

PROFILE

Nathan Efron

Charismatic academic returns to Australia

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Nathan Efron will take up an appointment as Research Professor in the School of Optometry at the Queensland University of Technology in January 2006. He is returning to Australia after 16 years as Professor of Clinical Optometry at the University of Manchester Institute of Science and Technology (UMIST) in the United Kingdom.

Early years at Melbourne

Nathan Efron is a graduate in optometry from The University of Melbourne. His undergraduate studies between 1973 and 1976 coincided with the very early years of the commercial development of soft contact lenses, an area that captured his imagination and drew him into research as soon as he graduated. Professor Leo Carney had just returned to Melbourne following post-doctoral studies with Professor Richard Hill at the Ohio State University in the USA and had established the Corneal Biophysics Laboratory. Nathan commenced PhD studies with Leo, working in the field of corneal oxygenation during contact lens wear. This was an important topic because it was the key to explaining the clinical performance of rigid and soft contact lenses during open and closed eye lens wear. Nathan adapted the 'equivalent oxygen percentage' (EOP) technique—previously developed by Richard Hill for use in rabbit eyes—so it could



Nathan Efron PhD DSc

be applied to the human eye.

Nathan's first refereed article,¹ published in 1979 and co-authored with Leo Carney, is one of his most cited works. It defined the level of oxygen at the corneal surface beneath the closed eyelid (it is about one-third of that available to the open eye). This was a critical finding for accurate modelling of corneal oxygenation while wearing contact lenses overnight, a topic that is still of considerable interest today. His doctoral studies also resulted in the publication of a series of models that demonstrated significant

levels of hypoxia beneath all forms of contact lenses in open and closed eye conditions.² This work formed an important part of the rationale for developing high oxygen performance silicone hydrogel lenses, which have become available in recent years and provide a much more satisfactory ocular response.

After completing his PhD, Nathan held two 12-month post-doctoral appointments, one with Professor Ken Polse at the University of California and the other with Professor Brien Holden at the University of NSW. The highlight of this period was co-authorship of the 'Gothenburg Study',³ which documented the long-term effects of extended wear contact lenses on the cornea and defined key requirements for the future development of contact lenses: that they should be replaced regularly and made from materials of higher oxygen performance. The current dominance in the marketplace of disposable contact lenses and super oxygen-permeable silicone hydrogel materials attests to the prescience of the Gothenburg Study.

Nathan returned to The University of Melbourne in 1984 to take up an appointment as Lecturer in the Department of Optometry where he established a fruitful and prolific collaboration with Dr Noel Brennan. Their work concentrated on the hydration characteristics of soft lenses and methods for measuring contact lens gas permeability. They developed an optical instrument for measuring the water content of hydrogel lenses, the Soft Contact Lens Refractometer, which was commer-

cially produced by Atago. They also published an important series of papers on the methodology for determining the oxygen performance of contact lenses, which resulted in the contact lens industry adopting a more standardised approach to the reporting of contact lens oxygen permeability and transmissibility.⁴ Nathan's two PhD students at Melbourne, Suzanne Fleiszig^a and John Ang,^b have gone on to develop their own distinguished careers in academia and industry, respectively.

While at Melbourne, Nathan won an Academic Exchange Award from the British Council to travel to London for six months to undertake historical research with Dr Richard Pearson in the Department of Optometry at the City University. The year 1988 marked the centenary celebration of Fick's *Eine Contactbrille*, which was the first published paper on contact lenses. The following year was the 100th anniversary of August Müller's inaugural dissertation on contact lenses, which was the first reported attempt to correct myopia with contact lenses. Nathan and Richard published historical reviews of each of these pioneering works in prominent international ophthalmic journals^{5,6} that provided a nostalgic retrospective analysis of 100 years of development of the contact lens industry and corrected a number of misinterpretations of previous historians. About 15 years after their paper on Müller was published—and with the aid of the internet which did not exist at the time of their earlier work in the 1980s—they unearthed additional historical material about the optician Otto Himmler, who made the glass lenses used by Müller and who can be credited as being the first manufacturer of a contact lens of specified dimension and power. They published a short account of this in *Survey of Ophthalmology*.⁷

a. Suzanne Fleiszig is Professor of Optometry and Vision Science and Associate Dean for Basic Sciences in the School of Optometry at the University of California, Berkeley, USA.

b. John Ang is Vice-President, Asia-Pacific Professional and Regulatory Affairs, Johnson and Johnson Vision Care.

The move to Manchester

In 1990, Nathan was appointed Professor of Clinical Optometry in the Department of Ophthalmic Optics (renamed in 1992 as the 'Department of Optometry and Vision Sciences' and renamed yet again in 1997 as the 'Department of Optometry and Neuroscience') at UMIST in Manchester in the United Kingdom. His formal interview for the Professorial Chair was held immediately following the annual meeting of the British Contact Lens Association, which Nathan attended. At that meeting, he was introduced to an engaging and attractive young woman, Suzanne Bloore, who had previously graduated in Optometry from UMIST, by a mutual friend, the editor of the *Optician*, Alison Ewbank, ostensibly so that Nathan would be better informed about UMIST prior to his interview. The 'ploy' worked; two years later Suzanne became Nathan's wife and a further 12 years later she was a research collaborator and co-author.

The professorial chair at UMIST to which Nathan was appointed was sponsored by a major contact lens company, Bausch & Lomb, with the expectation that the incumbent would engage in research relating to contact lenses and provide general support for the UK contact lens industry. Professor Efron had bigger ideas, and quickly established a European-wide contact lens research and consultancy group known as Eurolens Research (short for the European Centre for Contact Lens Research). Realising that single-company sponsorship of his chair could compromise the potential of this venture, Professor Efron sought and obtained ongoing sponsorship from 11 other contact lens companies. This provided a support vehicle for fundamental research into the cornea and contact lenses in addition to commercially-negotiated industrial consulting work.

One of the first of Professor Efron's 19 PhD students in Manchester was Philip Morgan. Together they embarked on a research project that had received little prior attention, the mapping of ocular temperature of the eye using highly sensitive infra-red thermal imaging. A series of important papers on this topic followed,

highlighting a number of potential applications for ocular thermography, including monitoring the pre-corneal tear film in dry eye, assessing post-herpetic neuralgia, quantifying the extent of ocular inflammation in anterior eye disease and assessing the thermal impact of various forms of laser refractive surgery on the cornea. Dr Morgan became Research Manager of Eurolens Research and has remained Nathan's closest research collaborator; together they have co-authored more than 40 refereed scientific papers.

Professor Efron's arrival in the UK corresponded with the introduction of disposable contact lenses. One of his first papers on this subject focused on the questionable quality of these mass-produced lenses.⁸ This was hugely controversial and was reported and debated internationally in both the ophthalmic and lay press. Although causing great upheaval at the time, that work is now recognised as a landmark paper that drew the attention of the contact lens industry to the importance of contact lens quality and led to significant improvements in contact lens design and manufacture.

Professor Efron makes a habit of controversial pronouncements, such as his predictions of the demise of rigid contact lenses⁹ and his outspoken criticism of orthokeratology and fitting rigid lenses to arrest the progression of myopia.¹⁰ Despite drawing fire from many quarters, Professor Efron's arguments are always based on well marshalled evidence and cogently expressed. It is unlikely that he will be deterred from expressing controversial opinions, however politically incorrect they may seem; the more politically incorrect the view, the more he enjoys espousing it.

The mid-1990s heralded the clinical development of the corneal confocal microscope, which allows the human cornea to be imaged *in vivo* at about 700x magnification and enables the cornea to be viewed *in vivo* at a cellular level. Professor Efron acquired an early-generation instrument and embarked on a wide-ranging series of studies, elucidating the response of the cornea to contact lens wear and refractive surgery, and developing a

greater understanding of the normal and keratoconic cornea. Professor Efron and Panagiotis Kallinikos were able to show, for the first time, that contact lens wear causes a reduction in the number of keratocytes in the corneal stroma, which appears to be due, at least in part, to the mechanical effects of lens wear.

A highly significant application of corneal confocal microscopy developed by Professor Efron's team is the detection of diabetic neuropathy and monitoring its severity.¹¹ This is achieved by observing the sub-basal nerve plexus; patients with diabetic neuropathy—and indeed other forms of small fibre neuropathy—show a degeneration of this layer, as evidenced by a reduction in the number of nerves, reduced nerve branching and increased nerve tortuosity. This approach will supplement current electrophysiological and sensory measurements and may obviate skin biopsy testing of diabetic patients. Over the past decade, Professor Efron has liaised with consultant diabetic specialists and neurologists and in collaboration with a number of graduate students has published 21 papers on confocal microscopy.

Professor Efron has interests in practical aspects of clinical optometry. One of these has been standardisation of gradings of the severity of contact lens complications. He worked for several years with acclaimed medical ophthalmic artist Terry Tarrant to develop and validate a series of illustrated grading scales.¹² He secured industry sponsorship to produce these grading scale charts for clinical use and more than 70,000 have been distributed world-wide to clinical practices without charge. The 'Efron Grading Scales for Contact Lens Complications' has become a standard tool for assessing and communicating the level of severity of adverse events relating to contact lens wear. An electronic version, in the form of operator-controlled computer morph movie sequences, has also been developed.

Easy writer

Nathan Efron enjoys writing and writes with an easy facility. He has published 195 refereed scientific papers, 136 clinical articles and 208 abstracts. That is a remark-

able output by ordinary standards. His work is widely read and debated as evidenced by his published work having obtained more than 600 citations. He has also published six textbooks. His first venture was *International Contact Lens Yearbook*, which ran to three editions. His book *Contact Lens Complications* published in 1999 proved so popular that it had to be reprinted only three months after it was launched and a second edition appeared in 2004. A Spanish translation was published in 2005. Figuring that he had a few more books in him, Nathan arranged to take 12 months sabbatical leave at the School of Optometry at QUT in 2000-2001 with the express purpose of writing these books. The mission succeeded and in that year he wrote three more books: *The Cornea* (2001), *Contact Lens Practice* (2002) and *Contact Lenses A-Z* (2002). His sixth title, *Optometry A-Z*, is in press and due to appear in mid-2006.

Conference junkie and showman

It is said that joining the navy is one of the best ways of seeing the world. Enthusiastic participation in international academic conferences and meetings for practitioners is another. Nathan Efron has lectured at no fewer than 360 conferences in 35 countries. His reputation for translating complex scientific material into easily digestible, clinically-applicable information for contact lens practitioners, as well as a reputation for enthusiastic presentation and for stirring controversy, has resulted in 170 invitations as guest lecturer or key speaker.

This is Nathan Efron the showman and entertainer, a role symbolised by his dazzling array of flamboyant and colourful bow ties. His father was a clothing manufacturer so many of the bow ties were bespoke, hand-made by his father. Conference delegates have been known to complain when he does not don his famous neckwear.

I recall the showmanship when he was an undergraduate student. He would always sit in the front row and would commonly go to sleep, ostentatiously sprawled over his student desk, head in arms, even before the lecture began. That is one way

to make yourself known to your lecturer.

The showmanship and enthusiasm carries over to successful undergraduate teaching. UMIST awarded him an Excellence in Teaching Award in 1999 and nominated him for a UK National Teaching Award. He did not win the award but the 'consolation prize' was an invitation from Prime Minister Tony Blair to 10 Downing Street to join a celebration of excellence in UK higher education. Nathan recalls being unimpressed by the Prime Minister and the Prime Minister being unimpressed by him. Nathan introduced himself as a Professor of Optometry to which the Prime Minister replied 'So is that what you do?' and moved on. He remembers having a more engaging conversation with the Prime Minister's wife who was at least interested in his bow tie collection.

Organised and an organiser

Professor Efron is organised and an organiser. In Melbourne he served on the Board of Continuing Education of the Victorian College of Optometry for 11 years (1977-1989) and as President of the Contact Lens Society of Australia (1981). He was a councillor of the British Contact Lens Association for seven years (1992-1999) and its President in 1996. He was Head of the Department of Optometry and Vision Sciences at UMIST from 1992 to 1997. He has also taken his turn in senior academic administrative roles at UMIST as university-wide Dean of Undergraduate Studies (1992-1995), Dean of Quality (1997-2000) and Dean of Research (2001-2004).

During his time as Head of Department, Nathan joined with the Head of Ophthalmology at the nearby Victoria University of Manchester, Professor David McLeod, to establish the world's first joint Optometry and Ophthalmology higher degree course: the MSc in Investigative Ophthalmology and Visual Science. This multidisciplinary course, shared evenly between optometry and ophthalmology, is still running and has trained numerous optometrists, ophthalmologists, orthoptists and vision scientists from the UK and abroad.

His department did well at research

while he was its Head: it attained the highest possible research rating in the UK-wide research assessment, but it ranked well in teaching too, getting equal highest rating with two other UK optometry schools for teaching excellence from the UK Quality Assurance Agency for Higher Education.

Being an organiser, the opportunity to serve on the General Optical Council, the national registration body in the UK for optometrists and dispensing opticians, could not be refused. He served two terms from 1994 to 2005, the first as a representative of the UK schools of optometry and the second as an elected optometric member. He was very much involved in the drafting of the new Opticians' Act, especially those aspects relating to the rules and regulations surrounding the fitting and supply of contact lenses. He was the expert witness for the GOC in its celebrated case against Vision Direct Ltd, which was accused of the unsupervised selling of contact lenses. His evidence was a turning-point in the case, as the Magistrate's written judgment makes clear, and Vision Direct Ltd was found guilty, an outcome that provided important impetus for subsequent optometric legislation.

An opportunity to give something back to The University of Melbourne came in 1993 when the University of Melbourne Alumnus Association decided to become more international. After attending a reception in London organised by the university to address this issue, Nathan volunteered to form the United Kingdom branch of the association. He has always been an enthusiastic volunteer. He was elected as inaugural president and, to keep it in the family, his sister Nicole, who was living in London at the time and was also an alumnus of the university, was elected as secretary. Nathan found himself travelling frequently to London and Oxford to host alumni events and entertain the likes of the High Commissioner for Australia, the Vice-Chancellor and Chancellor of The University of Melbourne, the Agent General for Victoria and even fellow alumnus, Germaine Greer. He recalls greeting Germaine Greer in the candlelit formality of an Oxford College refectory when she travelled from Cam-

bridge to speak at an alumnus dinner. He greeted her and thanked her for travelling all the way from Cambridge, to which she replied loudly so all could hear 'What the (powerful expletive), Nathan; you're an Australian, you know that 60 (equally powerful expletive) miles is nothing.'

His contributions to his discipline and his enthusiastic participation in both academic and professional affairs have not gone unrecognised. He has received numerous awards, notable among which are the Garland W Clay Award (American Academy of Optometry, 1980), the Dallos Award (British Contact Lens Association, 1993), the Emerson Woodruff Award (University of Waterloo, Canada, 1994), the award for Distinguished Research on the Cornea and Contact Lens (University of Houston, USA, 1999), BCLA Gold Medal (British Contact Lens Association, 2001), the Peter Abel Award (German Association of Contact Lens Specialists, 2001) and the Max Schapero Award (American Academy of Optometry, 2003). He was awarded the degree of Doctor of Science by UMIST in 1995.

Time for a change

In 2002, a decision was made to merge UMIST with the nearby Victoria University of Manchester, to create a new institution, called simply The University of Manchester. As a senior academic at UMIST, Professor Efron was conscripted to the joint senior management team of the two predecessor institutions. He co-chaired the committee that developed the framework for the Graduate School of the new university and served on the interim board of the Faculty of Medicine and Human Sciences. Professor Efron regrets that he was unable to persuade the new university, which formed in October 2004, to include Optometry as a school in the Faculty of Medicine and Human Sciences. Instead, because of its association with neuroscience, Optometry has been assigned to the Faculty of Life Sciences, a single school faculty, where optometry is simply a course without a 'school' or 'department' to underpin it. Maybe it was time to move on.

Like most Australians, Nathan has always

been proud of his native country. He often embellishes his lectures with images of famous Australians, indigenous wildlife and Australian landscapes. He claims to have been continually haunted during his decade and a half in the UK by the lyrics of Peter Allen's classic anthem *I still call Australia home*. He is now taking the opportunity to turn the anthem to reality by returning to Australia to be an active part of what he sees as the exciting developments taking place in the School of Optometry at QUT.

REFERENCES

1. Efron N, Carney LG. Oxygen levels beneath the closed eyelid. *Invest Ophthalmol Vis Sci* 1979; 18: 93-95.
2. Efron N, Carney LG. Models of oxygen performance for the static, dynamic and closed lid wear of hydrogel contact lenses. *Aust J Optom* 1981; 64: 223-233.
3. Holden BA, Sweeney DF, Vannas A, Nilsson KT, Efron N. Effects of long-term extended contact lens wear on the human cornea. *Invest Ophthalmol Vis Sci* 1985; 26: 1489-1501.
4. Holden BA, Newton-Howes J, Winterton L, Fatt I, Hamano H, LaHood D, Brennan NA, Efron N. The Dk project: an interlaboratory comparison of Dk/L measurements. *Optom Vis Sci* 1990; 67: 476-481.
5. Efron N, Pearson RM. Centenary celebration of Fick's *Eine Contactbrille*. *Arch Ophthalmol* 1988; 106: 1370-1377.
6. Pearson RM, Efron N. Hundredth anniversary of August Müller's inaugural dissertation on contact lenses. *Surv Ophthalmol* 1989; 34: 133-141.
7. Pearson RM, Efron N. Otto Himmler: first manufacturer of lathe cut corneo-scleral lenses (*sic*). *Surv Ophthalmol* 2004; 49: 374-375.
8. Efron N, Veys J. Defects in disposable contact lenses can compromise ocular integrity. *Int Contact Lens Clin* 1992; 19: 8-18.
9. Efron N. Contact lens practice and a very soft option. *Clin Exp Optom* 2000; 83: 243-245.
10. Efron N. The desperate last gasps of rigid contact lenses. *Clin Exp Ophthalmol* 2005; 33: 341-342.
11. Malik RA, Kallinikos P, Abbott CA, vanSchie CHM, Morgan PB, Efron N, Boulton AJM. Corneal confocal microscopy: a non-invasive surrogate of nerve fibre damage and repair in diabetic patients. *Diabetologia* 2003; 46: 683-688.
12. Efron N. Efron grading scales for contact lens complications. In: *Contact Lens Complications*, 2nd ed. Oxford: Butterworth-Heinemann; 2004. p 239-243.