14 months
23	57	No	30	22 - two meds - 8 months
24	83	No	26	22 - no meds - 2 months
25	69	No	30	15 - two meds - 14 months

Summary – Clinical Results

- PO duration: 1 – 14 months
- Combined cataract & trabectome: 14/25
- Pressure reduction 2 or more mm: 16/25
- Increase pressure: 5/25
- Achieved target pressure of 14-17 mm Hg: 14

Literature – 2-7+ Year Results

- IOP reduced by 33%
- Medication reduced in 33- 67%
 - Mosaed, S: European Ophthalmic Review: 2014;8(2):113-9
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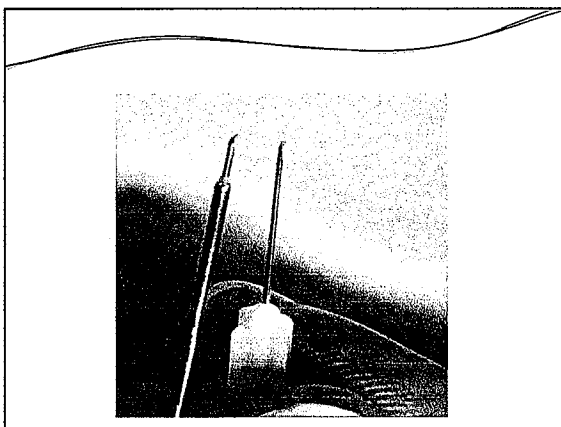
Our patients benefited from the procedure, but not even close to these results

Drawbacks - Trabectome

- Identification of trabecular meshwork with gonioscopic
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- Cost - approximations
 - Console - about 40,000 USD
 - Disposable procedure pack - 413 - 685 USD
 - Handpiece
 - Tubes
 - Keratome

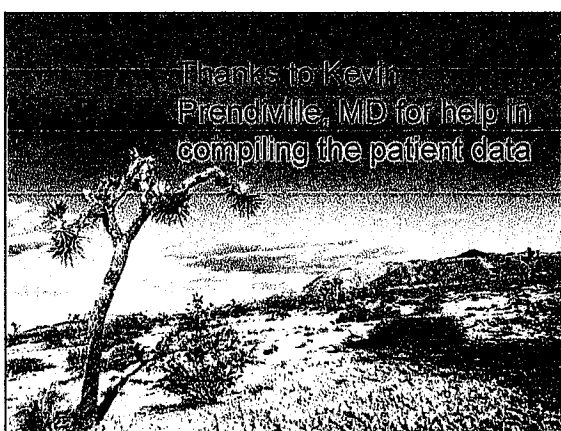
Alternative

- Strip trabecular meshwork with 27 G 1 ½ inch needle with bent tip and side port infusion (AC maintainer)
- Drawbacks
 - Not as easy to strip as with thermal ablation
 - Without cauterization the trabeculum may regenerate or be replaced with scar tissue

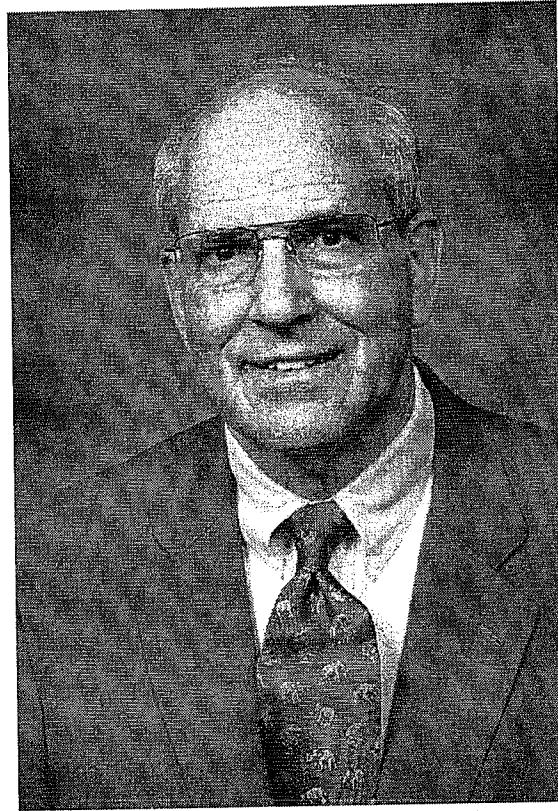


Conclusion

- The Trabectome is a quick, effective instrument to reduce moderately elevated IOP in non-compliant patients and patients intolerant to topical medications
- The Trabectome eliminates the need for a filtration bleb
 - Filtration blebs
 - Subjects the patient to intra-ocular infections
 - Irritating



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Dr. Schultz is a Life Member of the All India Ophthalmological Society and is a Fellow of the American College of Surgeons, the American Academy of Ophthalmology, the Royal College of Ophthalmologists and the Royal Society of Medicine.