

Contact Lens Association of Ophthalmologists, Inc.® • Eye & Contact Lens

Silicone Hydrogel Lenses

- Ten Years Later

May 4-5, 2012 • Riverside Hotel, Fort Lauderdale, FL



Friday, May 4, 2012

New River Ballroom

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| 7:45 am | Breakfast | West Balcony |
| 8:45 am | Opening Remarks | New River Ballroom |

Session I: Contact Lens Materials/Surfaces and Support of the Tear Film

Moderator: Desmond Fonn, DipOptom, MOptom

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| 8:50 am | Surface Properties and Ocular Compatibility of SiHy Lenses • Brian Tighe, PhD, DSc |
| 9:20 am | Biocompatibility in the Development of SiHy Lenses • Jean Jacob, PhD |
| 9:50 am | Deposits on SiHy Lenses • Jason Nichols, OD, MPH, PhD, FAAO |
| 10:10 am | Discussion |
| 10:30 am | Break |

Session II: Contact Lens Care

Moderator: Michael H. Goldstein, MD, MM

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| 11:00 am | Solutions for Care of SiHy Lenses • Mark Willcox, PhD | |
| 11:20 am | Uptake and Release of CL Care Components Into SiHy Lenses • Lyndon Jones, OD, PhD, FCOptom, FAAO | |
| 11:40 am | SiHy Solution Interaction and Inflammation • Nicole Carnt, PhD | |
| 12:00 pm | Impact of SiHy/Solution Combinations on Corneal Epithelial Cells • Maud Gorbet, PhD | |
| 12:20 pm | Discussion | |
| 12:50 pm | Lunch | East Balcony |

Session III: Ocular Reaction to Contact Lens Wear (micro and macro)

Moderator: Oliver D. Schein, MD, MPH

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| 2:10 pm | Epidemiology of Corneal Infiltrates with Silicone Hydrogel Lenses with Current Use Patterns
• Robin Chalmers, OD, FAAO, FBCLA and Loretta Szczotka-Flynn, OD, PhD | |
| 2:30 pm | Have SiHy Lenses Eliminated Hypoxia? • Deborah Sweeney, BOptom, PhD | |
| 2:50 pm | Microbial Adhesion to SiHy Lenses • Mark Willcox, PhD | |
| 3:10 pm | Break | |
| 3:40 pm | Effect of SiHy Lenses on Epithelial Homeostasis • Danielle Robertson, OD, PhD | |
| 4:00 pm | Pathogenesis of MK: Does Lens Material Make a Difference? • David Evans, PhD | |
| 4:20 pm | Epidemiology of MK with SiHy Lenses • Fiona Stapleton, PhD, McOptom, DCLP, FAAO, FBCLA | |
| 4:40 pm | Discussion | |
| 5:10 pm | Close | |
| 7:00 pm | Dinner | Champ Carr Room |

Saturday, May 5, 2012

New River Ballroom

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| 8:00 am | Breakfast | West Balcony |
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Session IV: Impact of Lens Wear

Moderator: Michael H. Goldstein, MD, MM

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| 8:40 am | Are SiHy Lenses More Comfortable Than Hydrogels? • Michel Guillon, PhD, FCOptom, FAAO, FBCLA, CCTI |
| 9:00 am | Have SiHy Lenses Decreased Dropouts? • Kathy Dumbleton, MSc, McOptom, FAAO (Dip CL), FBCLA |
| 9:20 am | Wettability of SiHy Lenses • Nancy Keir, OD, PhD, FBCLA, FAAO |
| 9:40 am | Break |
| 10:10 am | North American Post Market Surveillance of SiHy Lenses • Robin Chalmers, OD, FAAO |
| 10:20 am | EW and DW Induced Mechanical Complications of SiHy Lenses • Meng Lin, OD, PhD, FAAO |
| 10:40 am | SiHy Lenses: What is Needed in the Next Decade • Padmaja Sankaridurg, BOptom, PhD, Brien Holden, PhD |
| 11:00 am | Discussion |
| 11:30 am | Closing Remarks |

SiHy Solution Interaction and Inflammation
Nicole Carnt, PhD

Daily wear of silicone hydrogel lenses using marketed lens care solutions results in varied levels of anterior eye inflammation. There are several pathways that may lead to corneal and conjunctival inflammation that include mechanical, allergic and pathogen driven stimuli. The hypotheses and evidence for these various models of inflammation will be discussed in the context of silicone hydrogel lens designs and materials and lens care solution components.

North American Contact Lens Post-Market Surveillance
Robin L. Chalmers, OD, FAAO, FBCLA

As 30-night continuous wear silicone hydrogel and rigid gas-permeable lenses were approved into the United States in 2001, the Food and Drug Administration mandated large post-market surveillance studies in order to assess the risk of microbial keratitis under that wearing schedule. Since that time, the majority of these lenses are being prescribed for daily or flexible wear and not for 30 night wear. With daily use, silicone hydrogel lenses have been exposed frequently to lens care products, lens cases and handling that may introduce sources of microbial contamination that could influence their safety profile. A summary of post-market surveillance methods and current results will be reviewed.

Epidemiology of Corneal Infiltrates with Silicone Hydrogel Lenses with Current Use Patterns
Robin L. Chalmers, OD, FAAO, FBCLA and
Loretta Szczotka-Flynn, OD, PhD

Assessment of the relative risk and risk factors associated with corneal infiltrates has been a focus of contact lens research for decades. Prescribed and actual wearing schedules for silicone hydrogel lenses have evolved from primarily 30-night continuous wear lenses when they were first approved to mostly daily wear or occasional overnight use now. Lenses worn on a daily basis are exposed to lens handling, lens care products and the lens case environment, and all of these factors may influence the amount of microbial contamination that will drive corneal infiltrates. This talk will summarize recent epidemiology studies of corneal infiltrates with silicone hydrogel lenses and pose preventive steps that could be taken to ameliorate the risk of infiltrates.

Have Silicone Hydrogel Lenses Decreased Drop-outs?
Kathy Dumbleton, MSc, MCOptom, FAAO, FBCLA

Discontinuation or "drop-out" from contact lens (CL) wear continues to afflict the contact lens industry. Several studies have reported the most common reasons for discontinuing wear to be discomfort, dryness, and the onset of visual problems associated with presbyopia. However, since these studies were conducted, lens materials, modalities for lens wear and lens designs have changed considerably. Specifically, it is not known whether the advent of silicone hydrogel (SiHy) CLs has impacted the drop-out rate and the reasons for discontinuation. This presentation will review the literature relating to CL drop-outs and compare these findings with the results from an internet based study evaluating CL drop-out which was recently conducted at the Centre for Contact Lens Research.

Co-authors of the publication: Craig A. Woods PhD MCOptom FAAO FACO, Lyndon W. Jones PhD FCOptomDipCLPDipOrth FAAO (Dip CL) FIACLE and Desmond FonnDip Optom, MOptom, FAAO

Pathogenesis of MK: Does Lens Material Make a Difference?
David Evans, PhD

Microbial keratitis (MK) is a vision-threatening complication of contact lens wear. The introduction of silicone hydrogel lens materials with increased oxygen transmission to the ocular surface has not significantly altered the incidence of MK. These data suggest that alternate, or additional, predisposing factors involving lens wear must be addressed to reduce or eliminate these infections. The contact lens can provide a surface for microbial growth in situ, and can also influence ocular surface homeostasis through effects on the tear fluid and corneal epithelium. Thus, it is intuitive that future contact lens materials could make a significant contribution to preventing MK. Design of the "right" material to prevent MK requires understanding the effects of current materials on bacterial virulence in the cornea, and on ocular surface innate defense. Current knowledge on each of these areas will be presented, with discussion of future directions needed to understand the influence of lens material on MK pathogenesis.

Impact of SiHy Solution Combinations on Corneal Epithelial Cells
Maud Gorbet, PhD

Multipurpose solutions (MPS) are used daily to clean and disinfect silicone hydrogel (SiHy) contact lenses. In vitro studies typically investigate MPS toxicity by incubating diluted MPS with cells. However, interactions with contact lens materials lead to preferential uptake and release of agents contained within MPS. Our in vitro studies have compared how corneal epithelial cells react to diluted MPS solutions and to MPS-soaked lenses. In vitro results demonstrate that the response of corneal epithelial cells to MPS is affected by the type of lenses the MPS is released from and may potentially be influenced by the surface treatment (or lack of it) of SiHy materials. Monolayer and stratified in vitro models are currently being used to better understand the mechanisms of MPS-induced cell toxicity. How these in vitro models may further assist in the development of more compatible MPS and in the assessment of lens-MPS bio-incompatibility will be discussed.

Are SiHy Lenses More Comfortable Than Hydrogels?
Michel Guillon, PhD, FCOptom, FAAO, FBCLA, CCTI

Silicone hydrogel contact lenses were developed to fulfil the oxygen requirements not met by conventional hydrogel contact lenses for overnight wear. However, the use of such contact lenses for extended wear represents a minority use estimated at most at 15% of all fittings. Further, contact discomfort, particularly end of day discomfort, at this ten year review of the progress made with silicone hydrogel contact lenses remain the major complaint. The key question to answer is, therefore, how much improvement in comfort has been achieved compared with conventional hydrogel contact lenses. The presentation will review the published literature to address this multifactorial question in the context of the material properties, lens design, replacement frequency and interaction with lens care products.

Biocompatibility in the Development of SiHy Lenses

Jean Jacob, PhD

In response to patient demands for extended contact lens wearing times, the contact lens industry has developed novel silicone-hydrogel lens materials which combine the enhanced oxygen permeability of silicone polymers with the water-based comfort of conventional hydrogels. In the past 10 years since the successful launch of these SiHy lenses, much has been learned about their ability to provide the biocompatibility necessary to sustain ocular health and comfort. A review of the unique physiological requirements for a successful extended wear lens and how the first and current SiHy lenses address them will be provided.

Uptake & Release of Contact Lens Care Components into Silicone Hydrogel Lenses

Lyndon Jones, PhD, FCOptom, FAAO

Contact lens solutions are highly complex mixtures of biocides (preservatives), surfactants and other agents designed to disinfect, clean and wet contact lenses. The commercialization of silicone hydrogel (SiHy) lenses has resulted in unique challenges to the contact lens solution manufacturers, as the properties of these materials differ markedly from those seen previously with polyHEMA-based hydrogels. Historically, uptake and release of preservatives with low molecular weights into hydrogels, such as chlorhexidine and thimerosal, was known to result in allergic reactions, resulting in corneal irritation, stinging, conjunctival hyperaemia, development of corneal infiltrates, palpebral lid changes and corneal staining. However, little is known about the interaction of modern care systems with modern soft lens materials. Factors to be considered when evaluating uptake and release of care components include the water content, charge, relative hydrophobicity, surface treatment and porosity of the lens material, in conjunction with the charge/molecule, ionicity, molecular weight and hydrophobicity of the care component in question. These factors control the adsorption and absorption of the solution components, resulting in a variety of differences in the amount of the component being taken up into the lens material and subsequently released onto the ocular surface. This presentation will review current knowledge concerning these interactions and investigate what clinically observable complications may arise from these interactions. It also reviews whether current methods to determine these interactions could be improved upon.

Wettability of Silicone Hydrogel Contact Lenses

Nancy Keir, OD, PhD, FBCLA, FAAO

One of the major breakthroughs in the development of silicone hydrogel contact lenses has related to the ability of manufacturers to overcome the surface hydrophobicity that occurred with silicone elastomer lenses. However, the wettability of silicone hydrogel lenses continues to be of interest as a potential link between in vivo lens performance and contact lens-related comfort. This presentation will review some of the knowledge we have gained in the area of contact lens wettability over the past decade and will discuss future research areas that may be promising.

EW and DW Induced Mechanical Complications of SiHy Lenses

Meng Lin, OD, PhD, FAAO

This talk will provide an overview of mechanical complications induced by silicone hydrogel contact lenses — mucin balls, lid wiper epitheliopathy, meibomian gland dropouts, corneal erosions, superior epithelial arcuate lesions, palpebral conjunctivitis, and conjunctival epithelial flap. Effects of lens materials, lens-wearing modalities, ethnic and racial factors on these mechanical complications will also be discussed.

Deposits on SiHy Lenses

Jason Nichols, OD, MPH, PhD, FAAO

The interaction between a contact lens, the ocular surface, and the tear film is vital for successful contact lens wear. It has long been known that both organic and inorganic tear film and ocular surface-related components deposit on contact lenses. Over the years, significant emphasis has been placed on understanding the interaction between protein and lipid deposits on contact lenses. It has become well-recognized that the polymer composition of the contact lens material has a significant impact on the trends associated with deposition patterns. Likewise, other factors such as lens care, compliance and the environment all may play a role in observed trends in deposition patterns. Finally, it is important to note the methodology used when studying contact lens deposition, as the methodological approach used may lead to variability in findings compared to other studies using differing methodologies. Going forward, it is important to develop both standardized and unique methodologies that lead to new insights into contact lens deposition patterns that ultimately are able to detect associations with in-vivo performance and adverse events.

Effect of SiHy Wear on the Corneal Epithelium and Risk for Microbial Keratitis

Danielle M. Robertson, OD, PhD

Previous studies using animal models and human clinical trials have demonstrated that the use of low oxygen transmissible contact lens materials induced corneal epithelial surface damage resulting in increased *Pseudomonas aeruginosa* (PA) adhesion and internalization into surface corneal epithelial cells, leading to the testable predictions that (1) MK risk is greatest during the first 6 months of wear; (2) there is no difference between 6 and 30 night extended wear; and (3) that increased lens oxygen transmissibility would reduce the reported incidence of infection. Subsequent epidemiological studies have confirmed the first two predictions; however, increased oxygen transmissibility with silicone hydrogel lens wear has not altered the overall incidence of MK. In this review, clinical and basic studies that investigate epithelial alterations and bacterial adhesion to corneal epithelial cells following wear of SiHy lenses and exposure to chemically preserved multipurpose solutions (MPS) will be examined. The collective findings suggest that even in the absence of lens-related hypoxia, some MPS induce ocular surface changes which are associated with an increase in PA adherence in the corneal epithelium. In agreement with these findings, new epidemiological data have demonstrated that the use of MPS is associated with an increased risk for contact lens-related MK.

Silicone Hydrogels: What is next?

Sankaridurg P, Lazon de la Jara P and Holden BA

Significant advances of the past decade with silicone hydrogel lenses have made them the primary mode for new contact lens wear. Their dominance in the marketplace is driven largely by the elimination of the structural and physiological changes induced by contact lens induced hypoxia, as exemplified by the reduction in especially limbal redness. On the other hand, end of day dryness and discomfort still drives many to discontinue from lens wear. Evidence also shows that the rate of serious adverse events such as microbial keratitis have not been impacted with silicone hydrogel lenses. Moreover there are additional challenges relating to 'staining' and infiltrates associated with solution incompatibility with lens materials. On the other hand, the technological advances enabled by the high oxygen platform present opportunities for expanding the use of contact lenses in areas that had limited uptake in the past such as astigmatism, presbyopia and importantly, myopia control. The challenges and opportunities facing the field and how we need to address these challenges will be discussed.

The Epidemiology of Microbial Keratitis with Silicone Hydrogel Contact Lenses

Fiona Stapleton, BSc, MSc, PhD

It was widely anticipated that following the introduction of silicone hydrogel contact lenses, the risk of microbial keratitis would be lower than with hydrogel contact lenses. Large scale epidemiological studies have confirmed however that the absolute and relative risk of microbial keratitis is unchanged with silicone hydrogel materials. Key findings include: 1) The risk of infection with 30 nights continuous use of silicone hydrogel contact lenses is equivalent to 6 nights of hydrogel lens extended wear; 2) Occasional overnight lens use is associated with a greater risk than daily lens use independent of material type; 3) While the rate of vision loss due to corneal infection is similar to that seen with hydrogel contact lenses, there is some evidence for less severe disease with extended wear silicone hydrogel lens use; 4) The spectrum of causative organisms is similar for both lens types; and, 5) Modifiable independent risk factors for infection include overnight lens use, the degree of exposure, failing to wash hands prior to lens handling, storage case hygiene practice and Internet purchase.

The unchanged absolute risk of disease therefore suggests factors other than hypoxia are relevant in the pathogenesis of contact lens related microbial keratitis. Epidemiological studies remain important in the assessment of risks associated with new modalities and materials. In designing future studies, specific consideration of an early adopter effect and further investigation of the impact of second generation silicone hydrogel materials is warranted.

Have Silicone Hydrogels Eliminated Hypoxia?

Deborah Sweeney, BOptom, PhD

Goodlaw was one of the first individuals to hypothesize that contact lenses act as a barrier to the eyes' anterior oxygen supply. We are now well aware that inadequate oxygen, or hypoxia, can result in the development of a number of contact lens-related complications. The development of silicone hydrogels focused on meeting the oxygen transmissibility requirements for overnight wear. The benefits of these materials for continuous wear have been demonstrated and studies have also confirmed similar advantages with daily wear of silicone hydrogels. This paper will review corneal oxygen requirements and the research that has indicated that most contact lens wearers who wear silicone hydrogels experience fewer corneal hypoxia related problems.

Surface Properties and Ocular Compatibility of Silicone Hydrogels

Brian Tighe, PhD, DSc

The last decade has been very significant for the development of contact lens materials. The most important feature of this period has been the appearance, increasing diversity and market growth of the so-called silicone hydrogels. Both name and oxygen transport properties are a direct consequence of the inclusion of a significant proportion of siloxy groups, which contain the element silicon linked directly to both oxygen and carbon atoms. Because of their enhanced oxygen permeability, the initial focus of silicone hydrogels was extended wear. Developments in both materials science and production technology in the last decade have enabled their use in both scheduled replacement daily wear and daily disposable modalities.

In consequence, since the initial launch of silicone hydrogel (SiHy) lenses there has been a considerable broadening in the range of commercial SiHy properties, with some fifteen SiHy materials variants currently available. EWC is influential and the decade has seen a progressive rise, encompassing materials from 24% to 74%. Moduli have decreased over the same period from 1.4 MPa to 0.3 MPa, but not solely as a result of EWC changes. Surface properties do not correlate directly with EWC, and ingenious approaches have been used to achieve desirable improvements (e.g. greater lubricity, lower contact angle hysteresis). This is demonstrated by comparing the hysteresis values of the earliest ($>40^\circ$) and the most recent ($<10^\circ$) coated SiHys. Arguably, the changes that have taken place have been strongly influenced by practitioner feedback based on clinical experience.

Although there have been undeniable property developments, conventional and silicone-based materials still show marked differences, particularly in surface properties. The difference is characterized in such areas as protein deposition, lipid deposition and coefficient of friction. An underlying contributory factor is the difference in surface energy of the constituent polymers. Surface energies are made up of both polar and non-polar components, which can be readily quantified and expressed in terms of the fractional polarity of the surface. Whereas the average polar fraction of conventional hydrogels is 0.54, with a range of ± 0.09 , the average polar fraction of SiHys is 0.22, with a range of ± 0.17 .

The search for improved comfort has been an ongoing quest, but it has become apparent that simple improvements in wettability and reduction in lens modulus have only brought limited success in this respect. Once the physical causes of discomfort associated with the lens (for example edge-related factors, defects and physical imperfections) have been minimised, we are faced with the problem of making the indwelling lens resemble, as closely as possible, the surface and lubrication characteristics of the non lens-wearing eye. It is clear, however, that we can never match the behaviour of the natural system, simply because the lens itself is several times thicker than the tear film.

It is useful to identify two distinct influences on contact lens comfort. The first is the mismatch of individual patient tear chemistry and contact lens material, which is largely avoidable. The second - the interference of the lens with ocular dynamics - is more complex and is an important current area of contact lens research. Consequent effects are not linked to any single universally applicable discomfort marker, but appear to be best characterised as a cumulative burden which increases with wear time. There is growing evidence that links the dynamics of lens-eye interaction with biochemical consequences that are known to induce discomfort in other body sites. These relate to sites of tissue-material interactions involving anterior and posterior lens surfaces separately and may hold the key to improvements in end of day comfort.

Solutions for Care of Silicone Hydrogel Lenses

Mark Willcox, PhD

Silicone hydrogel (SiHy) lenses are most commonly prescribed for use as daily wear lenses. However, as lenses of this type were originally developed for use as extended wear lenses, the development of care solutions for them lagged behind. In recent years several manufacturers have released new versions of multipurpose disinfecting solutions (MPDS) designed to be used with silicone hydrogel and other lens types. The new solutions contain alternative combinations of agents (e.g. PHMB and polyquad; Alexidine and polyquad), alternative surfactants (e.g. polyoxyethylene-polyoxybutylene copolymer; sulfobetaine; tetricon 904), or conditioning agents (e.g. hyaluronan), as well as a return to the inclusion of EDTA in their formulations. These changes are likely to have impacts on the microbiology of lenses and lens cases, the ability to kill potential pathogens, as well as the clinical performance of the SiHy/MPDS combinations. For example, the exchange of nonanoyl-ethylenediaminetriacetic acid for ethylenediaminetriacetic acid (EDTA) in the formulations of EXPRESS® RepleniSH® vs. EXPRESS® EverMoist/PureMoist® appears to have increased the stand alone activity against yeasts and Acanthamoeba trophozoites. Exchanging disinfectants, surfactants and buffers in COMPLETE® Easy Rub® vs. RevitaLens OcuTec™ has increased the stand alone activity against *Fusarium solanii*. These and other data on the microbicidal activities of MPDS in combination with SiHy lenses will be presented and discussed.

Microbial Adhesion to Silicone Hydrogel Lenses

Mark Willcox, PhD

The relative lack of success of silicone hydrogel lenses in reducing the incidence of adverse events, including events such as microbial keratitis, contact lens-induced acute red eye, and other infiltrative events is likely due to the adhesion of microbes to these lenses. Bacteria appear to adhere in higher number to silicone hydrogel lenses than conventional HEMA-based hydrogel contact lenses, at least in vitro. Similarly, silicone hydrogel lenses appear to promote the penetration of certain fungal hyphae (*Fusarium* sp.) into their surfaces compared to conventional HEMA-based lenses. Furthermore, first generation silicone hydrogel lenses adhere more, 13-18 times more, *Acanthamoeba* trophozoites compared to HEMA-based lenses. *Acanthamoeba* adhere in higher numbers to silicone hydrogel lenses even after wear or after adhesion of bacteria to the lenses. Adhesion of *Acanthamoeba* to second generation silicone hydrogel lenses is generally equivalent to adhesion to HEMA-based lenses. Recent data from experiments conducted at the Brien Holden Vision Institute have evaluated the adhesion of strains of *P. aeruginosa* and *S. aureus* to various silicone hydrogel lenses. The adhesion of strains of *P. aeruginosa* was always greater (9×10^5 to 3×10^6 CFU/lens) compared to strains of *S. aureus* (3×10^4 to 4×10^5 CFU/lens). The adhesion of *P. aeruginosa* stains to silicone hydrogel lenses split the lenses into 2 distinct groups, but this was not related to the classification of lenses as 1st, 2nd or 3rd generation. Rather, the split appeared to be related to the hydrophobicity of the lens surface, with bacteria adhering less to the more hydrophobic surface lenses. The affect of lens wear was also examined. Whilst different strains of bacteria can behave differently, overall, daily disposable contact lens wear resulted in increased numbers of total cells of *S. aureus* but had less overall effect on total numbers of *P. aeruginosa*. Lens wear did not affect the viable numbers of *S. aureus* adhered to lenses, but did affect viable numbers of *P. aeruginosa*, and this was contact lens type dependent. This latter finding may be associated with the adsorption of the antimicrobial protein lactoferrin to lens surfaces.



Nicole Carnt, PhD, graduated from UNSW in Optometry in 1989 and worked in private practice in Australia and the UK before taking a position with the CCLRU in 1999, where she has held a variety of roles. In recent years, she has been Principal Investigator on BHVI Matrix studies, an ongoing evaluation of silicone hydrogel and solution combinations. She is currently undertaking a PhD on Epidemiology of Contact Lens Related Infection and Inflammation, with particular interest in patient factors, such as risk taking behaviour, compliance and genetics.



Maud Gorbet, PhD, is an assistant professor in the faculty of engineering at the University of Waterloo and is cross-appointed with the School of Optometry. She also works in collaboration with the Centre for Contact Lens Research. A bio-engineer in training, she obtained her PhD in chemical engineering at the University of Toronto (Canada) and working in industry until 2007. Her research focuses on understanding cell interactions and inflammatory response with ophthalmic materials using both in vitro and ex vivo models. Part of her research program involves the development of better in vitro models and tools to assess biocompatibility.



Robin L. Chalmers, OD, FAAO, FBCLA, is a graduate of UC Berkeley School of Optometry. Dr. Chalmers is an independent clinical trial consultant. She is Vice-Chair of the American Academy of Optometry Research Committee and co-chair of the Contact Lens Assessment in Youth Study (CLAY) group studying the safety of contact lens wear in teens and young adults. She serves as faculty for the AOA/AAO Summer Research Institute and on the Editorial Board of Contact Lens and Anterior Eye. Her contact lens areas of research interest are epidemiology of complications with contact lenses, and post-market surveillance of contact lens outcomes.



Michel Guillon, PhD, FCOptom, FAAO, FBCLA, CCTI, is Clinical Director of OTG Research & Consultancy and of Michel Guillon Sports Vision. He is past President of the International Society for Contact Lens Research and current executive member, past European President of the International Association of Contact Lens Educators. He is a member of the Medical and Scientific Board of the Tear Film and Ocular Surface Society and of the Editorial Boards of Eye & Contact Lens and Contact Lens & Anterior Eye Journals. Dr. Guillon has published numerous scientific papers, co-edited a major text book on contact lenses and is a co-inventor on several EU, US and world patents.



Kathy Dumbleton, MSc, McOptom, FAAO (Dip CL), FBCLA, graduated in Optometry from the University of Wales. She completed a pre-registration year at Moorfields Eye Hospital and received an MSc in Vision Science from the University of Waterloo, Canada. Kathy is Head of Clinical Logistics at the Centre for Contact Lens Research, University of Waterloo. She is a fellow of the British Contact Lens Association, a diplomat of the Cornea and Contact Lens Section of the American Academy of Optometry, a council member of the International Society for Contact Lens Research and president-elect of the American Optometric Foundation. Her research interests include the ocular response to contact lenses, compliance and the measurement of ocular discomfort.



Jean T. Jacob, PhD, is Director of Research Development for the Louisiana State University School of Medicine, Professor of Ophthalmology and Neuroscience, and Director of Research at the LSU Eye Center of Excellence. She is also Adjunct Professor of Biomedical Engineering at Tulane University. She received her undergraduate degree in biochemistry at the University of California, Riverside and her doctoral degree in biomedical polymer science from Tulane University. Dr. Jacob is currently a Vice-President of the International Society of Contact Lens Research and chairs the biannual Symposium on the Material Science and Chemistry of Contact Lenses.



David J. Evans, PhD, obtained his PhD in Pharmaceutical Microbiology from the School of Pharmacy, University of Manchester. After a post-doctoral fellowship at Harvard Medical School, he joined the clinical faculty at the School of Optometry, University of California, Berkeley. Currently, he is a Professor of Biological and Pharmaceutical Sciences at the College of Pharmacy, Touro University California, and an Associate Research Scientist at the University of California, Berkeley. Dr. Evans' research interests include the pathogenesis of *Pseudomonas aeruginosa* infections, mucosal surface innate immunity, and antimicrobial therapy.



Lyndon Jones, PhD, FCOptom, FAAO, is a Professor at the School of Optometry and Director of the Centre for Contact Lens Research at the University of Waterloo. He graduated in Optometry from the University of Wales in 1985 and gained his PhD from the Biomaterials Research Unit at Aston University, Birmingham, UK in 1998. He is a Fellow and Diplomate of the American Academy of Optometry (AAO) and the current Chair of the Research Committee of the AAO. He has authored over 250 refereed and professional papers, one text-book and given over 600 invited lectures at conferences worldwide, in over 30 countries.



Desmond Fonn, Dip. Optom, M. Optom., is Professor Emeritus and the founding Director of the Centre for Contact Lens Research at the School of Optometry, University of Waterloo, Waterloo, Ontario, Canada. He is a graduate of the School of Optometry in Johannesburg, South Africa and the University of New South Wales in Sydney, Australia where he also served as a consultant for the Cornea and Contact Lens Research Unit. He currently serves as Editor-In-Chief of Eye & Contact Lens.



Nancy Keir, OD, PhD, FBCLA, FAAO, is Head of Clinical Operations at the Centre for Contact Lens Research at the School of Optometry, University of Waterloo in Ontario, Canada where she oversees the clinical trials conducted at the Centre. She graduated with an OD degree from Waterloo in 2000 and subsequently undertook a part-time PhD on the impact of customised LASIK on higher order aberrations and visual performance, which was gained in 2008. Nancy is also a Senior Clinical Scientist and has been the Lead Investigator for trials investigating SCL design, lens care, anterior segment physiology and comfort and has particular interests in the assessment of optical quality and in vivo wettability of SCLs.



Michael H. Goldstein, MD, MBA, is Co-Director of the Cornea Service at the New England Eye Center/ Tufts Medical Center in Boston where he is an Assistant Professor of Ophthalmology at Tufts University School of Medicine. Dr. Goldstein currently serves as President as CLAO. He is also the President for the Massachusetts Medical Society and the Vice President for the Tufts Medical Center Medical Staff. In addition, he is the Chair of the AAO's Cornea POC Panel and teaches the cornea section for the AAO's board review course. He, also, currently serves as team ophthalmologist for the Boston Celtics.



Meng C. Lin, OD, PhD, is an Associate Professor at University of California, Berkeley. She is also the founding Director of the Clinical Research Center and Co-Chief of the Ocular Surface Clinic. Her research focus is on dry eyes, rheology properties of tear and meibum lipids, and effects of contact lens on the ocular surface integrity. She also investigates fundamental differences in racial and ethnic ocular anatomy and physiology as well as their responses to ophthalmic devices.



Jason J. Nichols, OD, MPH, PhD, FFAO, was appointed the Kevin McDaid Vision Source Professor at the University of Houston, College of Optometry in 2011. He received his undergraduate degree in Biology from Hope College (1995), and Doctor of Optometry (1999), Master's in Public Health (2003, epidemiology) and PhD (2004) all from the Ohio State University. He was on the faculty at Ohio State University from 2004-11 as a tenured associate professor. He is currently Editor of Contact Lens Spectrum and Contact Lenses Today®, whose publications reach over 50,000 eye-care practitioners worldwide.



Fiona Stapleton, BSc, MSc, PhD, McOptom, DCLP, FFAO, FBCLA, GradCertOcTher, graduated in Optometry from the University of Cardiff, Wales in 1985 and has since worked in academic, hospital and private optometric practice. She was awarded her PhD in 1991 from City University and Moorfields Eye Hospital in London for her research on the pathogenesis and epidemiology of contact lens-related disease and completed a post-doctoral fellowship at University College London. She is Professor and Head of School of Optometry and Vision Science, University of New South Wales, Sydney, NSW, Australia, and a Senior Research Associate, Brien Holden Vision Institute, University of New South Wales, Sydney, NSW, Australia.



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Deborah Sweeney, BOptom, PhD, is the Associate Pro-Vice Chancellor, Research at the University of Western Sydney with responsibility for the Health and Science Cluster. Deborah received her Bachelor of Optometry from UNSW in 1980, and completed her PhD in 1992. She has held various executive roles within the Cornea & Contact Lens Research Unit, School of Optometry and Vision Science, UNSW and the CRC for Eye Research & Technology and the Vision CRC and was Director of Research for the College of Health and Science at UWS. She is active in national and international organizations, and holds executive positions in the International Association of Contact Lens Educators; the Keratoprosthesis Study Group; VisionCare NSW, the CRC Association and the International Society of Contact Lens Research, and is a Director on the Board for Vision 2020 Australia.



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