# **BIOGRAPHICAL SKETCH**

Provide the following information for the Senior/key personnel and other significant contributors. Follow this format for each person. **DO NOT EXCEED FIVE PAGES.** 

NAME: Ronald R. Krueger, MD, MSE

eRA COMMONS USER NAME (credential, e.g., agency login):

POSITION TITLE: McGaw Memorial Professor and Chairman, University of Nebraska Medical Center & Director, Stanley M Truhlsen Eye Institute

EDUCATION/TRAINING (Begin with baccalaureate or other initial professional education, such as nursing, include postdoctoral training and residency training if applicable. Add/delete rows as necessary.)

INSTITUTION AND LOCATION	DEGREE (if applicable)	Completion Date MM/YYYY	FIELD OF STUDY
Rutgers University, New Brunswick, New Jersey	BS	1982	Electrical Engineering
University of Washington, Seattle, Washington	MSE	1983	Bioengineering
University of Medicine and Dentistry of New Jersey (UMDNJ), Newark, New Jersey	MD	1987	Medicine

#### A. Personal Statement

As Chair of the Department, I oversee the laboratory and clinical research in Ophthalmology at the University of Nebraska Medical Center. To this end, I am supportive of and familiar with the multidisciplinary research efforts of my faculty. Personally, as cornea and refractive trained specialist, I have performed twenty thousand cornea and lens based refractive procedures and have been the principle investigator on numerous clinical trials. I have >35 years of experience in ultraviolet laser research, including the first physical descriptions of the effects of the excimer lasers on corneal tissue, and many more developments, including the early principles of ocular wavefront customized laser vision correction. To this end, I have co-organized an international congress on Ocular Wavefront Customization for the past 20 years and co-authored the first book on the subject, "Customized Corneal Ablation: The Quest for Super-Vision", which was later followed by a second edition. I also have over 25 years research experience in ultrashort pulse laser photodisruption of ocular tissue, and am involved in research investigating the cause(s) of presbyopia and restoration of accommodation with ultrashort pulse lasers, as well as ultrashort pulse laser assisted cataract surgery and vitreolysis. I have authored over 175 peer reviewed publications and many more abstracts, book chapters and trade journal articles. I served as the former Secretary of Education and Past President of the International Society of Refractive Surgery (ISRS), which is part of American Academy of Ophthalmology (AAO). I have been Associate Editor for the Journal of Refractive Surgery for over 20 years, and past recipient of the Barraguer Medal and Lecture and Lifetime Achievement Award of the ISRS/AAO. My own early research at UNMC includes collaboration with the Extreme Light Laboratory in the Physics Department at UN Lincoln on the complex optical delivery and retinal safety thresholds of ultrashort pulse lasers in the separation of tractional vitreous bands, which has implications for non-externally invasive treatment of proliferative diabetic retinopathy and other tractional vitreoretinopathies. I also am involved as PI in two industry sponsored, multicenter, U.S. FDA clinical trials of laser vision correction, and am the coordinating investigator in one of them.

### **B.** Positions and Honors

2019 **McGaw Memorial Professor and Chairman**, University of Nebraska Medical Center, Director, Stanley M Truhlsen Eye Institute, Omaha, NE

2009 **Professor of Ophthalmology**, Lerner College of Medicine at Case Western Reserve University, Cleveland, OH

1998-2018	Medical Director, Department of Refractive Surgery, Cole Eye Institute, Cleveland Clinic, Cleveland, OH		
1998	Associate Professor of Ophthalmology, Saint Louis University School of Medicine, St. Louis, MO		
1993-1998	Assistant Professor of Ophthalmology, Saint Louis University School of Medicine, St. Louis, MO		
1995(2 Mo)	Visiting Professor in Ophthalmology, University Eye Clinic, Dresden, Germany		
1992-1993	<b>Cornea and Refractive Surgery Fellow</b> , Clinical Instructor in Ophthalmology, University of Southern California, Doheny Eye Institute, Los Angeles, CA		
1991-1992	<b>Cornea and External Disease Fellow</b> , U of Oklahoma, Dean A. McGee Eye Institute, Oklahoma City, OK		
1988-1991	Resident in Ophthalmology, Columbia-Presbyterian Medical Center, New York, NY		
1987-1988	Transitional Intern, Hackensack Medical Center, Hackensack, NJ		

# Awards and Other Professional Activities:

- 2019 Lifetime Achievement Award in Refractive Surgery by American Academy of Ophthalmology (AAO) and International Society of Refractive Surgery (ISRS)

- 2018 Jose I. Barraquer Medal and Named Lecture by the International Society of Refractive Surgery (ISRS) and American Academy of Ophthalmology (AAO)

- 2016 American Academy of Ophthalmology Lifetime Achievement Award

- 2015 Founder's Award by the International Society of Refractive Surgery (ISRS)

- 2012 The "Richard L. Lindstrom, MD Lectureship" of the Contact Lens Association of Ophthalmologists at the American Society of Cataract and Refractive Surgery (ASCRS)

- 2010 American Academy of Ophthalmology Secretariat Award
- 2010 Gold Medal Award, Indian Intraocular Implant/Refractive Society
- 2010 Top 250 Premium Implant Surgeon (PS250) by Premium Implant
- 2008 Lans Distinguished Award by the ISRS/AAO
- 2007 Kritzinger Memorial Lecture Award by the ISRS/AAO
- 2006 American Academy of Ophthalmology Senior Achievement Award
- 2005/2006 Top Fifty Opinion Leaders (by Cataract & Refractive Surgery Today)
- 2005 National Leadership Award
- 2005 Appointment to U.S. Physician's Advisory Board (Honorary Chairman-Ohio)
- 2005 Castle Connolly America's Top Doctors
- 2005 Strathmore's Who's Who of Professionals
- 1998 International Who's Who of Professionals
- 1997 American Academy of Ophthalmology Honor Award
- 1987 MAP, Reader's Digest International Fellowship for Medical Externship in Zaire
- 1984 Medical School Alpha Omega Alpha Honor Society
- 1984 Medical Student Laser Research Fellowship from Coherent Medical, Inc.

# C. Contributions to Science: Categorical List of Representative Publications

**1.** Laser Biophysics, Optics and Wound Healing of Excimer Laser Corneal Photoablation: Modern day laser vision correction (LASIK) began as a paradigm shift in the treatment of the optically clear center of the cornea. Previously, treating the center of the cornea was forbidden, but the science of corneal photoablation was birthed with the excimer laser in the mid-80s, and the characterization of the biophysics, optics and wound healing of this tissue interaction fueled the growth of laser vision correction, such that LASIK is the most frequently performed elective procedure in all of medicine. My career in ophthalmology began with this contribution to science.

- 1. **Krueger RR**, Trokel S. Quantitation of corneal ablation with ultraviolet laser light. *Arch Ophthalmol.* 1985;103:1471-1472.
- 2. Puliafito C, Stern D, **Krueger RR**, Mandel E. High-speed photography of excimer laser ablation of the cornea. *Arch Ophthalmol.* 1987;105:1255-1259

- 3. Marshall J, Trokel S, Rothery S, **Krueger RR**. Long-term healing of the central cornea after photorefractive keratectomy using an excimer laser. *Ophthalmol.* 1988;95:1411-1421.
- 4. **Krueger RR**, Rabinowitz Y, Binder PS. The 25th Anniversary of Excimer Lasers in Refractive Surgery: Historical Review. *J Refract Surg*, 2010, Oct; 26(10): 749-759.

## 2. Ultrashort Pulse Laser Interaction in the Cornea as a Cutting & Cleaving Tool in Refractive Surgery:

Ultrashort pulse lasers were first investigated in ophthalmology during the mid-90s. The ultrashort pulse lasers (picosecond and femtosecond) could be focused inside the cornea rather than being used to treat the surface. What was hoped to produce an effect similar to photoablation in the surgical removal corneal tissue was discovered to simply cut and cleave corneal tissue intrastromally. My early experimental investigations in exvivo and in-vivo animal eyes and partially sighted human subjects, eventually led to the femtosecond laser as the most commonly used method of producing a LASIK flap, and the creation of a new procedure, small incision lenticular extraction (SMILE), which is growing internationally as an alternate procedure to LASIK.

- 1. **Krueger RR**, Quantock A, Juhasz T, Ito M, Assil K, Schanzlin D. Ultrastructure of picosecond laser intrastromal photodisruption. *J Refract Surg.* 1996;12:607-612.
- 2. Ito M, Quantock A, Malhan S, Schanzlin D, **Krueger RR**. Picosecond laser in situ keratomileusis with a 1053-nm Nd:YLF laser. *J Refract Surg*. 1996;12:721-728.
- 3. **Krueger RR**, Marchi V, Gualano A, Juhasz T, Speaker M, Suarez C. Clinical analysis of the Nd:YLF picosecond laser as a microkeratome for LASIK partially sighted eye study. *J Cat Refract Surg*. 1998; 24:1434-1440.
- 4. Reggiani-Mello GH, **Krueger RR**. Comparison of Commercially Available Femtosecond Lasers in Refractive Surgery. *Expert Review Ophthalmol*, 2011;6(1):55-65

**3.** Physiologic Optics of Wavefront Aberrometry in Vision Correction and Ocular Imaging: Early laser vision correction procedures, such as LASIK, would produce good visual acuity, but often be associated with optical symptoms, such as glare and halos. The science of physiologic optics had the tools to measure what these patients were experiencing, and the first international congress of Ocular Wavefront Sensing and Customized Visual Correction, which I hosted and held in the year 2000, was a transformation exchange between clinical ophthalmology, physiologic optics researchers and industry to usher in the science of wavefront aberrometry and customized laser vision correction into ophthalmology.

- 1. Mrochen M, **Krueger RR**, Bueeler M, Seiler T. Aberration-sensing and wavefront-guided laser in situ keratomileusis management of decentered ablation. *J Refract Surg.* 2002; 18(4): 418-429.
- 2. Chalita MR, Chavala S, Meng X, **Krueger RR**. Wavefront analysis in post-LASIK eyes and its correlation with visual symptoms, refraction and topography. *Ophthalmol.* 2004;111(3): 447-453.
- 3. **Krueger RR**, Applegate R, MacRae SM (Editors): <u>Wavefront Customized Visual Correction</u>: <u>The Quest</u> for Super Vision II. SLACK Inc., Thorofare, NJ 2004.
- 4. De Stefano VS, Meister C, Ehlke GL, **Krueger RR**. Analysis of planning strategies in primary eyes gaining a line or more of visual acuity after topography-guided laser in situ keratomileusis. Journal of Cataract & Refractive Surgery. 2019 Mar 1;45(3):321-7.

4. **Ultrashort Pulse Laser Delivery and Treatment to the Crystalline Lens:** The success of ultrashort pulse lasers being used as a corneal cutting tool, led to the quest to apply this deeper in the eye at the crystalline lens, especially in the aging crystalline lens in eyes with presbyopia and cataract. This was experimentally tested by myself with Nd:YAG lasers, and eventually with shorter pulse, femtosecond lasers in rabbits eyes, showing no cataract formation despite the high total laser energy used in treatments. This led to clinical studies that demonstrated safety in treating the crystalline lens without creating a vision threatening cataract (subject of my thesis in the American Ophthalmological Society). The technology ultimately was applied commercially in laser assisted cataract surgery (LACS), in which I participated as a start up company cofounder and contributed to the science with the first textbook on the subject.

- 1. Krueger RR, Sun XK, Stroh JL, Myers RI. Experimental increase in accommodative potential following Nd:YAG laser photodisruption of paired cadaver lenses. *Ophthalmol.* 2001;108(12):2122-2129.
- 2. Krueger RR, Kuszak J, Lubatschowski H, Myers RI, Ripken T, Heisterkamp A. First safety study of femtosecond laser photodisruption in animal lenses: Tissue morphology and cataractogenesis. J Cat Refract Surg. 2005, 31 (12); 2386-4.
- 3. Krueger RR. Uv H. McDonald J. Edwards K. Ultrashort-Pulsed Lasers Treating the Crystalline Lens: Will They Cause Vision Threatening Cataract? Trans Am Ophthalmol Soc. 2012; 110: 130-165.
- 4. Krueger RR, Talamo JH, Lindstrom RL (editors): Textbook of Refractive Laser Assisted Cataract Surgery (ReLACS). Springer, New York, 2013.

## 5. Ocular Biomechanics, Keratoectasia and Collagen Cross-linking of the Cornea and Ocular Tissues:

The science of corneal laser vision correction was challenged by the reporting of structural weakening in certain corneas, leading to corneal ectasia, similar to keratoconus. Since keratoconus is in part a refractive disorder, this was the focus of my early investigations in the mid 2000s. Methods for measuring the corneal elasticity and then ultimately in using corneal collagen cross-linking to strengthen the weakened collagen, opened a new therapeutic intervention that would provide hope to the treatment of patients with keratoconus and keratoectasia. Other ocular tissues, such as the peripapillary sclera might also benefit from cross-linking to protect the optic nerve in glaucoma. Screening of laser vision correction eyes and computational modeling is leading to corneal refractive procedures. Recently, stromal molecular markers have indicated structurally weakening of the cornea in eyes where biomechanical tests were not abnormal to provide further areas of investigation for the future.

- 1. Dupps WJ, Netto MV, Herekar S, Krueger RR. Surface wave elastometry of the cornea in porcine and human donor eyes. J Refract Surg. 2007; 23(1):66-75.
- 2. Rocha KM, Ramos-Esteban JC, Qian Y, Herekar S, Krueger RR. Comparative Study of Riboflavin-UVA Cross-linking and "Flash-linking" Using Surface Wave Elastometry. J Refract Surg, 2008 September: 24(7) S748-S751.
- 3. Thornton IL, Dupps WJ, Roy AS, Krueger RR. Biomechanical effects of intraocular pressure elevation on optic nerve/ lamina cribrosa before and after peripapillary scleral collagen cross-linking. Invest Ophthalmol Vis Sci. 2009 March; 50(3) 1227-1233.
- 4. Shetty R, Kumar NR, Khamar P, Francis M, Sethu S, Randleman JB, Krueger RR, Roy AS, Ghosh A. Bilaterally asymmetric corneal ectasia following SMILE with asymmetrically reduced stromal molecular markers. Journal of Refractive Surgery. 2019 Jan 14:35(1):6-14.

# D. Additional Information: Research Support and/or Scholastic Performance

# **Ongoing Research Support:**

884

Krueger (Site PI)

03/03/20-03/02/22

Bausch & Lomb Inc

A Study to Investigate the Safety and Effectiveness of the Technolas TENEO 317 Model 2 Excimer Laser for Laser In Situ Keratomileusis (LASIK) Surgery to Treat Myopia or Myopic Astigmatism (TENEO) The principal aim of this grant is to enroll 330 subject at 10 investigational centers to determine the safety and effectiveness of the using Technolas Teneo 317 Excimer laser in performing LASIK for the correction of myopia and astigmatism. Additional grants for additional indications, such as hyperopia, mixed astigmatism, transepithelial PRK and customized LASIK, will be awarded in succession over the ensuing years. Role: PI

RFP911-C001

Alcon

Krueger (Site PI)

07/01/20-06/30/22

Pivotal Trial of Wavelight EX500 Excimer Laser System for the Correction of Myopia with and without Astigmatism Using InnovEyes in Conjunction with InnovEyes sightmap

The principal aim of this grant is to enroll 330 subject at 9 investigational centers to determine the safety and effectiveness of the WaveLight EX500 in treating myopia and myopic astigmatism using of the new customized InnovEyes software in conjunction with the InnovEyes Sightmap device.

Role: PI and Coordinating Investigator

**Completed Research Support:** No research has been completed in the last 3 years.