

Date Prepared: September 26, 2018

Education

1967-1969		Biology	Wells College
1971	A.B.	Biology	Barnard College of Columbia University
1978	Ph.D.	Physiology Stella Y. Botelho	University of Pennsylvania

Postdoctoral Training

1978	Research Associate	Physiology Stella Y. Botelho	University of Pennsylvania
1978-1979	Postdoctoral Fellow	Physiology Neils Thorn	Institute of Medical Physiology C University of Copenhagen, Denmark
1979-1981	Postdoctoral Fellow	Physiology Geoffrey G.W. Sharp	Tufts University School of Medicine

Faculty Academic Appointments

1981-1985	Research Assistant Professor	Physiology	Tufts University School of Medicine
1985-1992	Associate Scientist		Schepens Eye Research Institute
1985-1987	Instructor	Ophthalmology	Harvard Medical School
1987-1992	Assistant Professor	Ophthalmology	(Cellular and Molecular Physiology), Harvard Medical School
1992-	Senior Scientist		Schepens Eye Research Institute

1992-2014	Associate Professor	Ophthalmology	(Cellular and Molecular Physiology), Harvard Medical School
2012	Visiting Scientist	Optometry	School of Optometry, University of California, Berkeley
2014-	Professor	Ophthalmology	Harvard Medical School
2015-2017	Professor II	Oral Biology	University of Oslo

Major Administrative Leadership Positions

1991-1997	Chairperson, Training Committee	Schepens Eye Research Institute
1997- 2000	Chairperson, Responsible Conduct of Research Committee	Schepens Eye Research Institute
1997- 2000	Associate Director of Laboratory Research	Schepens Eye Research Institute (Elected)
2000- 2004	Acting Director of Research	Schepens Eye Research Institute
2004-2009	Director of Scientific Affairs	Schepens Eye Research Institute
2008, 2010, 2012, 2017	Conference Director	Biennial Military Vision Research Symposium: Traumatic Eye and Brain Injury Boston, MA
2014	Conference Vice-Chair	Gordon Research Conference: Biology and Pathobiology of the Cornea
2016	Conference Chair	Gordon Research Conference: Biology and Pathobiology of the Cornea

Committee Service

Local

Year(s) of Membership	Name of Committee	Institution/Organization
1985-1988	Chairperson, Cornea, Pharmacology & Immunology Seminar Series	Schepens Eye Research Institute
1985-1992	Member, Animal Care and Use Committee	Schepens Eye Research Institute
1990-1991	Member, Computer Committee	Schepens Eye Research Institute
1991-1997	Chairperson, Training Committee	Schepens Eye Research

1994-2000	Member, Responsible Conduct of Research Committee	Institute Schepens Eye Research Institute
1997-2000	Chairperson, Responsible Conduct of Research Committee	Schepens Eye Research Institute
1995-2000	Member, Radiation Safety Committee	Schepens Eye Research Institute
1996-1997	Member Research Advisory Committee	Schepens Eye Research Institute
1997-2005	Member, Research Planning and Review Committee	Schepens Eye Research Institute
1998-2004	Ad Hoc Member, Internal Communications Committee	Schepens Eye Research Institute
2000-2005	Leader, Research Planning and Review Committee	Schepens Eye Research Institute
1999-2000	Faculty Representative, Board of Trustee's Nominating Committee	Schepens Eye Research Institute
1999-2001	Safety & Use for Gene Expression and Delivery Systems Committee	Schepens Eye Research Institute
2000-2005	Board of Trustees	Schepens Eye Research Institute
2000-2002	Executive Committee, Center for Research in the Aging Eye	Schepens Eye Research Institute
2000-	Faculty Member, Department of Ophthalmology, National Eye Institute Training Grant Program	Harvard Medical School
2001-2005	Staff Liaison, Board of Trustees Research, Training, and Faculty Committee –	Schepens Eye Research Institute
2005-2010	Member Board of Trustees Research, Training, and Faculty Committee –	Schepens Eye Research Institute
2009-2014	Member, Residency Committee	Mass Eye and Ear
2010-	Chair, Internal Communications Committee	Schepens Eye Research Institute
2010-2012	Member, Technology Transfer Committee	Schepens Eye Research Institute
2014, 2015	Organizing Committee, HMS Department of Ophthalmology Faculty Retreat 2014	Harvard Medical School
2014-2017	Promotion and Reappointments Committee	Harvard Medical School
2014-	Promotion and Reappointments Committee	Harvard Medical School
2017-	Department of Ophthalmology	Harvard Medical School
	Sub Committee of Professors	Harvard Medical School

National and Regional

1984	Organizing Committee Texas International Tear Film Meeting,	
1988-1992, 1997-	Organizing Committee Lacrimal Gland Study Group	
2001-2004	Treasurer, Tear Film and Ocular Surface	Tear Film and Ocular Surface Society

2000	Co-Director, International Conference on the Lacrimal Gland, Tear Film and Dry Eye Syndromes: Basic Science and Clinical Significance, (Maui, Hawaii, Nov. 2000)	Tear Film and Ocular Surface Society
2011	Member, Corneal Diseases Program Planning Panel	National Eye Institute

International

1989	Organized Platform Session on Lacrimal Gland Secretion and Treatments for Dry Eye	Association for Research in Vision and Ophthalmology
1990-1992	Organizing Committee, International Conference on the Lacrimal Gland, Tear Film and Dry Eye Syndromes: Basic Science and Clinical Significance, (Bermuda, Nov., 1992)	Tear Film and Ocular Surface Society
1995-1996	Co-Director, Organizing Committee International Conference on the Lacrimal Gland, Tear Film and Dry Eye Syndromes: Basic Science and Clinical Significance, (Bermuda, Nov., 1996)	Tear Film and Ocular Surface Society
2012-2016	Vice-chair and Chair, Biology & Pathobiology of the Cornea	Gordon Research Conference
2012-2013	Member Workshop on Contact Lens Discomfort	Tear Film and Ocular Surface Society
2015-2016	Member Dry Eye Workshop II	Tear Film and Ocular Surface Society

Professional Societies

1979-1981	Scandinavian Physiological and Pharmacological Society
1980-	Association for Research in Vision and Ophthalmology
1992-1994	Member, Cornea Section Program Planning Committee
1994	Chairperson
2000-2002	Member, Members-In-Training Committee
2005-2007	Member, Committee on Committees
1982-2017	Member, American Physiological Society
1983-2010	Member, General Physiology Society
1999-2006	Member, American Society for Cell Biology
2000-	Member, International Society for Contact Lens Research
	2001- Councilor
	2015- Vice-President
2002-	Member, International Society for Eye Research
	2005-2009 Vice-President for North America

Grant Review Activities

1998	Ad Hoc Member, VISA Study Section	National Eye Institute
1998	Ad Hoc Member, VISB Study Section	National Eye Institute
1998	Grant Review	Veterans Administration

2000	Grant Review, Grants-In-Aid	Fight for Sight, Inc.
2000	Ad Hoc Member, VISA Study Section	National Eye Institute
2001	Special Study Section	National Eye Institute
2005	Special Study Section	National Eye Institute
2007	Special Study Section	National Eye Institute
2009	Special Study Section, Stimulus Grants	National Institutes of Health
2009	Grant Reviewer	Singapore Eye Research Inst.
2010	Ad Hoc Reviewer AED	National Eye Institute
2011-2012	Member, AED Study Section	National Eye Institute
2012-2017	Member, DPVS Study Section	National Eye Institute

Editorial Activities

1999-2001	Guest Editorial Board Member	Investigative Ophthalmology and Visual Science
2000-2010	Executive Editor	Experimental Eye Research
2000-2017	Editorial Board Member	Investigative Ophthalmology and Visual Sciences
2003-	Editorial Board Member	The Ocular Surface
2011	Editor in Chief	Encyclopedia of the Eye, Elsevier Ltd. Amsterdam
2011	Editor	Ocular Periphery and Disorders, Elsevier 2011
2012	Guest Editor Special Issue	Experimental Eye Research, Elsevier, 2012 95:1
2012-	Guest Editor Special Issue	Experimental Eye Research
2016-	Associate Editor	BMJ Open Ophthalmology

Community Service Related to Professional Work:

1996, 1998	Speaker, Career Day	Newton North High School
1999	Speaker, Women in Biotechnology	Newton North High School
2000	Speaker, Woman in Science	Newton South High School

Honors and Prizes

1978-1979	Fellowship, George G. Marshall	Scandinavian-American Foundation
1979-1981	Postdoctoral Fellowship	National Institutes of Health
2001	Lew R. Wasserman Award	Research to Prevent Blindness
2004	Spirit Award	Schepens Eye Research Institute
2009	Gold Fellow	Association for Research in Vision and Ophthalmology
2009	Best Oral Presentation	Third Military Refractive Surgery Meeting
2010	Best Oral Presentation	Third Military Refractive Surgery Meeting

1991-2010 P.I. National Eye Institute/R01 \$225,000 per year
R01-EY09057

Regulation of Conjunctival Goblet Cell Mucin Production

For this grant we developed the culture of rat and human goblet cells and used them to identify the neurotransmitters that stimulate conjunctival goblet cell mucin production and the components of the signaling pathways. We also investigated the cellular signaling pathways used by the EGF family of growth factors to stimulate proliferation.

2010-2011 P.I. Alcon \$200,000 total funding

Use of Trigeminal Ganglion Neurons to Measure Pain Receptors

We measured the intracellular $[Ca^{2+}]$ of cultured trigeminal ganglion neurons in response to activation of a variety of pain stimuli to determine the types of receptors present.

2010-2011 P.I. National Eye Institute/R21 \$80,000 total funding
R21-EY020992

Characterization of Lacrimal Gland Stem Cells

For this project we have developed a method to isolate progenitor cells from the lacrimal gland. We are characterizing these cells in vivo and in vitro.

2004-2012 P.I. Department of Defense \$1,700,000 total funding
W81XWH-04-1-0892 (Multiple PI)

Low Vision Research at the Schepens

This is a multi-year, multi-project grant that I direct and in which I participate. Recently we are continuing the study of identifying risk factors for developing chronic dry eye after both LASIK and PRK and determining the role of goblet cells.

01/06/2014 – 06/06/2014 Johnson & Johnson Vision Care \$100,000 total funding

Development of a Conjunctival Construct for Testing Solutions and Contact Lens Materials"

The purpose of the grant is to grow conjunctival cells in a multilayered format to test solutions and materials used with contact lenses.

1981-2014 P.I. National Eye Institute/R01 \$250,000 per year
R01-EY06177

Mechanism of Lacrimal Gland Secretion

This grant has been focused on identifying the components of the signaling pathways used by neurotransmitters to regulate lacrimal gland secretion and the interaction of the pathways. The current project is to determine the role of purinergic P2X7 receptors in the regulation of lacrimal gland secretion under normal conditions and in dry eye.

2013-2015 P.I. Johnson & Johnson Vision Care \$50,729 per year

Development of Preclinical Models to Evaluate Interaction in Ocular Tissue

The overall goal of this project is to grow a multilayer conjunctival equivalent containing stratified squamous cells and goblet cells from female rats using tissue from tarsal conjunctiva. Different media will be used to obtain a mixture of stratified squamous and goblet cells in a multilayered construct. The cells in the construct will be characterized by determining cell type, amount of live or dead cells, mucin type and location, anatomical structure (e.g., number of cell layers and cell junctions), and transepithelial resistance (TEER).

2012-2016 P.I. NIH/National Eye Institute \$225,000, per year
R01-EY022415

Conjunctival Goblet Cell NLRP3 Inflammasome in Ocular Surface Bacterial Infection

Major goal of the project is to determine: a) if bacteria interact directly with conjunctival goblet cells, b) what cellular signaling mechanisms and functions are triggered in the goblet cells, c) if activation of these functions prevents bacterial keratitis and conjunctivitis, and d) if drugs that activate these functions can be developed to treat ocular surface infections

Present

2009-2018 P.I. NIH/National Eye Institute \$280,813 current year
R01-EY019470

Conjunctival Goblet Cell Mucin Secretion in Inflammation and Its Resolution

The overall goal of this new grant is to determine the cellular mechanisms by which pro-inflammatory mediators, such as histamine and leukotrienes, induce goblet cell secretion and anti-inflammatory proresolution compounds attenuate goblet cell secretion to restore the normal, critical mucin layer to the ocular surface and prevent development of dry eye.

2016-2020 Co-Investigator NIH/National Eye Institute \$434,360/year
(PI Helen RO1-EY026202
Makarenkova)

Lacrimal Gland Repair Using Progenitor Cells

The goal of this project is to analyze lacrimal gland progenitor cell populations, determine cell lineage specific changes during dry eye disease progression and to identify the optimum progenitor cells to repair the "diseased" lacrimal gland.

Report of Local Teaching and Training**Teaching of Students in Courses**

1973 Physiology; lecturer; 30 undergraduates;
University of Pennsylvania; 100 hrs.

1973-1974 Cellular Physiology Laboratory; lecturer; 10 graduate students;
University of Pennsylvania; 20 hrs.

1973-1978 Laboratory for Medical Physiology; lecturer; 20 Medical Students;
University of Pennsylvania, 60 hrs.

1974 Introductory Biology Laboratory; lecturer; 20 undergraduates;
University of Pennsylvania

1975-1976 Physiology; lecturer; 60 nursing students, University of
Pennsylvania; 160 hrs.

1981-1985 Physiology; lecturer; 150 medical and graduate students; Tufts
University School of Medicine; 80 hrs.

1989-1990 Metabolism and Function of Human Organ Systems; tutor; Harvard
Medical School; 6-8 medical and dental students; 90 hrs preparation and 45 hrs.
contact time.

1991, 1992 Metabolism and Function of Human Organ
1994 Systems; substitute tutor; 6-8 medical and dental students; Harvard
Medical School, 20 hrs.

Formal Teaching of Residents, Clinical and Research Fellows

- 1984-2015 Signal Transduction Journal Club; Tufts University and Schepens Eye Research Institute, 6 fellows; 1-3hrs preparation time and 1-2hr contact time each week.
- 1992 Lancaster Course of Ophthalmology; Massachusetts Eye and Ear Infirmary; 60 residents; 20 hrs preparation time and 2 hrs contact time.
- 1997 Lecture, Harvard Department of Ophthalmology Annual Retreat, Wellesley, MA
- 2004 Lecture, Annual Course, Molecular Bases of Eye Diseases, Training Program, Department of Ophthalmology, Harvard Medical School
- 2005 Harvard Department of Ophthalmology Annual Retreat; 100 fellows, residents, and faculty; 2 hrs preparation time and 8 hrs contact time.
- 2011 Harvard Department of Ophthalmology Annual Retreat; 100 fellows, residents, and faculty; 2 hrs preparation time and 8 hrs contact time.
- 2011- Director, Molecular Basis of Eye Diseases, Training Program, Department of Ophthalmology, Harvard Medical School, 40 postdoctoral fellows, 4 hrs organization, supervised 2 hrs of lectures/week, 10 weeks
- 2013, 2015, 2017 Panelist, Grant Writing Workshop, Massachusetts General Hospital, 100 postdoctoral fellows, 2 hrs preparation time and 1 hr contact time.
- 2015 Lecturer, Grant Writing Workshop. Training Program, Department of Ophthalmology, Harvard Medical School, 40 postdoctoral fellows, 4 hrs organization,
- 2016 Lecturer, How to Write a Successful Grant, Gordon Research Seminar, Biology and Pathobiology of the Cornea, 30 students and fellows, 2 hrs preparation time, 1 hr contact time.

Formally Supervised Trainees (selected list)

- 1985-1988 James Lechleiter Ph.D., Professor, University of Texas Health Science Center, San Antonio, Texas
Published manuscript in *Neuron*
- 1988-1989 Samuel Yiu, M.D. Ph.D. Assistant Professor, Keck School of Medicine, Doheny Eye Institute, University of Southern California, Los Angeles, CA.
Chosen for Marine Biological Laboratory Summer course, received Fight For Sight Postdoctoral Fellowship
- 1993-1995 Dr. Driss Zoukhri, Associate Professor, Tufts School of Dental Medicine, Boston, MA
Published over 10 manuscripts, received Lacrimal Gland Study Group Best Poster Award; received NEI R01 grant
- 1996-1998 Dr. Isao Ota, Instructor, Department of Ophthalmology, Asahikawa Medical College, Japan
Published one manuscript
- 1996-1998 Dr. José Rios-Garcia, Investigator, Schepens Eye Research Institute, Harvard Medical School
Published over 7 manuscripts, received minority supplement to NIH R01 grant
- 1998-2000 Dr. Harumi Kanno, Instructor, Department of Ophthalmology, Asahikawa Medical College, Japan
Published one manuscript
- 1998-1999 Dr. Yolanda Diebold, Senior Scientist, Instituto de Oftalmobiología, Universidad de Valladolid, Spain
Published two manuscripts

- 2000-2002 Dr. Yoshitaka Horikawa, Kanagawa Clinic Refraction Center, Tokyo Japan
Published one manuscript
- 2001-2004 Dr. LiLi Chen, Investigator, Department of Ophthalmology, Tokyo Women's Medical University, Tokyo, Japan
Published two manuscripts
- 2002-2003 Dr. Ahn Nguyen, Private Practice, Montreal, QC, Canada
- 2004-2005 Dr. Keiko Konomi, Clinical Fellow, Eiju General Hospital, Tokyo, Japan
Published one manuscript
- 2004-2007 Dr. Chika Funaki, Department of Ophthalmology, Tokyo Women's Medical University, Tokyo, Japan
Published two manuscripts
- 2007-2009 Dr. Densen Hayashi, Assistant Professor, Department of Ophthalmology, Tokyo Womens's Medical University, Tokyo, Japan
Published one manuscript
- 2009-2011 Dr. Kaori Ohtomo, Assistant Professor, Juntendo School of Medicine, Tokyo, Japan
Published one manuscript
- 2010-2011 Dr. Victoria McGilligan, University of Ulster, Ulster, Northern Ireland
Published one manuscript; winner Cora Verhagen Award, ARVO 2011
- 2010-2011 Dr. Yukako Tatematsu, Assistant Professor, Keio University School of Medicine, Tokyo, Japan. One manuscript accepted for publication
- 2011-2012 Dr. Thomas Storr-Paulsen, Staff Ophthalmologist, Glaucoma and Cataract Service, Odense University Hospital, Odense, Denmark. One manuscript published.
- 2011-2012 Ms. Erin Guilbert, supervised Masters Thesis at Boston University School of Medicine, Student, Drexel University School of Medicine, One manuscript in preparation.
- 2011-2013 Dr. Jon Roger Eidet, co-supervisor PhD, Ulleval University, Oslo Norway, Published three manuscripts
- 2012- Dr. Tor Utheim, Fulbright Fellow, Ulleval University, Oslo Norway, Published three manuscripts
- 2013-2014 Dr. Sumit Battacharya, Two manuscripts published.
- 2013- Dr. Ida Fostaedt, co-supervisor Ph.D. Ulleval University, Oslo Norway, Published two manuscripts
- 2014-2015 Dr. Min He, Lecturer, 2nd Affiliated Hospital of Shanxi Medical University, Department of Ophthalmology, Shanxi, China, Published two manuscripts.
- 2014-2015 Marit Lippestaedt, Supervisor Ph.D. Medical Student, University of Oslo School of Medicine, Oslo, Norway , Published three manuscripts, One manuscript in preparation
- 2015-2016 Dr. Rebecca Kaye, Academic Clinical Trainee, West Middlesex University Hospital, London, UK, One manuscript submitted.
- 2016- Nora Botten, Supervisor PhD. Medical Student, School of Medicine, University of Oslo School, Oslo, Norway
- 2016-2017 Dr. Laura Garcia-Posados, Postdoctoral Fellow, Schepens Eye Research Institute, Massachusetts Eye and Ear Infirmary, Boston. MA Three manuscripts published, one in preparation
- 2016- Anneviktorja Lyngstadass, Supervisor Ph.D. Medical Student, School of Medicine, University of Oslo School, Oslo, Norway. Two manuscripts in preparation.
- 2016- Markus Olson, Supervisor Ph.D. Medical Student, School of Medicine, University of Oslo, Norway. Two manuscripts in preparation.
- 2016 Qalbi Khan, Associate Professor, Department of Medical Biology, The Artic University of Norway, Tromso, Norway, One manuscript published .
- 2016 Erlend Aas Engstrom, Medical Student, School of Medicine, Norwegian University of

- 2016 Science and Technology, Trondheim, Norway. Three manuscripts published.
Christian Nebb Sorenson, Medical Student, School of Medicine, Norwegian University of Science and Technology, Trondheim, Norway
- 2017- Menglu Yang, Postdoctoral Fellow, Schepens Eye Research Institute, Massachusetts Eye and Ear Infirmary, Boston, MA. Two manuscripts in preparation.
- 2018 Haakon Fjaervoll, Medical Student, School of Medicine, University of Oslo, Norway
- 2018 Ketil Fjaervoll, Medical Student, School of Medicine, University of Oslo, Norway
- 2018 Eduarda Guerreiro, PhD Student, Faculty of Dentistry, University of Oslo, Norway
- 2018 Morten Magno, Medical Student, School of Medicine, University of Oslo, Norway
- 2018 Andy Want, MD. Visiting Ophthalmologist, National Health Service, Oxford Deanery, UK

Formal Teaching of Peers

- 1980 Departmental Seminar, Schepens Eye Research Institute, Boston, MA Single Presentation
- 1993 Lecture, Department of Ophthalmology; Brigham and Women's Hospital, Boston, MA Single Presentation
- 1994 Lecture, Cornea Research Interest Group, Massachusetts Eye and Ear Infirmary, Boston, MA Single Presentation
- 1995 Lecture, Immunology Department, Massachusetts Eye and Ear Infirmary, Boston, MA Single Presentation
- 1995 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 1996 Lecture, Dry Eye Interest Group Meeting, Department of Ophthalmology, Beth Israel Hospital, Boston, MA
- 1996 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 1997 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 1998 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 1998 Lecture, Sjögrens Symposium, Schepens Eye Research Institute, Boston, MA
- 1999 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 2000 Lecture, Board of Trustees, Schepens Eye Research Institute, Boston, MA
- 2000 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 2001 Lecture, Second Meeting on Sjögrens Syndrome and Diseases, Schepens Eye Research Institute, Boston, MA
- 2001 Lecture, Board of Trustees, Schepens Eye Research Institute, Boston, MA
- 2002 Lecture, Director of Research Seminar, Schepens Eye Research Institute, Boston, MA
- 2004 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 2004 Lecture, TATRC Product Line Review Department of Defense, Boston, MA
- 2005 Lecture, Military Symposium, Department of Defense, Boston, MA
- 2006 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 2008 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation

- 2009 Departmental Seminar, Schepens Eye Research Institute, Boston, MA, Single Presentation
- 2010 Departmental Seminar, Schepens Eye Research Institute, Boston MA Single Presentation
- 2011 Departmental Seminar, Schepens Eye Research Institute, Boston MA Single Presentation
- 2011 Annual Meeting, Department of Ophthalmology, Harvard Medical School, Boston, MA Single Presentation
- 2012 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2013 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2014 Presentation, New Frontiers in Corneal Research, Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2014 Cornea Center of Excellence, Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2014 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2015 Cornea Center of Excellence, Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2016 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2017 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2018 Departmental Seminar, Schepens Eye Research Institute/Massachusetts Eye and Ear, Boston, MA Single Presentation
- 2018 Grand Rounds, Massachusetts Eye and Ear, Boston, MA, Single Presentation.

Report of Regional, National and International Invited Teaching Presentations (Titles Not Available)

Regional

- 1993 Lecture, American Academy of Optometry Meeting, Boston, MA None
- 1995 Lecture, Cornea Conference, Boston, MA None
- 1999 Lecture, Southeastern District Lions, Mid-winter meeting, Hyannis, MA None
- 2001 Lecture, Eleventh Biennial Cornea Conference, Boston, MA None
- 2008 Lecture, Wellman Center, Massachusetts General Hospital, Boston MA None
- 2008 Lecture, Third Biennial Military Vision Research Symposium: Traumatic Eye and Brain Injury, Boston, MA None
- 2010 Lecture. Boston University School of Medicine, Boston, MA None
- 2010 Lecture GTIBio, Boston, MA None
- 2013 Lecture, Mucosal Immunology Laboratory, Massachusetts General Hospital, Boston MA. None
- 2017 Lecture, Grand Rounds, Department of Ophthalmology, Tufts University School of Medicine. None
- 2017 Distinguished Lecture, Department of Molecular and Cellular Biology, Boston University School of Dental Medicine, Boston, MA, None
- 2018 Grand Rounds, School of Dental Medicine, Tufts Univeristy, Boston MA

National

- 1984 Lecture, Meeting on the Preocular Tear Film in Contact Lens Wear and Disease, Lubbock, TX None
- 1985 Lecture, Department of Physiology, Medical College of Wisconsin, Madison, WI
Medical College of Wisconsin
- 1987 Lecture, Department of Physiology, University of West Virginia, Morgantown,
WV University of West Virginia
- 1988 Lecture, Lacrimal Gland Study Group, Sarasota, FL None
- 1990 Lecture, Department of Physiology, University of Southern California, Los Angeles, CA
None
- 1994 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale FL
None
- 1995 Lecture, Alcon Laboratories, Ft. Worth, TX Alcon
- 1996 Lecture, Vistakon, Jacksonville, FL Vistakon
- 1997 Lecture, Department of Physiology, State University of New York at
Stony Brook, NY
- 1997 Lecture, Keystone Symposium, Durango, CO None
- 1997 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale FL
None
- 1998 Lecture, Berkeley College of Optometry 75th Anniversary Symposium, Berkeley, CA
Berkeley College of Optometry
- 1998 Lecture, American Academy of Optometry Meeting, San Francisco, CA Berkeley
College of Optometry
- 1998 Lecture, Keystone Symposium, Keystone, CO None
- 1999 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale FL
None
- 1999 Lecture, Sharp Symposium, Cornell University, Ithaca, NY None
- 1999 Lecture, Vistakon, Jacksonville, FL Vistakon
- 1999 Lecture, Allergan, Irvine, CA Allergan
- 1999 Lecture, University of Southern California, Los Angeles, CA None
- 1999 Lecture, Special Interest Group, Association for Research in Vision and
Ophthalmology, Ft. Lauderdale, FL None
- 2001 Lecture, Special Interest Group, Association for Research in Vision and Ophthalmology,
Ft. Lauderdale FL None
- 2001 Lecture, International Society for Contact Lens Research, Sun Valley, Idaho
International Society for Contact Lens Research
- 2002 Lecture, International Congress for Eye Research, Santa Fe, New Mexico None
- 2002 Lecture, Johnson & Johnson, Vistakon, Jacksonville, FL Vistakon
- 2002 Lecture, Transport 2002, Miami, FL None
- 2003 Lecture and Panel Member, Dry Eye Panel, Vistakon, Jacksonville, FL Vistakon
- 2004 Lecture, Department of Pharmacology, University of Southern California
School of Pharmacy, Los Angeles, CA University of Southern California
- 2004 Bekor Lecture, Department of Ophthalmology, University of Southern California School
of Medicine, Los Angeles, CA Doheny
- 2004 Keynote Speaker, Tear Film and Ocular Surface Society, Puerto Rico, US Tear
Film and Ocular Surface Society
- 2005 Lecture, Mini-Symposium, Association for Research in Vision and Ophthalmology, Ft.
Lauderdale, FL (No remuneration)

- 2005 Lecture and Panel Member, Dry Eye Panel, Vistakon, Jacksonville, FL (Vistakon)
- 2006 Lecture, Department of Ophthalmology, University of California at Irvine, Irvine, CA (University of California Irvine)
- 2006 Lecture, School of Pharmacy, University of Southern California, Los Angeles, CA (University of Southern CA)
- 2006 Lecture, Johnson & Johnson, Vistakon, Jacksonville, FL (Vistakon)
- 2006 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale, FL (Abstract)
- 2007 Lecture, Johnson & Johnson, Vistakon, Jacksonville FL (Vistakon)
- 2007 Lecture, Product Line Review, TATRC, Fredericksburg, MD (No remuneration)
- 2007 Lecture, Case Western Reserve University, Cleveland, OH (Case Western Reserve University)
- 2007 Lecture, Gordon Conference, Ventura, CA (Gordon Conference)
- 2008 Lecture, University of Rochester, Rochester, New York (No remuneration)
- 2008 Lecture, Bausch & Lomb, Rochester, New York (Bausch & Lomb)
- 2008 Lecture, Second Military Refractive Surgery Conference, San Antonio, TX (Abstract)
- 2008 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale, FL (Abstract)
- 2009 Lecture, University of Houston School of Optometry, Houston, TX (University of Houston)
- 2009 Lecture, University of Indiana School of Medicine, Indianapolis IN (University of Indiana)
- 2009 Lecture, Military Health Research Forum, Kansas City, MO, (Abstract)
- 2010 Lecture, Johnson & Johnson, Vistakon, Jacksonville, FL (Vistakon)
- 2010 Lecture, Third Military Refractive Surgery Conference, San Antonio, TX (Abstract)
- 2010 Lecture. Winter Eicosanoid Meeting, Baltimore MD (Abstract)
- 2010 Lecture Dry Eye Summit Ft. Lauderdale FL (ORA Pharmaceuticals, Inc.)
- 2011 Lecture, School of Dental Medicine, University of Pennsylvania, Philadelphia, PA, (University of Pennsylvania)
- 2011 Lecture, School of Optometry, University of California at Berkeley, Berkeley, CA, (University of California, Berkely)
- 2011 Keynote Presentation, Gordon Conference, Salivary Gland and Exocrine Biology, Galveston, TX, (Gordon Conference)
- 2011 Lecture, Association for Research in Vision and Ophthalmology, Ft. Lauderdale, FL, (Abstract)
- 2012 Lecture, Association for Research in Vision and Ophthalmology, Ft Lauderdale, FL, (Abstract)
- 2012 Oxyopia Seminar, School of Optometry, University of California at Berkeley, Berkeley CA, (University of California, Berkely)
- 2012 Lecture, Coopervision Inc, Pleasanton CA (Coopervision)
- 2012 Lecture, Proctor Institute, University of California at San Francisco, San Francisco CA, (University of California, San Francisco)
- 2012 Distinguished Lecture Series, Department of Ophthalmology, University of Pittsburgh School of Medicine, Pittsburgh PA, (University of Pittsburgh)
- 2012 Lecture, University of New England, Biddeford ME, (University of New England)
- 2013 Lecture, Association for Research in Vision and Ophthalmology, Seattle, WA (Abstract)
- 2014 Lecture, Department of Dermatology, Northwestern University, Chicago, IL (Northwestern University)

- 2014 Lecture, Department of Ophthalmology, University of Illinois, Chicago, IL (Northwestern University)
- 2014 Lecture, Association for Research in Vision and Ophthalmology, Orlando, FL. (Abstract)
- 2014 Poster, American Society for Microbiology, Boston, MA (Abstract)
- 2014 Lecture, XXI ISER Biennial Meeting, San Francisco, CA (Abstract)
- 2014 Participant AEVR Congressional Briefing AEVR/Research America Study, Washington, DC, (No remuneration)
- 2014 Poster, 2014 MHSRS Symposium, Ft. Lauderdale, FL (Abstract)
- 2014 Lecture, Frontiers in Medicine, Ophthalmology & Vision Science, University of Arizona, Tucson (University of Arizona)
- 2014 Poster, 2014 Ocular Immunity Conference, Fort Lauderdale FL (Abstract)
- 2015 Lecture, Department of Ophthalmology, University of California Los Angeles, Los Angeles, CA
- 2015 Lecture, Department of Ophthalmology, University of Southern California, Los Angeles, CA
- 2017 Lecture, Department of Ophthalmology, University of Texas Southwestern, Dallas, Texas
- 2017 Lecture, Association for Research in Vision and Ophthalmology, Baltimore, MD. (Abstract)
- 2018 Lecture, Association for Research in Vision and Ophthalmology, Honolulu HI. (Abstract)

International

- 1979 Lecture, Department of Physiology; University of Dundee, Scotland (University of Dundee)
- 1984 Lecture, Institute of Medical Physiology, University of Copenhagen, Denmark (University of Copenhagen)
- 1984 Lecture, Meeting on Fluid Secretion by the Ocular Surface, Berlin, Germany (German Drug Company)
- 1990 Lecture, Institute of Medical Physiology, University of Copenhagen, Denmark (University of Copenhagen)
- 1992 Conference Address, Meeting on Lacrimal Gland, Tear Film and Dry Eye Syndromes: Basic Science and Clinical Relevance, South Hampton, Bermuda (Tear Film and Ocular Surface Society)
- 1995 Lecture, Vereinigung Deutscher Contactlinsen-spezialisten, Saabrucken, Germany (Vereinigung Deutscher Contactlinsen-spezialisten)
- 1995 Lecture, University of Paris Sud, Orsay, France (University of Paris Sud)
- 1996 Keynote Address, Meeting on Lacrimal Gland, Tear Film, and Dry Eye Syndromes: Basic Science and Clinical Relevance, South Hampton, Bermuda (Tear Film and Ocular Surface Society)
- 1996 Outside Reader, Thesis Defense, University of Paris Sud, Orsay, France (University of Paris Sud)
- 1999 Lecture, International Society for Contact Lens Research, Phuket, Thailand (International Society for Eye Research (Int. Soc. For Contact Lens Res.)
- 1999 Lecture, Universidad de Valladolid, Valladolid, Spain (Universidad de Valladolid)
- 1999 Lecture, International Sjögrens Meeting, Venice, Italy (Abstract)

- 2000 Lecture, University of East Anglia, Harwich England (University of East Anglia)
- 2001 Lecture, Johnson and Johnson, Vistakon, London, England (Vistakon)
- 2001 Lecture, European Vision Research Meeting, Alicante Spain (EVER)
- 2002 Lecture, European Vision Research Meeting, Alicante, Spain (EVER)
- 2002 Lecture, International Congress for Eye Research, Geneva, Switzerland (Abstract)
- 2004 Lecture, International Congress for Eye Research, Sydney, Australia (Abstract)
- 2005 Lecture, Department of Chemistry and Biological Sciences, University of Kalmar, Kalmar Sweden (University of Kalmar)
- 2005 Outside Reader, Thesis Defense, Department of Chemistry and Biological Sciences, University of Kalmar, Kalmar Sweden (University of Kalmar)
- 2005 Lecture, International Society for Contact Lens Research, Coolom, Australia (International Society for Contact Lens Research)
- 2005 Lecture, European Association for Vision and Eye Research, Vilamoura, Portugal (EVER)
- 2006 Lecture, International Congress for Eye Research, Buenos Aires, Argentina (Abstract)
- 2007 Lecture, International Society for Contact Lens Research, Whistler, Canada (International Society for Contact Lens Research)
- 2007 Mini-presentation, Tear Film and Ocular Surface Society, Taormina, Italy, (Tear Film and Ocular Surface Society)
- 2008 Lecture, University of Ottawa Eye Institute, Ottawa, Canada (University of Ottawa)
- 2008 Lecture, Vision RRG, Belfast, Northern Ireland (Vistakon Ireland)
- 2008 Lecture, Purines 2008, Copenhagen, Denmark (Abstract)
- 2008 Lecture, International Congress for Eye Research, Beijing, China (Abstract)
- 2009 Lecture 11th International Conference on Biolipids in Cancer, Inflammation, and Related Diseases, Cancun, Mexico (Abstract)
- 2011 Outside Reader, Thesis Defense, Department of Chemistry and Biological Sciences, Linneas University, Kalmar Sweden (Linneas University)
- 2011 Lecture, Department of Chemistry and Biological Sciences, Linneas University, Kalmar Sweden (Linneas University)
- 2013 Lecture, Seventeenth ISCLR Symposium, Kyoto Japan (Int. Soc. For Contact Lens Res.)
- 2013 Lecture, Videoconference, Harvard Cornea Center of Excellence and Federal University of Sao Paulo, Brazil (no remuneration)
- 2013 Moderator, Tear Film and Ocular Surface Society International Meeting, Taormina, Sicily (Tear Film and Ocular Surface Society)
- 2013 Outside Reader, Thesis Defense, University of Liverpool, Liverpool, England (University of Liverpool)
- 2013 Session Co-Chair and Lecture, Bioactive Lipids in Cancer, Inflammation and Related Diseases, San Juan, Puerto Rico (Abstract), no remuneration
- 2014 Poster, FASEB Calcium and Cell Function Conference; Nassau, Bahamas, no remuneration
- 2015 Lecture, International Society for Contact Lens Research, Budapest, Hungary (International Society for Contact Lens Research)
- 2015 Outside Reader, Thesis Defense, IOBA, Valladolid, Spain (IOBA)
- 2015 Outside Reader, Thesis Defense, IOBA, Valladolid, Spain (IOBA)
- 2016 Lecture, Harvard Seminar Series, School of Dental Medicine, University of Oslo, Oslo, Norway
- 2016 Lecture, Biomaterials Conference, School of Dental Medicine, University of Oslo, Oslo,

- Norway
- 2016 Lecture, School of Medicine, University of Oslo, Oslo, Norway
- 2017 Lecture, Graduate Student Program, IOBA, Valladolid, Spain, no remuneration
- 2017 Short Talk, 5th Conference on Bioactive Lipids in Cancer, Inflammation, and Related Diseases. Puerto Vallarta, Mexico, no remuneration
- 2017 Faculty of Dentistry, University of Oslo, Oslo Norway, Two presentations. No remuneration

Technological Innovations

1. Gilbard; Jeffrey P. and **Dartt; Darlene A.** Stimulation of tear secretion. US Patent 4,745,100. May 17, 1988.
2. Gilbard; Jeffrey P. and **Dartt; Darlene A.** Stimulation of tear secretion with phosphodiesterase inhibitors. US Patent 4,753,945. June 28, 1988.
3. Gilbard Jeffrey P. and **Dartt; Darlene A.** Stimulation of tear secretion with melanocyte stimulating hormones. US Patent 4,868,154
4. Gilbard; Jeffrey P., and **Dartt; Darlene A.** Stimulation with cyclic nucleotides. US Patent 4,956,348. September 11, 1990.
5. **Dartt; Darlene A.** and Kessler; Timothy L., Therapeutic regulation of abnormal conjunctival goblet cell mucous secretion. US Patent 5,545,617. August 13, 1996.
6. Shatos; Marie A., **Dartt; Darlene A.**, Rios; Jose D., Culture of goblet cells. US Patent 7,052,690. May 30, 2006.
7. Shatos; Marie A., **Dartt; Darlene A.**, Rios; Jose D. Culture of goblet cells. US Patent 7,316,927. January 8, 2008.

Peer-Reviewed Publications in Print and Other Media

1. **Dartt DA**, Botelho SY. Protein in rabbit lacrimal gland fluid. Invest Ophthalmol Vis Sci. 1979;18:1207-1209.
2. Thorn NA, Torp-Pedersen C, Treiman M, **Dartt DA**, Worm-Petersen S. Biochemical mechanism of release of vasopressin. Proc 9th Congr Hungarian Soc Endocrinol Metab. Akademia, 1979.
3. Botelho SY, **Dartt DA**. Effect of calcium antagonism or chelation on rabbit lacrimal gland secretion and membrane potentials. J Physiol. 1980;304:397-403.
4. **Dartt DA**, Knox I, Palau A, Botelho SY. Proteins in fluids from individual orbital glands and in tears. Invest Ophthalmol Vis Sci. 1980;19:1342-1347.
5. **Dartt DA**, Torp-Pedersen C, Thorn NA. Effect of Ca²⁺ and calmodulin on cyclic nucleotide metabolism in neurosecretosomes from ox neurohypophyses. Brain Res. 1981;204:121-128.
6. Gratzl M, Torp-Pedersen C, **Dartt DA**, Thorn NA. Isolation and characterization of secretory vesicles from bovine neurohypophyses. Hoppe-Seyler's Z Physiol Chem. 1980;361:1615-1628.
7. **Dartt DA**, Poulsen A Moller M. Lacrimal gland electrolyte and water secretion: Localization of Na⁺~K⁺-ATPase and role of Na⁺ coupled Cl⁻ transport. J Physiol. 1981;321:557-569.
8. **Dartt DA**, Guerina VB, Donowitz M, Taylor L, Sharp GWG. Calcium- and calmodulindependent protein phosphorylation in rat lacrimal gland. Biochem J. 1982;202:799-802.
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10. **Dartt DA**, Donowitz M, Joshi VM, Mathieu RS, Sharp GWG. Cyclic nucleotide-dependent enzyme secretion in the rat lacrimal gland. J Physiol. 1984;352:375-84.
11. **Dartt DA**, Baker AK, Vaillant C, Rose PE. Vasoactive intestinal polypeptide stimulation of protein

- secretion from rat lacrimal gland acini. *Am J Physiol.* 1984;247:G502-509.
12. **Dartt DA**, Mircheff AK, Donowitz M, Sharp GWG. Ca⁺ and cyclic AMP-induced phosphorylation in lacrimal gland basolateral membranes. *Am J Physiol.* 1988;254:G543-G551.
 13. **Dartt DA**, Shulman M, Rossi S, Gray K, Gilbard JP. Stimulation of lacrimal gland secretion with biologically active peptides. *Am J Physiol.* 1988;254:G300-G306.
 14. **Dartt DA**, Matkin CC, Gray KL. Comparison of proteins in lacrimal gland fluid secreted in response to different stimuli. *Invest Ophthalmol Vis Sci.* 1988;29:991-995.
 15. Lechleiter JD, **Dartt DA**, Brehm P. Vasoactive intestinal peptide activates Ca²⁺ dependent K⁺ channels through a cAMP pathway in mouse lacrimal cells. *Neuron.* 1988;1:227-235.
 16. **Dartt DA**, Ronco LV, Murphy SA, Unser MF Effect of phorbol esters on rat lacrimal gland protein secretion. *Invest Ophthalmol Vis Sci.* 1988;29:1726-1731.
 17. **Dartt DA**, Baker AK, Rose PE, Murphy SA, Ronco LV, Unser MF Role of cAMP and Ca²⁺ in potentiation of lacrimal gland protein secretion. *Invest Ophthalmol Vis Sci.* 1988;29:1732-1738.
 18. Gilbard JP, **Dartt DA**, Rood RP, Rossi JR, Gray KL, Donowitz M. Increased tear secretion in pancreatic cholera: A newly recognized symptom in an experiment of nature. *Am J Med.* 1988;85:552-554.
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 20. Rossi SR, **Dartt DA**, Gilbard JP. Eledoisin and lacrimal secretion in the rabbit. *Curr Eye Res.* 1990;9:273-276.
 21. **Dartt DA**, Dicker DM, Ronco LV, Kjeldsen IM, Hodges RR, Murphy SA. Lacrimal gland inositol trisphosphate isomer and inositol tetrakisphosphate production. *Am J Physiol.* 1990;259: G274-G281.
 22. Gilbard JP, Rossi SR, Heyda KG, **Dartt DA**. Stimulation of tear secretion and treatment of dry eye with 3-isobutyl-1-methylxanthine. *Arch Ophthalmol.* 1991;109:672-676.
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 31. **Dartt DA**, Zoukhri D, Krenzer K. Effect of contact lens wear on the regulation of tear secretion. *die Kontaktlinse*, 1996;9/96:6-14, (cover illustration).
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Thesis

Inhibition of cholinergic agonist-induced secretion without change in cholinergic agonist-induced

hyperpolarization in the presence of verapamil and EGTA in the lacrimal gland.

Narrative Report

I am a cell physiologist studying the neural regulation of tear production. I have unraveled novel signaling pathways activated by nerves and growth factors to stimulate lacrimal gland protein, and conjunctival goblet cell mucin secretion that contribute to the tear film and developed potential treatments for dry eye. I have taught medical students, postdoctoral and corneal fellows served as chair of numerous Institute committees, and have been a mentor. For nine years I led the research at the Institute as the elected Associate Director of Research, Acting Director of Research, and Director of Scientific Affairs. Nationally I serve on committees for national research societies, editorial boards, NIH study sections, and as an officer for national and international research societies. I spent 80% time on research, 10% on teaching, and 10% on administration.

My research addresses the neural regulation of tear production. With the advent of refractive surgery and its ablation of corneal nerves and resultant dry eye, the neural regulation of tear production has taken on new importance. The recent realization that the symptoms of dry eye are neurally based and that corneal nerves are altered in multiple ocular surface diseases has given considerable significance to my field of research in terms of treating dry eye from multiple pathogenic mechanisms. My research focuses on the cellular signaling pathways that nerves and growth factors use to stimulate protein secretion from the lacrimal gland and mucin secretion from conjunctival goblet cells. My research goal is to identify the signaling pathways used to stimulate secretion under normal conditions and to determine the dysfunction of these pathways in dry eye, LASIK, and aging. I characterized the three major G protein linked signaling pathways critical for regulation of lacrimal gland secretion. Surprisingly each agonist induces specific stimulatory and inhibitory pathways that regulate the shape of the resultant secretion. Some of our novel findings from this work were highlighted in a focus article in the *American Journal of Physiology Cell Physiology* (AC Snider and KE Meirer, *Am J Physiol Cell Physiol* 292:C1-C3, 2006). Proper activation of these signaling pathways is critical for tear production and is disrupted in disease pathogenesis. Our work on murine models of Sjogrens syndrome and aging highlighted the role of nerves in secretory dysfunction and suggested new mechanisms to induce lacrimal gland secretion by bypassing the action of the nerves. Specifically we developed cAMP-dependent compounds that activate post-receptor signaling pathways as topical treatments for dry eye syndromes. I am presently studying a non-G protein linked signaling pathway the purinergic P2X₇ receptor that stimulates lacrimal gland secretion. We are now investigating if the persistent activation of this receptor, especially in the setting of inflammation, may participate in the loss of neurally-stimulated secretion in dry eye. Most recently I isolated precursor cells from the lacrimal gland that appear to be a subset of myoepithelial cells and could repair the damaged lacrimal gland and cure dry eye.

My work revolutionized the area of conjunctival goblet cell mucin secretion, as we found that nerves using parasympathetic neurotransmitters stimulate goblet cell secretion that protects the ocular surface. Mine is the only laboratory able to culture both rat and human goblet cells and to investigate the regulation of proliferation and secretion of these cells in a purified culture. We studied the cellular signaling pathways used by G protein-linked agonists and growth factors to stimulate goblet cell mucous production. One of my articles in *Experimental Eye Research* was noted at the 2008 International Conference on Eye Research to be one of that journal's most highly cited recent articles. My laboratory recently discovered that the inflammatory and allergic leukotrienes cause goblet cell secretion that can be resolved by resolvins that actively terminate inflammation. This work suggests a pivotal role for goblet cells in ocular surface inflammation that occurs in a plethora of ocular surface diseases. We are now able to modulate goblet cell proliferation and secretion to manipulate the mucus layer of the tear film and protect the ocular surface. This is especially relevant to dry eye after LASIK in which we found that in some individuals the ocular surface cannot recover from the surgery and its sequelae, as well as in ocular

allergy, neurotrophic keratitis, and contact lens wear.

In my administrative positions I improved the academic program at the Institute and helped support the research effort. Subsequent to the emotional impact of Dr. Wayne Streilein's death, when Dr. Michael Gilmore was forced to assume both he and Dr. Streilein's positions, I remained a stable, strong presence in my role as Acting Director of Research and Director of Scientific Affairs. I ensured a smooth transition for Dr. Gilmore's arrival by mentoring the junior faculty and postdoctoral fellows from the Streilein laboratory, interacting with the board of trustees, stabilizing the faculty. I have been the PI on our multiproject Department of Defense grant since 2002 and organized our six symposia on the needs of the military vision professionals. I was the principal investigator on an NIH roadmap grant for interdisciplinary research on blinding eye diseases. This was one of only 21 grants funded across NIH. Multiple new research collaborations and successful research projects arose from this effort. I was the Editor-In-Chief of the *Encyclopedia of the Eye*, a four-volume major reference work from Elsevier.