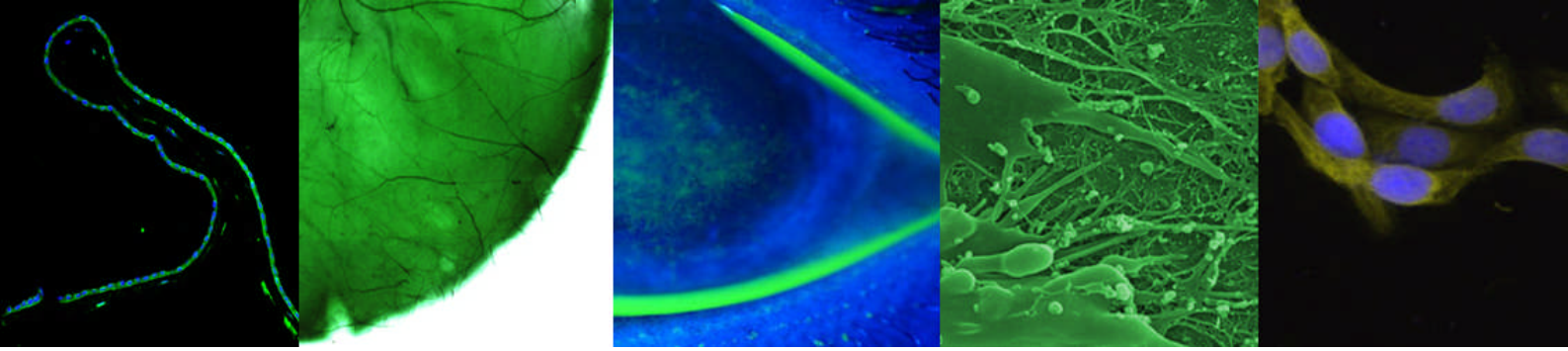
We would like to take this opportunity to thank these organisations for their kind support and sponsorship of this event



16th Nottingham Eye Symposium and Research Meeting

27th January 2012

Programme and Abstracts

The University of Nottingham
UNITED KINGDOM · CHINA · MALAYSIA

NCER Centre for Eye

PROGRAMME CONTENTS

PROGRAMME SUMMARY

8.30am: Registration, Coffee and Pastries

9.00am: Chair's Welcome and Opening Remarks

16th Nottingham Eye Symposium Part 1: Practical Tips for a Plethora of Plastic Procedures
Chair: Mrs Katya Tambe

9.10am: Dr William Katowitz, Children's Hospital of Philadelphia, USA. Advances in the management of nasolacrimal duct obstruction in adults and children

9.35am: Dr Milind Naik, LVPrasad Eye Institute, India. The use of botulinum toxin and fillers in aesthetic oculoplastics and their use in functional oculoplastics

10.00am: Mrs Sabrina Shah-Desai, Queens Hospital, Romford. Update on periocular tumours

10.20am: *Coffee, Trade Stand and Poster Viewing*

The 16th Norman Galloway Lecture

10.50am: Professor Irene Gottlob, University of Leicester. What is moving in nystagmus?

16th Nottingham Eye Symposium Part 2: Practical Tips for a Plethora of Plastic Procedures
Chair: Mrs Katya Tambe

11.45am: Ms Helen Garrott, Bristol Eye Infirmary. Orbital tumours and inflammation: assessment, management and how to avoid misses

12.10pm: Mrs Katya Tambe, Queens Medical Centre, Nottingham. Ptosis in adults and children, practical tips for assessment and management

12.25pm: Mrs Lorraine Abercrombie, Queens Medical Centre, Nottingham. Thyroid eye diseases: A practical guide to assessment and a management update

12.45pm: *Hot Buffet Lunch, Trade Stand and Poster Viewing*

16th Nottingham Eye Symposium Part 3: Paediatric Optometry Update
Chair: Prof Martin Rubinstein

1.45pm: Dr Nicola Logan, Aston University Birmingham. Epidemiology of refractive error in UK children

2.10pm: Dr Paul Murphy, Cardiff University. Tear film lipid layer morphology and corneal sensation in the development of blinking in neonates and infants

Coffee, Trade Stand and Poster Viewing

Nottingham Eye Research Group Research Meeting

3.00pm: Research Presentations
Chairs: Mr Winfried Amoaku and Dr Andrew Hopkinson

4.55pm: In the Pipeline

5.15pm: Research and Poster Prize Presentations, Chair's Concluding Remarks

5.30pm: CLOSE

See you next year!

9.00AM: 16TH NOTTINGHAM EYE SYMPOSIUM, PART 1

PRACTICAL TIPS FOR A PLETHORA OF PLASTICS PROCEDURES

Chair: Mrs Katya Tambe

This year the symposium is on an oculoplastic theme. We have invited speakers form the UK, USA and India. The aim is for the symposium to give guidance on the assessment and management of routine as well as complex oculoplastic conditions and practical tips useful in day to day oculoplastic practice. The topics that will be covered are ptosis by Mrs K Tambe from Nottingham, lacrimation by Dr W Katowitz from the Children's Hospital of Philadelphia, USA, eyelid and periocular tumours by Mrs Sabrina Shah-Desai from London, thyroid eye disease by Mrs L Abercrombie from Nottingham, orbital lesions by Ms H Garrott form Bristol and the use of fillers and botulinum toxin in functional and aesthetic oculoplastics by Dr M Naik form LVPrasad Eye Institute, Hyderabad, India.

9.10am: Dr William Katowitz, Children's Hospital of Philadelphia, USA. *Advances in the management of nasolacrimal duct obstruction in adults and children*

Oculoplastic and Orbital Surgeon, Assistant Professor of Clinical Ophthalmology in the Perelman School of Medicine at the University of Pennsylvania. Attending Surgeon at The Children's Hospital of Philadelphia and The Centre for Human Appearance. Dr Katowitz did his undergraduate degree at Brown University in Music and Religious Studies which he completed in 1989. His Medical Degree was awarded in 2001 from The University of Pennsylvania. He then completed his Ophthalmology Residency at the Scheie Eye Institute, The University of Pennsylvania, Philadelphia, PA, USA (2001-5). Dr Katowitz then completed two fellowship programmes, an ASOPRS Fellowship with Dr. James Katowitz at the University of Pennsylvania and The Children's Hospital of Philadelphia (2005-7) and an AAPOS Fellowship in Paediatric Ophthalmology at The Children's Hospital of Philadelphia (2005-6). He also travelled to complete a one year Orbital and Lacrimal Surgery in London, England at Moorfields Eye Hospital NHS Trust (2007-8).

Many different approaches exist in the management of congenital and acquired nasolacrimal duct obstructions. Some surgical techniques will be reviewed, as well as a discussion of newer silicone stents (including a "pushed" and a "pulled" monocanalicular stent), which have shown initial promising results in the treatment of congenital nasolacrimal duct obstruction. In addition, the approach to a "failed" probing will be reviewed.

9.35am: Dr Milind Naik, LVPrasad Eye Institute, India. *The use of botulinum toxin and fillers in aesthetic oculoplastics and their use in functional oculoplastics*

Milind Naik was born in Mumbai, and acquired his Ophthalmology training at Christian Medical College, Vellore. He completed his ophthalmic plastic surgery training at LV Prasad Eye Institute, Hyderabad, India and orbito-facial fellowship at Jules Stein Eye Institute, University of California. He serves as a faculty member at LV Prasad Eye Institute, to practice exclusive clinical and academic work in Ophthalmic and Facial plastic surgery. He is the vice president of Asia Pacific Society of Ophthalmic Plastic and Reconstructive Surgery (APSOPRS), and travels extensively to participate in clinical meetings related to Oculoplasty and Facial Aesthetics. Dr. Naik has a passion for painting and photography. He and his wife, Vibha, have a daughter, Jaee.

Facial rejuvenation is the art and science of improving the aesthetics of the face, scalp, and the neck to give a more youthful appearance. The periorbital region is invariably the centre point and the most critical region in this regard. Botulinum Toxin injections and Hyaluronic acid fillers are most widely used non-surgical rejuvenation techniques. With the background of extensive functional use of Botulinum toxin in Ophthalmology, there is an increasing trend amongst ophthalmic plastic surgeons to offer these procedures. As Hyaluronic acid fillers are becoming more popular amongst the dermatologists and cosmetic surgeons, the ophthalmologists and ophthalmic plastic surgeons continue to introduce innovative uses of the same as non-surgical alternatives for traditional oculoplasty procedures. This lecture gives a brief overview of the emerging

literature, and discusses our experience with the use of Botulinum toxin and Hyaluronic acid fillers in Aesthetic and Functional Oculoplasty.

Sponsored by IPSEN Innovation for patient care

10.00am: Mrs Sabrina Shah-Desai, Queens Hospital, Romford. *Update on periocular tumours*

Sabrina Shah-Desai, MBBS, MS, FRCS(Ed), Ophth is a Consultant Ophthalmic & Oculoplastic Surgeon at Queen's Hospital, Romford, Essex. Sabrina qualified from Sir JJ Group of Hospitals, Bombay University in 1994. She went on to complete 3 subspecialty fellowships in UK, which included a fellowship in Cornea & Oculoplastics at The Queen Victoria Hospital, East Grinstead (1996-1997), where she developed extensive expertise in managing periocular trauma, chemical burns and ocular surface diseases. This was followed by a joint oculoplastic fellowship at Salisbury & Southampton Eye Units (1998) and then at the prestigious Moorfields Eye Hospital (2000-2001), specializing in techniques of plastic surgery as it relates to the eye and their surrounding structures. She has also undertaken a secondment fellowship at the multidisciplinary craniofacial unit at Chelsea & Westminster Hospital (2009). She has expertise in the management of eyelid, lacrimal and socket disorders, based on her vast experience, both, as a consultant Oculoplastic surgeon in Bombay, India, (2001-2003) and as an Oculoplastic Associate Specialist at Moorfields Eye Hospital (2004-2010). Her clinical and research interests include thyroid eye disease, facial palsy, blepharospasm and periocular cancers. Sabrina enjoys teaching and is an invited speaker at many international conferences. She has contributed to numerous scientific papers, has written text book chapters and enjoys training and teaching budding oculoplastic surgeons.

Her symposium talk will cover Department of Health cancer pathways, common eyelid cancers and benign masqueraders and when to refer to the multidisciplinary team (MDT). She will also go into excision margin guidelines, histological guidance in tumour excision, tumour recurrence and what to do as well as guidance on follow up and sun protection.

10.50AM: THE 16TH NORMAN GALLOWAY LECTURE

PROFESSOR IRENE GOTTLOB, UNIVERSITY OF LEICESTER, UK. *WHAT IS MOVING IN NYSTAGMUS?*

Professor Gottlob graduated from the Medical School of the University of Vienna, Austria, where she also completed her training in Ophthalmology. She spent three years of research in the physiology of the visual system at the University of Vienna and then at the Max-Planck Institute for Physiological and Clinical Research in Bad Nauheim, Germany. During this time she became greatly attracted to the study of the connection between the eyes and the brain. She then undertook clinical and research fellowships in Paediatric Ophthalmology, Neuro-Ophthalmology and Oculoplastic Ophthalmology at Wills Eye Hospital in Philadelphia, USA. She obtained the Habilitation (Univ. Doz title) at the University of Vienna in 1990. Before she was appointed in 1999 as Professor and Chair in Ophthalmology at the University of Leicester, she was Head of Department of Strabismus and Neuro-Ophthalmology at St. Gall, Switzerland.

The talk "What is moving in nystagmus" will be an up to date presentation of clinical diagnosis, genetics, treatment and epidemiology of childhood nystagmus. The clinical and scientific use of OCT in nystagmus will be discussed.

THE HISTORY

The Norman Galloway Lecture was endowed in 1996, by Mr Nicholas R Galloway, Consultant Ophthalmologist at the University Hospital Queen's Medical Centre Nottingham (retired 2001), in memory of his father. This has since become a key feature of what is now a nationally recognised symposium.

Norman Patrick Galloway was born at Rhynie in Aberdeenshire on 27th March 1895 and died in Rempstone near Loughborough, Leicestershire on 2nd February 1976. He was a graduate of the University of Edinburgh and became a House Physician in the Edinburgh Royal Infirmary. During the First World War he served with the Army in South Africa, afterwards deciding to take up Ophthalmology. He obtained his DOMS in Oxford and during his time in Oxford met his future wife Eileen Thompson, the daughter of a general practitioner in Nottingham.

In 1922 he was appointed Clinical Assistant to the Nottingham and Midland Eye Infirmary and five years later, in 1927, he was elected Honorary Surgeon. He held this appointment through World War II and, in 1948, with the advent of the National Health Service, became Consultant Ophthalmologist. In the 1920's, Norman Galloway was an active member of the British Medical Association and helped to organise the meeting that was held in Nottingham in 1926. At a national level, for many years he supported the Midland Ophthalmological Society, regularly presenting papers, and in 1951 was appointed their President. He was also a member of the Council of the Oxford Ophthalmological Congress. He saw the introduction of antibiotics and steroids and, during the difficult post-war period, helped to steer the Hospital House Committee through the numerous negotiations involved with the formation of the National Health Service. He was also instrumental in gaining funding for the Eye Hospital extension to the wards and outpatient department. From 1950 to 1951 he was President of the Nottingham Medico-Chirurgical Society.

During his working life, Norman Galloway saw and helped to implement great changes in the practice of Ophthalmology in Nottingham. The old outpatient system where the doctor stood by a desk facing a queue of patients was replaced by consulting rooms and the building of the new extension allowed the introduction of special clinics. Nottingham had an Ophthalmic Nursing School before the war and at an early stage had an Orthoptic Department. Norman Galloway retired from the hospital in March 1959 after 34 years of service. His patients remember him as a kindly man who preferred one-to-one relationships. He tended to avoid public speaking whenever possible.

Nicholas R Galloway

11.45AM: 16TH NOTTINGHAM EYE SYMPOSIUM, PART 2

PRACTICAL TIPS FOR A PLETHORA OF PLASTICS PROCEDURES

11.45am: Ms Helen Garrott, Bristol Eye Infirmary. *Orbital tumours and inflammation: assessment, management and how to avoid misses*

Helen Garrott is a consultant oculoplastic and orbital surgeon at Bristol Eye Hospital. She trained at the Royal Victorian Eye and Ear Hospital in Australia and completed fellowships at Bristol Eye Hospital and Moorfields Eye Hospital in the U.K. She has a special interest in thyroid eye disease and is the Chairman of the Thyroid Eye Disease Charitable Trust.

She will be discussing a selection of challenging orbital cases, highlighting the need for an enquiring mind and clinical acumen to avoid pitfalls in diagnosis. Not every diagnosis is what it may initially seem to be – if the clinical picture does not fit, rethink the diagnosis!

12.10pm: Mrs Katya Tambe, Queen's Medical Centre, Nottingham. *Ptosis in adults and children, practical tips for assessment and management*

Mrs Katya Tambe is Consultant ophthalmologist specialising in Oculoplastics and Paediatric Ophthalmology, with a specialist interest in Paediatric Oculoplastics. She completed her ophthalmology training in the West Midlands training programme, the second largest training programme in the country, after the Moorfields Eye Hospital. Following this she has under taken three prestigious fellowships, two in adult and paediatric oculoplastics and one in general paediatric ophthalmology. Her weekly clinical commitment includes four clinics; one adult and one paediatric general ophthalmology clinic per week and one adult and one paediatric oculoplastic clinic and two operating sessions per week. Mrs Tambe manages general ophthalmology patients and performs cataract surgery routinely. She manages adult patients with eyelid malpositions, periocular skin tumours, watery eyes, thyroid related eyelid abnormalities, eyelid and adnexal trauma and patients with socket related problems.

Her paediatric expertise lies in paediatric ptosis management including levator resections and frontalis brow suspensions with autologus facialata and synthetic materials, paediatric watery eye management, squint surgery and routine and complex socket surgery. She undertakes general paediatric ophthalmology clinics where she routinely sees patients with squints, low vision and other paediatric ocular pathology. She works closely with the paediatric dermatology team in the management of children with periocular haemangiomas and with the paediatric oncologists in the management of children with optic pathway gliomas and periocular tumours. She also manages children with anophthalmia and microphthalmia along with the national artificial eye service department at the Nottingham University Hospitals campus. She has published articles in peer reviewed journals on a variety of ophthalmic conditions and has been invited as a guest speaker at national and international meetings.

Congenital ptosis, droopy lid present at birth. It can be a simple congenital ptosis, with no extraocular muscle involvement or associated with superior rectus muscle underaction. Congenital ptosis may be associated with Marcus Gunn jaw winking or may be due to congenital Horner's Syndrome and it is important not to miss these features. It may be bilateral or unilateral and the severity is graded according to levator function. Surgery depends on laterality, grading of levator function and associated features.
Adult ptosis is most often secondary to levator dehiscence, but many other etiological factors can cause ptosis like contact lens wear, Horner's syndrome, Myesthenia Gravis and third nerve palsy. Treatment depends on etiology, severity and response to phenyl ephrine 2.5%.
This talk will cover assessment of the most common types of ptosis, when to investigate further and what management strategy to apply.

12.25pm: Mrs Lorraine Abercrombie, Queen's Medical Centre, Nottingham. *Thyroid eye diseases: A practical guide to assessment and a management update*
Lorraine Abercrombie was appointed Consultant Oculoplastic Surgeon to the Nottingham University Hospitals in 2000. She has an interest in Thyroid Eye Disease and treats patients with thyroid eye disease in designated clinics. Lorraine is a Founder Member of BOPSS and was the East of England member on the BOPSS council 2006-2009. Lorraine was also one of the founders of MOS (Midlands Oculoplastic Society). Since 2010 Lorraine has been the Service Lead for Ophthalmology.

The lecture will give delegates an understanding in the terms 'activity', 'severity' in relation to patients with thyroid eye disease. The delegates will have an understanding of how to predict the patient at risk of developing severe thyroid eye disease and how to diagnose optic nerve compression in thyroid eye disease.

16TH NOTTINGHAM EYE SYMPOSIUM, PART 3

PAEDIATRIC OPTOMETRY UPDATE

Chair: Prof Martin Rubinstein

1.45pm: Dr Nicola Logan, Aston University Birmingham. *Epidemiology of refractive error in UK children*

Nicola Logan qualified as an optometrist in 1993 and completed a PhD in 1997. After a period of post-doctoral work Nicola was appointed as a lecturer in Optometry in the School of Life and Health Sciences, Aston University, Birmingham, UK in 2004. Nicola's main teaching areas are Clinical Optometry and Paediatric Optometry for undergraduate students and Myopia to postgraduate students. Nicola's research interests are in the epidemiology of refractive error, the development of myopia and ocular biometry. Her current main research project is the Aston Eye Study: an epidemiological, cross-sectional study to determine the prevalence of refractive error and its associated ocular biometry in a large multi-racial sample of school children from the metropolitan area of Birmingham, England. Nicola has published research papers on various aspects of myopia and also has 2 book chapters and one edited book published (Optometry: Science, Techniques and Clinical Management. Eds Rosenfield and Logan, Elsevier, Oxford, 2009).

Myopia is a condition that affects approximately 1 in 6 of the world's population and has reached epidemic proportions in some industrialized East Asian societies (e.g. Singapore), where 70% or more of young adolescents are myopic. The impact of these levels of myopia on all areas of society is enormous and authorities in these countries include myopia in their educational, health and economic strategic plans. Myopia interferes significantly with normal visual function, ranging from a simple visual hindrance to a precursor for secondary pathologies and accounts for approximately 35% of an optometrist's workload. The significant increase in prevalence of child myopia over recent decades has initiated a global surge of research into its epidemiological characteristics and ocular biometric corollaries. The prevalence of myopia varies between countries even when subjects of similar ethnicity are compared suggesting that prevalence rates may be population specific. Research findings from recent UK studies on epidemiology of refractive error in children will be discussed and compared with other studies from around the world.

2.10pm: Dr Paul Murphy, Cardiff University. *Tear film lipid layer morphology and corneal sensation in the development of blinking in neonates and infants*

Dr Paul J Murphy is a Reader and Director of Teaching in the School of Optometry and Vision Sciences at Cardiff University. He graduated from Cardiff University in 1988, and obtained his PhD from Glasgow Caledonian University in 1996.
As Director of Teaching, he has responsibility for the teaching activities within the School, and is a member of the School Management Board. He is a Director of the Contact Lens and Anterior Eye Research Unit (CLAER), which includes members of staff from different disciplines within the School and across Europe. His research interests are concentrated on the anterior ocular surface, and include contact lens wear, tear film physiology and corneal sensation. He has published in these areas, and in topics as varied as visual impairment, eye movement and optometric practice.
He is a Trustee and Board Member of the European Academy of Optometry and Optics.

Reflex blinking, particularly to noxious stimuli, is well developed at birth, but spontaneous blinking is infrequent in the newborn. This is surprising given the importance of the blink process for the formation of the pre-ocular tear film. The tear film of neonates and infants is associated with optical interference patterns commensurate with a thick lipid layer. It is proposed that this feature adapts the infant tear film to resist evaporation, preventing tear break-up and reducing the need for frequent blinking, alternatively, the corneal afferent pathway may be relatively immature, and changes in the tear film are not being detected. This talk reviews a study that considers these two alternative theories.

RESEARCH PRESENTATIONS

Chairs: Mr Winfried Amoaku and Dr Andrew Hopkinson

3.00pm: ***In Vivo*** **Confocal Microscopic Features of The Normal Limbus**
Ammar Miri, University of Nottingham

3.07pm: **Clinical Evaluation and Classification of Corneal Neovascularisation**
Lana Faraj, University of Nottingham

3.14pm: **The Effects of Toll-like receptor 3 Induction on the Expression of Vascular Endothelial Growth Factor and Fibroblast Growth Factor 2 in Human Choroidal Endothelial Cells**
Ruoxin Wei, University of Nottingham

3.21pm: **Effect of Compliance to Glasses Wear on the Outcome of Visual Acuity after Refractive Adaptation**
Gail Maconachie, University of Leicester

3.28pm: **6-weekly bevacizumab versus 4-weekly ranibizumab on an as required basis for neovascular age-related macular degeneration treatment: 2-year outcome**
Patrick Chiam, Leighton Hospital, Cheshire

3.35pm: **Optical treatment of nystagmus – a randomized, controlled, cross-over study**
Pavitra Jayaramachandran, University of Leicester

3.42pm: **Living with Nystagmus – A Qualitative Study**
Rebecca McLean, University of Leicester

3.49pm: ***Ex vivo*** **expansion and differentiation of limbal stem cells is affected by substrate mechanical properties**
Che Connon, University of Reading

3.56pm: **Corneal Stromal Stem Cells-A Mesenchymal Epithelial Transition**
Khurram Hashmani, University of Nottingham

4.03pm: **Molecular study on self-renewal capacity of corneal epithelium**
Bina Kulkarni, University of Nottingham

4.10pm: **Association Between Retinal Abnormalities Measured Using Oct And Null-region Characteristics In Albinism**
Sarim Mohammad, University of Leicester

4.17pm: **The Diagnostic Potential of Iris Anterior Segment Optical Coherence Tomography in Albinism**
Viral Sheth, University of Leicester

4.24pm: **Using Collagen density to restore the quiescent phenotype of keratocytes**
James Foster, University of Reading

4.31pm **Chemical and spatial influence on corneal stromal cell phenotype**
Samantha Wilson, Institute for Science & Technology in Medicine, Keele University

4.38pm **Sudan Oculodrastics**
Sabah Stafanous

ORAL PRESENTATION ABSTRACTS

3.00pm: ***In Vivo*** **Confocal Microscopic Features of the Normal Limbus**

Ammar Miri MD, MSc; Mouhamed Al-Aqaba MD; Ahmad M Otri MD; Usama Fares MD; Dalia G Said MD, FRCS; Lana Faraj MSc; Harminder S Dua MD, PhD

University of Nottingham, England, UK

Aim: To describe *in vivo* confocal microscopy (IVCM) features of the limbus in normal eyes as related to the palisades of Vogt's.
Methods: 46 eyes of 29 consecutive volunteers were recruited in this observational study. A detailed examination by IVCM was performed in addition to a routine slit-lamp biomicroscopy. Size and density of corneal and limbal epithelial cells were measured and statistically analyzed using SPSS software.

Results: Anatomical and morphological features were noted between corneal and limbal cells. Size and density differences reached to significant levels ($P < 0.05$). Different shapes of Palisades of Vogt have been described clearly by confocal microscopy. Cell-like structures were observed in the peripheral end of the palisades which might represent limbal stem cell crypts.
Conclusions: Laser IVCM can be used to establish the features of the normal limbus. The identified features demonstrate quantitative changes in the basal epithelium between the limbus and the central cornea and morphological differences between pigmented or non-pigmented studied subjects. Further studies should be performed to correlate with histology the possible crypts which were observed in this study.

3.07pm: Clinical Evaluation and Classification of Corneal Neovascularisation

Lana A. FARAJ, Muneer A. Otri, Dalia G. Said, Mohamed A Al-Aqaba, and Harminder S. Dua

Division of Ophthalmology and Visual Sciences, University of Nottingham

Purpose: To propose a novel classification for corneal neovascularisation (CVas) based on understanding the patho-physiological activity and maturity of corneal vessels reflected in the clinical appearance of the vessels.
Methods: More than 150 patients with CVas were clinically evaluated and observed during their routine outpatient clinic appointments over the course of 12 months. The study did not interfere with the management plan of the eye condition or the CVas. The patients were also reviewed retrospectively through analysing their case notes and anterior segment digital photographs in different time scales throughout the course of the pathology. The patients' observations were recorded by the clinic attendee while the digital photographs were analysed by clinically qualified observers. The inter-rater and intra-rater agreement was tested using Randolph's free-marginal multirater kappa.
Results: Depending on their maturity and state of 'activity' corneal vascularisation can be divided into five different types; young active, old active, mature, partially regressed and regressed (ghost) vessels. An evolving vascular complex did not necessarily pass through all stages. Depending on the clinical criteria defined for each type of vessel; the inter-rater agreement between three independent clinical observers was substantial with an overall percentage of agreement of 79.3% and Fee-marginal kappa of 0.74. The intra-rater agreement was more than 90%. The pathology behind the vascularisation and the behaviour of the vessels in different pathologies was also described.
Conclusions: This study provides a standard clinical classification of corneal neovascularisation which will improve our understanding of the clinical significance of CVas, guide any future trials of clinical interventions targeting different types of CVas, and will eventually bring CVas therapeutic approaches into a consensus.

3.14pm: The Effects of Toll-like receptor 3 Induction on the Expression of Vascular Endothelial Growth Factor and Fibroblast Growth Factor 2 in Human Choroidal Endothelial Cells

Ruoxin Wei, Elizabeth A. Stewart, Winfried M. Amoaku

Division of Ophthalmology & Visual Sciences, University of Nottingham, UK

Purpose: Vascular Endothelial Growth Factor (VEGF) and fibroblast growth factor 2 (FGF2) induces angiogenesis and enhances vascular permeability, which plays a critical role in the pathogenesis of age-related macular degeneration (AMD), a leading cause of permanent visual impairment in the elderly. Recent evidence has suggested Toll-like receptor 3 (TLR3) as a consequence of AMD in animal models since its function to suppress choroidal neovascularisation (CNV) formation. The purpose of this study was to investigate the role of TLR3 in the regulation of VEGF and FGF2 expression on human choroidal endothelial cells (hCEC).
Methods: hCEC were isolated from 3 donors' eyes and cultured until they reached 70% confluence. Polyinosinic:polycytidylic acid (Poly I:C, the TLR3 ligand) was then used to stimulate the cells on 1, 3, 6, 9 and 24 hours, respectively. Finally, RT-PCR was performed to detect the expression of VEGF and FGF2.
Results: RT-PCR results revealed that the VEGF expression was down-regulated after treatment with Poly I:C, while the FGF2 expression was up-regulated. The production of VEGF after 6-hour incubation had been decreased by nearly 50 percent, and 6 hours' stimulation with Poly I:C induced almost 5 times higher level of FGF2 expression.
Conclusions: Although some data support the notion that TLR3 induces neovascularisation, these were not replicated in human CECs. VEGF induction in response to Poly I:C treatment was decreased in hCEC; however,

it did indicate a possible role for TLR3 in human neovascular AMD and suggest that targeting the TLR3 pathway may be a promising approach to prevent pathologic angiogenesis in AMD.

3.21pm: Effect of Compliance to Glasses Wear on the Outcome of Visual Acuity after Refractive Adaptation

Gail Maconachie[1], Shegufta Farooq[2], Glen Bush[3], Frank Proudlock[1], Irene Gottlob[1]

[1]Ophthalmology, University of Leicester, Leicester, United Kingdom; [2]Bradford Teaching Hospitals, Bradford, United Kingdom; [3]Medical Physics, University Hospitals of Leicester, Leicester, United Kingdom

Purpose: Refractive adaption has become an important part of amblyopia treatment. However, it is unknown whether the outcome of refractive adaptation is dictated by compliance to glasses wear since compliance has never been objectively monitored. The dose-response relationship between visual acuity (VA) and compliance has also never been established. We explored both these issues using electronic dose monitors.
Methods: Twenty-five amblyopes with no previous treatment were recruited to the study, twelve anisometropes, nine mixed and four strabismic amblyopes. Patients were asked to wear their glasses full time for 18 weeks during which compliance was monitored using electronic monitors. VA was measured at the beginning of the study and further assessed every six weeks.
Results: Compliance for refractive correction ranged from 19.1% to 95.4% of waking hours, with 23% achieving less than 50% compliance (equivalent to 6.5hrs per day) (mean compliance was 67.6%). There was a highly significant dose response relationship between hours of glasses worn per day and VA (r=0.76, p=0.0001). The linear trend in the data indicated that optimal improvement in VA (≥12 hours of glasses wearing per day) was equivalent to a 42% improvement in visual acuity. Four hours of glasses wearing a day produced no improvement in VA.
Conclusion: Evidence from this study reveal compliance to glasses wear during refractive adaptation is far from optimal. The dose response function indicated that best expected improvement in VA after 18 weeks refractive adaptation is only 42%. This poses the question as to the benefits provided by extended refractive adaptation.

3.28pm: 6-weekly bevacizumab versus 4-weekly ranibizumab on an as required basis for neovascular age-related macular degeneration treatment: 2-year outcome

Patrick JT Chiam, Venkat Kotamarthi

Leighton Hospital, Cheshire

Purpose: To compare the visual and anatomical outcomes of 6-weekly bevacizumab with 4-weekly ranibizumab on an as required basis for the treatment of neovascular age-related macular degeneration.
Methods: Retrospective analysis of consecutive patients who were treated with bevacizumab or ranibizumab for 2 years. Patients were followed-up 6-weekly in the bevacizumab and 4-weekly in the ranibizumab groups. Treatment method was 3-loading injections followed by as required basis. With a sample size of 102 for bevacizumab and 54 for ranibizumab, the power to detect a moderate effect difference was 80%. Main outcomes measured were mean change in visual acuity (non-inferiority limit of 5 letters), central macular thickness (CMT) and number of injections.
Results: At 1 year, the visual acuity improvement with bevacizumab was 7.6 and ranibizumab 9.0 letters (p=0.56). The 95% confidence interval was -3.3 to 6.0 letters. At 24 months, the improvements were 7.0 and 8.0 letters (p=0.72). The 95% confidence interval was -4.3 to 6.3 letters. The mean number of bevacizumab injections in the first year was 5.1 and ranibizumab 5.7 (p=0.037). In the second year, there were 2.6 and 3.5 (p=0.025). In the first year, the improvement in CMT were 139µm for bevacizumab and 147µm for ranibizumab (p=0.69); in the second year there were 146µm and 160µm (p=0.45).
Conclusion: Neither noninferiority nor inferiority was established between 6-weekly bevacizumab prn and 4-weekly ranibizumab prn in terms of visual acuity. There was no statistical significant difference between the CMT changes. The number of bevacizumab injections required in 2 years is fewer than ranibizumab.

3.35pm: Optical treatment of nystagmus – a randomized, controlled, cross-over study

Miss Pavitra Jayaramachandran, Dr Frank A Proudlock, Miss Nita Odedra, Professor Irene Gottlob, Miss Rebecca McLean

Ophthalmology Group, University of Leicester

Purpose: Several studies investigated the use of contact lenses in infantile nystagmus (IN), but findings are controversial. Rigid gas-permeable lenses (RGPL) and soft contact lenses (SCL) have not been previously compared. Visual function and eye movement changes in IN using RGPL and SCL were compared to glasses in a randomised controlled cross-over study.
Methods: 24 patients with IN were recruited and attended 5 visits at 2-week intervals (wks 1-2: glasses wearing; weeks 3-6: contact lens wearing - two weeks of RGPL and SCL each with the order randomized; weeks 7-8: glasses wearing). At each visit eye movement (500 Hz), logMAR best-corrected visual acuity (BCVA) at near (0.4m) and distance (4m), gaze-dependent visual acuity (GDVA) and the Radner reading test (measure of reading acuity and reading speed) were recorded. The primary outcome was nystagmus intensity derived from the eye movement recordings (EMR). Friedman test and linear mixed models were used to analyse EMR measurements and visual function. Missing data was substituted using last observation carried forward, enabling an intention-to-treat analysis.
Results: Neither RGPL nor SCL significantly changed nystagmus intensity (or any other EMR outcome) compared to glasses wearing ($p>0.05$). In contrast, BCVA and reading acuity were significantly worse with SCL compared to RGPL and glasses wearing (BCVA, $p<0.0001$, reading acuity $p=0.0009$). There were no significant differences between treatment groups for GDVA ($p>0.05$).
Conclusions: In contrast to previous studies, we found SCL resulted in significantly worse visual and reading acuities compared to RGPL and glasses. We found no change in eye movement for the three treatments which implies that the deterioration in vision caused by SCL is a refractive problem, possibly misalignment of the lens on the eye.

3.42pm: Living with Nystagmus – A Qualitative Study

Rebecca McLean, Kate Windridge and Irene Gottlob

Ophthalmology Group, University of Leicester

Purpose: To identify specific aspects of daily living that are affected by nystagmus.
Methods: Semi-structured interviews were conducted at the University of Leicester, UK, with participants with acquired and infantile nystagmus. In total 21 participants were purposively sampled and recruited. Transcript analysis was conducted using constant comparative technique, based upon grounded theory, to identify specific areas of living affected by nystagmus.
Results: Analysis identified six domains that were adversely affected by nystagmus; visual function, restriction of movement, standing out/not fitting in, feelings about the inner self, negativity about the future and relationships. Cosmetic appearance of nystagmus, including others' avoidant response to this, was described (n=18), as was others' failure to recognise what it is like to have nystagmus (n=18). Driving issues were frequently raised (n=19) and restrictions in occupation choice/opportunities (n=17) were highlighted. Reliance on others (n=16) also emerged. Additional to other categories was an overarching and universal distress arising from nystagmus affecting every aspect of everyday life.
Conclusion: Interviews revealed universally negative experiences of living with nystagmus that are previously unreported. Findings are similar to studies conducted for strabismus, in particular cosmetic impact. This study provides the content that is required to develop a nystagmus-specific quality of life tool.

3.49pm: *Ex vivo* expansion and differentiation of limbal stem cells is affected by substrate mechanical properties

Che J Connon, Roanne R Jones, Bo Chen

Stem Cell and Nanomaterials laboratory, Reading School of Pharmacy, University of Reading

Adult stem cells of the cornea reside within an anatomical region at the edge of the cornea termed the limbus; as such limbal epithelial cells (LEC) are important for the maintenance and regulation of the corneal surface. Destruction or damage to the corneal limbus and the stem cells concentrated therein may lead to blindness via vascularisation or stromal opacity of the cornea. Currently the preferred treatment for limbal stem cell deficiency (LSCD) is autologous or allogenic transplantation of *ex vivo* expanded limbal epithelial stem cells using human amniotic membrane (HAM) as a substrate. However, compacted collagen gels with improved mechanical properties have been recently proposed as an alternative substrate for this treatment.
Having previously considered compacted collagen gels as sophisticated biologically relevant substrates capable of supporting the expansion of LEC and producing a functional ocular surface tissue construct; we have sought to apply LEC as a unipotent stem cell model to investigate the effects of altered mechanical properties of collagen gels on their differentiation *ex vivo*. We provide evidence to demonstrate that collagen fibre density can be dramatically altered to regulate substrate stiffness independently of surface topography. We successfully demonstrated the mechanical versatility of plastically compressed collagen gels and provided evidence to show that increased material stiffness drives differentiation of unipotent LEC producing tissue engineered constructs with defined levels of stem cell differentiation. Furthermore we relate substrate stiffness to the success of HAM. These findings have significant implications in the future development of artificial epithelial tissues particularly for restoration of the ocular surface using cells with regulated levels of differentiation.

3.56pm: *Corneal Stromal Stem Cells-A Mesenchymal Epithelial Transition*

Hashmani, K., Branch, M., Dhillon, P. Verma, M. Dua, H.S. and Hopkinson, A.

University of Nottingham, Queen's Medical Centre, Division of Ophthalmology and Visual Sciences

Introduction: The role of corneal stromal cells (CSC) in ocular surface healing has been indicated as scar tissue formation, while a potential role in tissue regeneration was, until now not reported. Our aim was to investigate the stem cell properties of these cells and determine any potential role in ocular surface regeneration.
Methods: CSC were cultured up to passage 3 (P0-3) and assessed against criteria set by the international society of cellular therapy (ISCT) for multipotent mesenchymal stromal cells (MSC) which are:
1. Adherence to plastic,
2. Defined cell surface markers (CSM) expression,
3. Differentiation into adipocytes, osteocytes and chondroblasts.
These were compared against foetal liver MSC as control cells. CSC were sorted into three populations based on their unique CSM expression profiles and were assessed against ISCT criteria. Each of these sub-groups was also analysed for their potential to differentiate into corneal epithelial cells (CEC).
Results: CSC fulfilled the ISCT criteria for MSC; also they expressed novel tissue specific markers. Three distinct sub populations expressing unique CSM profile isolated from CSC demonstrated significant differences in their CSM expression and their tri-lineage potential. More importantly, CSC demonstrated the capacity to differentiate into corneal epithelial and progenitor lineages. The differentiation capacity and resulting corneal epithelial phenotype was found to be population specific, with one population showing a superior progenitor and self renewal capacity.
Conclusion: This is the first study to show mesenchymal-epithelial transition (MET) in Ophthalmology. CSC have potential of being pre-limbal stem cell and if the correct population under suitable culturing environment is stimulated, they can be used as a source for generating CEC for various ocular surface diseases.

4.03pm: Molecular study on self-renewal capacity of corneal epithelium

Bina Kulkarni, Megha Verma, Andrew Hopkinson and H S Dua

Division of Ophthalmology and Visual Sciences, Queen's Medical Centre, Nottingham, UK.

Purpose: Based on clinical and laboratory based evidence it is hypothesised that corneal stem cells reside at the limbus and constantly replenish the corneal epithelial cells which are shed into the tear film.
Methods: Laser microdissected RNA samples from LEC, limbus and corneal epithelium were hybridized to two microarray platforms of spotted oligonucleotide arrays and Gene ST 1.0 array chips. The differentially

expressed gene list for each OS regions derived from the raw microarray data was analysed to determine pathways and geneontology of interest. Validation of microarray data was performed with quantitative real time PCR.
Results: The results of the two microarray studies showed that cornea was enriched for GO terms related to proliferating SC, transient amplifying cells (TAC) and differentiated cells (DC) whereas LEC harboured quiescent stem cells.
Pathway analysis showed that cornea was metabolically active and had significant expression of cell cycling property. Both studies have also demonstrated significant, upregulated expression of self-renewal genes in cornea such as *PCNA, FZD7, STAT3, SULF2, GLS,* and *CDH13*. Corneal epithelium was enriched for growth factors, cytokines, WNT, Notch, and TGF-Beta pathways involved in cell proliferation and differentiation. The abovementioned findings provide the evidence of proliferating stems cells or transient cells in cornea and support recent publications on regenerative potential of central cornea.
Conclusions: This study questions the popular belief that the corneal epithelium is constantly regenerated by migration of TACs derived from reservoir of SCs at the limbus. The findings of this study provide molecular evidence for the presence of proliferating stem like or "transient cells" in cornea supporting the recently published evidence that the cornea is capable of maintaining corneal epithelial regeneration in normal OS health conditions.

4.10pm: Association between Retinal Abnormalities Measured Using Oct and Null-region Characteristics in Albinism

Sarim Mohammad, Irene Gottlob, Rebecca McLean, Viral Sheth, Frank A. Proudlock.

Ophthalmology Group, University of Leicester, Leicester, United Kingdom

Purpose: Albinism is associated with profound structural deficits in the retina that we have recently quantified using optical coherence tomography (OCT). Mechanisms underlining infantile nystagmus (IN) in albinism are poorly understood but both sensory and motor causes have been implied. We have compared nystagmus characteristics of the null-region, with retinal abnormalities which we have measured using OCT.
Methods: Eye-movement recordings (EyeLink II, 500Hz) and retinal OCT scans (SOCT Copernicus) were acquired in 49 volunteers diagnosed with albinism. Retinal layers were measured using ImageJ (National Institutes of Health, MD, USA).
Null-region location and definition along the horizontal plane were used to assign volunteers into following five categories: left null (n=10), central null (n=12), right null (n=11), no null (n=8), small nystagmus (n=8). Thickness of the nerve fibre, ganglion cell, outer nuclear, outer segment layers as well the total foveal thickness was compared amongst the groups using a one-way ANOVA.
In addition nystagmus amplitude, frequency, intensity and foveation characteristics in the null region were compared to a foveal development index (fdi) which was calculated using the following formula:
fdi=(processing layer thickness/photoreceptor layer thickness)
Results: We found a significant correlation between the foveal development index and nystagmus amplitude ($p<0.005$, $r=0.542$), intensity ($p<0.005$, $r=-0.460$) and NAFX ($p<0.005$, $r=-0.407$) in the null region. However there was no significant difference in the thickness of retinal layers between the different null groups ($p>0.05$).
Conclusions: Our results indicate a significant association between the degree of foveal development and nystagmus characteristics especially amplitude. However the relationship between retinal abnormalities in albinism and null region location remains unclear.

4.17pm: The Diagnostic Potential of Iris Anterior Segment Optical Coherence Tomography in Albinism

Viral Sheth, Irene Gottlob, Anil Kumar, Sarim Mohammad, Rebecca McLean, Gail Maconachie, Frank Anthony Proudlock

Ophthalmology Group, University of Leicester

Purpose: Recent innovations in Anterior Segment Optical Coherence Tomography (AS-OCT) permit accurate imaging of iris anatomy. AS-OCT was used to compare thickness of layers within the iris in patients with albinism compared to healthy controls to evaluate the potential of this method diagnostically. We explored

the relationship between iris layers (stroma and anterior border layer (SAB) and posterior epithelial layer (PEL)), iris transillumination and visual acuity in the albinism group.
Methods: Irides of 55 patients with albinism and 45 healthy control subjects were imaged using AS-OCT under standardised conditions. Total iris thicknesses, SAB and PEL were measured in nasal and temporal cross sectional images along the horizontal meridian of both eyes using ImageJ software. These measures were compared to visual acuity and clinical iris transillumination severity.
Results: Total thickness of the iris was thinner in albinism compared to healthy controls (mean thickness±SD = 175.2±26.9µm albinism and 194.0±22.5µm controls) with greatest differences towards the iris root. SAB thickness was only thinner in albinism compared to controls at the root end of the iris whereas PEL thickness was significantly thinner along the whole profile (mean thickness±SD = 22.8±7.1µm albinism and 32.8±6.0µm controls, $P<0.001$). Using PEL thickness as a diagnostic indicator for albinism yielded a sensitivity of 85% and specificity of 78%. There were no significant relationships between iris layers thickness and visual acuity or transillumination grading.
Conclusions: This is the first time abnormalities of iris layers have been quantified in humans and we demonstrate that these measures have diagnostic potential clinically.

4.24pm: Using Collagen density to restore the quiescent phenotype of keratocytes

James Foster[1], Roanne Jones[1], Vitaliy Khutoryanskiy[1], Bruce Caterson[2], Che Connon[1]

1. *Stem Cell and Nanomaterials laboratory, Reading School of Pharmacy, University of Reading, UK*
2. *University of Cardiff, Cardiff School of Biosciences, UK*

Purpose: Keratocytes make up the bulk of the cellular component of the corneal stroma. They usually reside between the collagen fibrils and are critical for maintaining the clarity and function of the cornea. We hypothesise that by culturing keratocytes in a 3D environment that mimics the normal corneal stroma a more quiescent phenotype will be maintained.
Methods: Both Compressed and Uncompressed Collagen gels were seeded with low passage human central keratocytes and to create a 3D artificial corneal stroma[1,2]. These constructs were monitored over time for changes in hydration and contraction. Cell Phenotype was quantified by qPCR and protein analysis, alamar blue were used to examine proliferation. Rheology was used to monitor changes in stiffness and TEM was used to analyse fibril organisation**.**
Results: Keratocytes in compressed collagen gels expressed more of the quiescence markers Lumican and Keratocan at levels that are comparable with that seen in native tissue, we have demonstrated that this is due to factors inherent to the compressed collagen gel as although the uncompressed gels did contract to a similar degree of Hydration and Structure they were unable to retain cells in an undifferentiated state.
Conclusions: We have demonstrated that encapsulating keratocytes in compressed collagen gels induces a de-differentiation from an aggressive myo-fibroblastic cell type to a more quiescent one. The improved mechanical properties make our constructs more suitable for tissue engineering applications and provide an improved model of the stroma that recreates the native environment of the stroma better than existing models such as contracted collagen gels.
References:
1: Mi, S., Chen, B., Wright, B. and Connon, C. J. (2010) Plastic compression of a collagen gel forms a much improved scaffold for ocular surface tissue engineering over conventional collagen gels. Journal of Biomedical Materials Research Part A, 95A (2). pp. 447-453. ISSN 1549-3296
2 : *Ex Vivo* Construction of an Artificial Ocular Surface by Combination of Corneal Limbal Epithelial Cells and a Compressed Collagen Scaffold Containing Keratocytes. Shengli Mi, Bo Chen, Bernice Wright, Che J. Connon. Tissue Engineering Part A. June 2010, 16(6): 2091-2100. doi:10.1089/ten.tea.2009.0748.

4.31pm: Chemical and spatial influence on corneal stromal cell phenotype

S. L. Wilson, A. J. El Haj, Y. Yang

Institute for Science & Technology in Medicine, Keele University

Purpose: Control and maintenance of the keratocyte phenotype is vital to developing *in vitro* tissue engineered strategies for corneal repair.

Methods: The influence of chemical and environmental cues on corneal stromal cells' phenotype is examined by using different supplements in culture media and different substrates including 2D monolayer and 3D hydrogel culture respectively. A non-destructive indentation technique and optical coherence tomography are used to determine the elastic modulus and dimensional changes respectively in 3D constructs. The gene expression corresponding to the chemical and spatial influence was then measured by qPCR.
Results: qPCR data showed that stromal cells cultured in monolayer with serum-containing (fibroblast) media did not entirely lose their keratocyte gene expression. Simply changing the cells' spatial arrangement from 2D to 3D culture in fibroblast media increased the gene expression of keratocyte markers. The altering of supplements in culture media (keratocyte media, serum-free and insulin-containing media) further pushed the gene expression pattern towards keratocytes whilst suppressing fibroblastic gene expression. Cell-seeded hydrogel constructs cultured in fibroblastic media increased in modulus throughout the culture period and undergo significantly more contraction than constructs cultured in keratocyte media, implying that the growth factors present in serum promote a fibroblast-like phenotype.
Conclusions: Tailoring of the culture environment can encourage stromal cells towards a keratocyte or fibroblast lineage. Our results reveal that the phenotypes of stromal cells phenotypes are interchangeable. The combination of non-destructive monitoring techniques and analysis of gene expression provide important feedback for optimizing culture condition, which has not previously been shown in 3D corneal models.

4.38pm: Sudan Oculodrastics

Sabah Stafanous

Purpose: To show the real oculodrastic cases I have seen and managed in Sudan during my charity work. 2-3/52 of annual leave every January for 4 years spent at Mekka eye hospital in Khartoum to examine and treat patients (mainly oculoplastics) and to teach and train local ophthalmologists and registrars in oculoplastics. I would like to share with my colleagues the cases I have seen; rare congenital anomalies, advanced fungating retinoblastomas from as far as Darfour region, other advanced malignancies, complex traumas, common destructive orbital and face disease (asperagillosis) and other oculoplastics conditions like ptosis etc.
Method: Slides of cases with pre and post op. photos, the hospital theatre and clinic setting and other photos from Sudan.
Results: As this is the 4th year, I am pleased to say that the local doctors are well trained in oculoplastics clinical examination and operative procedures; they continue the follow up and the management of patients and collect difficult cases for my return in January every year.
Conclusion: Sudan patients have a large number of advanced cancers and bilateral retinoblastomas; this is believed locally to be due to buried nuclear waste during the last government rein.

IN THE PIPELINE

Updates on the most exciting new products coming to the market from some of our faithful sponsors

4.55pm: **Allergan Ophthalmology Update**
Allegan

5.00pm: **Yellox™ (Bromfenac)**
Bausch & Lomb

5.05pm: **Lenstar®: The Next-Generation Biometer**
Haag-Streit UK

5.10pm: **BluePeak Autofluorescence**
Heidelberg Engineering

5.15pm: **Introducing Azyter – The First 3 Day Ocular Antibiotic Treatment**
Spectrum Thea

POSTER PRESENTATIONS

1 **The clinical implications of spongy layer on amniotic membrane for ocular surface transplantation: an investigation of biochemical and functional properties**
Elena Lazutina, University of Nottingham

2 **Optimised expression of the Human Beta Defensin 9 (hBD9) fusion protein in an *E. Coli* system**
Nazri Omar, University of Nottingham

3 **Cellular and structural differences between cryopreserved and vacuum-dried amniotic membrane (AM) following denuding**
Jessica Gabriel, University of Nottingham

4 **Preparation of Human Cornea as a Scaffold for Corneal Stromal Cell Culture**
Fiona Kwok, University of Nottingham

5 **Comparison of the effect of VEGF and HGF on the Major Angiogenic Pathways Implicated in Neovascular AMD in the Human Eye**
Thomas Stubington, University of Nottingham

6 **Optical coherence tomography measurements of optic nerve morphology in healthy Asian and Caucasian subjects**
Anastasia Pilat, University of Leicester

7 **Vacuum-dried versus cryopreserved amniotic membrane (AM), as an alternative ocular surface dressing**
Claire Allen, University of Nottingham

8 **Intraocular pressure, Blood flow and Neuroprotection Somatosensory stimulation/ Acupuncture for chronic eye disease**
Edith Rom, Gloucestershire NHS Trust

9 **6-weekly bevacizumab versus 4-weekly ranibizumab on an as required basis for neovascular age-related macular degeneration treatment: 2-year outcome**
Patrick Chiam, Leighton Hospital, Cheshire

10 **Media Selection for Preservation of Mesenchymal Stem Cell Properties of Limbal Stromal Cells**
Permesh Dhillon, University Of Nottingham

11 **Histochemical Staining of Corneal Nerves in Mice**
Virinder Dhillon, University of Nottingham

12 **Lymphocyte Proliferation Assays for Ophthalmological Based Tissue Engineering**
Matthew Branch M, University of Nottingham

13 **Comparative protein expression profiling of selective tight junction proteins in choroidal and retinal endothelial cells**
Saker Saker, University of Nottingham

POSTER PRESENTATION ABSTRACTS

The Poster Exhibition is located in the Main Conference Hall

1: The clinical implications of spongy layer on amniotic membrane for ocular surface transplantation: an investigation of biochemical and functional properties

Dr E. Lazutina, Dr C. Allen, Dr A. Hopkison, Prof HS Dua

University of Nottingham

Background: Spongy Layer (SL) is the gelatinous, proteoglycan rich layer between avascular amnion and vascular chorion collectively known as the foetal membrane. SL forms between day 6 and week 12, during the period of gestation in chorionic cavity when the amniotic membrane fuses with the chorion. Little is known about the function of SL, *in vivo*. Even less known about the structure and biochemical composition of the SL. The current knowledgebase of the SL has been established indirectly through work carried out to assess the structural composition of the foetal membrane. SL is a proteoglycan rich structure, which can imbibe water and swell. The property is thought to be a function to facilitate or "lubricate" mutual sliding of AM and chorion as a part of the short-term mechanical repair system. The SL also contains high levels of hyaluronan, a major

carbohydrate component of the extracellular matrix (ECM) that is known to provide mechanical support and to interact with different growth factors. Antimicrobial properties of Amniotic Membrane (AM) are well known, however, none mention antimicrobial properties of Spongy Layer (SL) as an independent layer.
Methods: The different samples of SL were sent for Searchlight™ analysis to identify selected, angiogenesis, neurotrophic and growth factors, biomarkers, matrix metalloproteinases and cell adhesion molecules, chemokines and cytokines. Western blotting and immunohystochemical testing was also done for markers such as MMP 2,3,9, ICAM1, IL8, TGF β1, CD29, 34, 44, 45. Cytotoxic and proliferative properties of SL were investigated using the CTD, Apoptotic CaspAce and WST-1 assays and by culture of cornea epithelial cells and cornea keratofibroblasts.
Results: As previously reported, SL has eukaryotic cytotoxic effects and has now been shown to be bacteriostatic; however, SL is a depot of various factors with extensive potential effects on cells. It is likely that SL is responsible for the extensive but variable biochemical composition of transplanted AM and maybe key for the reported variable clinical effects of the membrane. There are some variations in different SL samples collected from single Amniotic Membranes and between pooled samples. This indicated that if used clinically at least 16 SL samples would need to be pooled to avoid significant variation.

2: Optimised expression of the Human Beta Defensin 9 (hBD9) fusion protein in an *E. Coli* system

Omar N, Allen C, Stewart E, Dua HS, Hopkinson A

Division of Ophthalmology and Visual Sciences, University of Nottingham

Introduction: hBD9 is a cationic, antimicrobial peptide of the beta defensin group with six cystein residues linked by three disulphide bridges. Recombinant expression of hBD9 in *E coli* strains from the optimised gene instead of actual (non-optimised) gene is believed to increase the amount of soluble peptide. A study was carried out to compare the production of the optimised hBD9 fusion protein with the recombinant gene in different *E coli* strains using different induction temperatures.
Method: The DEFB109 gene encoding the hBD9 protein was extracted and reverse transcribed prior to cloning and inserting into a plasmid vector The optimised gene was synthesized from the actual gene (non-optimised) into the preferred-codon sequence using available software (Eurofins MWG Operon, Ebersberg, Germany). Recombinant plasmids were transformed into different *E. coli* expression hosts (name these). Protein production was induced with isopropyl-thiogalactoside (IPTG) overnight, at both 37^{o}C and 20^{o}C. Cells were harvested by centrifugation and lysis buffer to give soluble and insoluble protein fractions. Protein samples were run on SDS-PAGE gels and Coomassie stained.
Results: Optimised DEFB109 gene expression is not increased following induction compared to the non-optimised gene expression. This is depicted by equal band intensities for each gene when visualised on SDS-PAGE gels.
Discussion: The enhanced effect of optimised gene was counterbalanced possibly by the toxic effect of the expressed peptide, leading to insignificant increase of peptide expression when compared to those from the non-optimised actual gene.

3: Cellular and structural differences between cryopreserved and vacuum-dried amniotic membrane (AM) following denuding

J Gabriel, C Allen, O M^{c}Intosh, H Dua, A Hopkinson

University of Nottingham

Introduction: AM is a biological substrate used for epithelial expansion in the treatment of many ocular disorders, particularly limbal stem cell deficiency (LCSD). It unique properties have been shown to reduce scarring and relieve pain. Presently AM is cryopreserved, rendering the tissue non-viable and requiring specialist storage facilities. Alternatively, vacuum-drying eliminates these problems, allowing ambient storage and simple transportation. In addition, vacuum-drying prevents the depletion of beneficial factors following thawing, increasing AM efficacy as a substrate for epithelial growth. Recently it has become increasingly popular to denude the membrane of epithelium to expose the functional basement membrane (BM), essential for promoting cell attachment and growth.

Materials and Methods: AM was collected from consenting patients undergoing elective caesareans. AM was used intact or denuded with thermolysin and either cryopreserved or vacuum-dried. In a sub-set of experiments membranes were pre-treated with a saccharide lyoprotectant, prior to drying. Cellular and structural differences between the different treatment cohorts were assessed using immunofluorescence. In addition membrane subtypes were co-cultured with human immortalised CECs and cell proliferation rates determined using WST-1 assays.
Results and Conclusions: Vacuum-drying AM enhanced retention of important beneficial factors and in combination with denuding exposed functional BM components allowing for greater cell attachment and increased epithelial cell proliferation, compared to cells grown on intact and cryopreserved AM. Studies are presently under completion to assess the stem like properties of LEC by growing corneal limbal explants on our membrane subtypes.

4: Human Cornea as a Scaffold for Corneal Stromal Cell Culture

Fiona Y.H. Kwok, Matthew Branch, Khurram Hashmani, Andrew Hopkinson, Harminder Singh Dua

Division of Ophthalmology and Visual Sciences, University of Nottingham

Aim: To optimise human cornea for corneal stromal cell culture.
Introduction: With an increasing demand for corneal epithelial transplantation due to mechanical damages and diseases, enormous effort has been put on stem cell culture. $CD34^{+}$ corneal stromal cells (CSC) expressed corneal epithelial markers when cultured on plastic in our laboratory. With the easy access of donor tissue by our laboratory, alcohol delaminated corneas (DCs) were used as scaffold for epithelial regeneration using CSC.
Methods: Full corneas were denuded in 20% ethanol for 1 minute. DCs experimented at different positions within wells of different sizes, were seeded with CSC of different densities for culture. Comparison of CSC density on corneal surface was made between debrided and non-debrided corneas. The extent of alcohol delamination (ALD) was assessed by H&E stain and immunefluorescence.
Results: DCs placed at the edge retained the most number of CSCs on surface. Corneal epithelium was lifted off from the underlying stroma, indicated by H&E stain. The plane of cleavage was at basement membrane, indicated by positive immunofluorescence stain of collagen IV, collagen VII, laminin-5 and CD49f. DAPI stain of the nucleus was negligible at stroma after ALD. CSC surface coverage on non-debrided DCs was not proportional to the seeding density.
Conclusion: ALD acted at the basement membrane, which potentially served as a physical barrier preventing CSC from submerging into the corneal stroma. ALD was effective in creating a decellularised layer for CSC seeding. Mechanical debridement after ALD was important to maximise CSC adhesion on basement membrane.

5: Comparison of the effect of VEGF and HGF on the Major Angiogenic Pathways Implicated in Neovascular AMD in the Human Eye

Thomas Stubington, University of Nottingham

Introduction: Wet or neovascular age-related macular degeneration (nAMD) is the most common cause of irreversible visual loss in the elderly population of the Western world. Vascular endothelial growth factor (VEGF) is a key molecule involved in pathogenic angiogenesis during the development of nAMD and is subsequently the most well studied. Most current treatments for nAMD inhibit angiogenesis by blocking VEGF using drugs such as Bevacizumab and Ranibizumab. However, VEGF blockage alone does not completely abrogate neovascularisation and other growth factors are known to be involved in the development of nAMD. Hepatic growth factor (HGF) is one of these, its receptor, c-Met, is known to be active in similar molecular pathways to VEGF, including phosphoinositol 3 kinase (PI3K)/Akt, Src/focal adhesion kinase (FAK) and p120/signal transducer and activator of transcription 3 (STAT3). HGF and c-Met induced pathways may therefore be significant in the pathogenesis of wet AMD and represent possible targets for future therapies.
Methods: This study used cultured human choroidal endothelial cell (hCEC) and examined the cell signalling responses when stimulated with VEGF and HGF. Western blots were carried out to confirm expression of c-Met, VEGFR2 and Key signalling molecules in each pathway (STAT3, FAK and Akt). Following this Phosphosite specific antibodies were used to investigate the precise phosphorylation and activation of each of the

aforementioned molecules. As an additional insight into HGF and VEGF in the eye immunofluorescence was carried out to visualize the receptors.
Results: We confirmed the presence of the HGF and VEGF receptors and the expression of key signalling molecules Akt, FAK and STAT3 hCEC. . Both receptors were found to be active in hCEC as were Akt, FAK and STAT3.
Conclusions: The presence of the molecules and active conformations implies that VEGF and HGF stimulated angiogenic pathways are active in the eye. However, we did find these pathways active in our control samples so it is not possible to draw firm conclusions about the source of activation. We plan to repeat our experiments using a revised protocol for the production of control samples.

6: Optical coherence tomography measurements of optic nerve morphology in healthy Asian and Caucasian subjects

A Pilat, V Sheth, I Gottlob and FA Proudlock

Ophthalmology Group, University of Leicester, Leicester, United Kingdom

Purpose: In spite of the growing interest in optical coherence tomography (OCT), optic nerve head (ONH) morphology in different ethnic and gender groups has been poorly investigated. We investigated ONH morphology and peripapillary retinal nerve fiber layer (RNFL) thickness in healthy subjects using optical coherence tomography (OCT) across different ethnicities comparing Asian (i.e. Indian sub-continent) and Caucasian individuals, gender and age.
Methods: High-resolution spectral domain OCT (Copernicus, 3 µm) was used to image the ONH in 123 healthy participants. Disc margins and position of internal limiting membrane and RNFL were defined manually to minimize inaccuracies.
Results: Asian participants had significantly larger cup areas (p=0.005) mainly due to elongated horizontal diameters (p=0.003). Disc areas were larger in Caucasian males compared to females but smaller in Asians males compared to females (interaction: p=0.002). There were no significant differences in rim areas or RNFL thicknesses between Asians and Caucasians or males and females. However, both rim areas (p=0.007) and mean RNFL thicknesses (p=0.02) significantly decreased with age resulting in larger cup volumes and cup/disc area ratio.
Conclusions: Using high resolution OCT, we have described for the first time significant differences in normal ONH morphology and peripapillary RNFL thickness between Asian and Caucasian ethnicities. We also show a differential effect of gender in these two ethnicities. These factors must be taken into consideration when pathology of the optic nerve or RNFL is suspected.

7: Vacuum-dried versus cryopreserved amniotic membrane (AM), as an alternative ocular surface dressing

CL Allen, G Clare, O M^{c}Intosh, H Dua, A Hopkinson

Division of Ophthalmology & Visual Sciences, University of Nottingham

Introduction: AM is extensively used in ocular surface reconstruction as a graft or a protective overlay. Presently AM is cryopreserved on procurement, a process that renders the tissue non-viable. However freeze or vacuum-drying AM has been shown to retain its physical properties on reconstitution and has been used recently as a surgical alternative. In addition pre-treatment of AM with complex saccharide lyoprotectants has been shown to stabilise membrane degradation, retaining essential biochemical and physical properties for re-epithelialisation.
Materials and Methods: AM was collected from consenting patients undergoing elective caesareans. AM sections were; i) cryopreserved; ii) freeze-dried, iii) vacuum-dried, iv) denuded, or vacuum-dried following saccharide pre-treatment. Structural assessment between membrane subtypes was achieved using electron microscopy. Samples were biochemically profiled using protein arrays and biomarker bioavailability determined using immunofluorescence analysis. The *in-vitro* potential of membrane subtypes were assessed by co-culturing with primary CECs.
Results and Conclusion: Vacuum-drying reduced the structural damage observed with cryopreservation and significantly enhanced factor retention. These effects were augmented further in the presence of saccharide. In addition time release data showed that unlike cryopreservation the optimised vacuum-drying technique

provides an immediate but sustained release of factors appropriate for both acute and long-term wound healing. Proliferation and cytotoxicity data corroborate epithelial remodelling data with optimised vacuum-drying promoting increased wound healing rates compared to cryopreservation. In addition degradation studies confirm that our optimised methodology produces an enhanced stable biomaterial that can be stored ambiently, for extended periods.

8: Intraocular pressure, Blood flow and Neuroprotection Somatosensory stimulation/ Acupuncture for chronic eye disease

Dr.med. Edith Rom, PhD

Wye Valley Trust, Gloucestershire NHS Trust, British Medical Acupuncture Society

Background: Many chronic eye diseases, e.g. normal-tension glaucoma or retinitis pigmentosa, can still lead to blindness in spite of best standard care with drugs and/or surgery. Somatosensory stimulation has been shown to be a safe, simple effective and efficient treatment modality for many chronic conditions. Application for eye disease is uncommon in the English-speaking world and needs to be explored further.
Methods: Literature Review: The major medical data bases (pubmed, Scopus, CINAHL) were searched for case reports, case series and trials using 'somatosensory stimulation' OR acupuncture OR acupressure AND 'eyes' OR 'glaucoma' OR 'optic neuropathy'. Articles relating to retinal ganglion cell apoptosis and stating an objectively measurable outcome were also included and the main results are summarized here.
Results: Numerous studies on humans and on animal models suggest that somatosensory-stimulation/acupuncture may lower intraocular pressure in glaucoma and ocular hypertension, provide neuroprotection and improve blood flow to affected eyes. As a complement to standard therapy, it may help to postpone surgery in cases of progressive disease, drug allergies or poor compliance. Overview of main papers providing evidence on poster.
Conclusions: Available evidence is limited but it suggests that somatosensory stimulation on local, segmental and distal levels may have some influence on IOP, blood flow and neuroprotection and is therefore worthwhile investigating.

9: 6-weekly bevacizumab versus 4-weekly ranibizumab on an as required basis for neovascular age-related macular degeneration treatment: 2-year outcome

Patrick JT Chiam, Venkat Kotamarthi

Leighton Hospital, Cheshire

Purpose: To compare the visual and anatomical outcomes of 6-weekly bevacizumab with 4-weekly ranibizumab on an as required basis for the treatment of neovascular age-related macular degeneration.
Methods: Retrospective analysis of consecutive patients who were treated with bevacizumab or ranibizumab for 2 years. Patients were followed-up 6-weekly in the bevacizumab and 4-weekly in the ranibizumab groups. Treatment method was 3-loading injections followed by as required basis. With a sample size of 102 for bevacizumab and 54 for ranibizumab, the power to detect a moderate effect difference was 80%. Main outcomes measured were mean change in visual acuity (non-inferiority limit of 5 letters), central macular thickness (CMT) and number of injections.
Results: At 1 year, the visual acuity improvement with bevacizumab was 7.6 and ranibizumab 9.0 letters (p=0.56). The 95% confidence interval was -3.3 to 6.0 letters. At 24 months, the improvements were 7.0 and 8.0 letters (p=0.72). The 95% confidence interval was -4.3 to 6.3 letters. The mean number of bevacizumab injections in the first year was 5.1 and ranibizumab 5.7 (p=0.037). In the second year, there were 2.6 and 3.5 (p=0.025). In the first year, the improvement in CMT were 139µm for bevacizumab and 147µm for ranibizumab (p=0.69); in the second year there were 146µm and 160µm (p=0.45).
Conclusion: Neither noninferiority nor inferiority was established between 6-weekly bevacizumab prn and 4-weekly ranibizumab prn in terms of visual acuity. There was no statistical significant difference between the CMT changes. The number of bevacizumab injections required in 2 years is fewer than ranibizumab.

10: Media Selection for Preservation of Mesenchymal Stem Cell Properties of Limbal Stromal Cells

Permesh Dhillon, Khurram Hashmani, Matthew Branch, Andrew Hopkinson, Harminder Singh Dua

Division of Ophthalmology and Visual Sciences, University Of Nottingham

Background: Mesenchymal stem cells (MSC) are found in connective tissue of many organs in the body. These fibroblastic cells display stem cell (SC) differentiation and proliferation properties and are currently used for tissue engineering in a clinical setting. Recently, we identified limbal stromal cells (LStC) as a novel source of MSC, however their characteristics have been shown to be variable in several publications.
Hypothesis: MSC properties are preserved in M199-based medium (MM).
Methods: LStC were isolated from the peripheral and limbal cornea of human donors and were cultured *in vitro* in MM and fibroblast medium (FM) and characterised using set criteria defined by the International Society of Cellular Therapy (ISCT) to identify MSC. A profile of MSC cell surface markers were analysed using flow cytometry at passage 3. The cells were then differentiated into adipocytes, osteoblasts, chondroblasts and analysed using standard staining techniques and quantitative polymerase chain reaction (qPCR).
Results: The LStC cultured in MM were spindle shaped and conformed to the ISCT criteria (≥ 95% for CD29, CD44, CD73, CD90, CD105 and ≤ 2% for CD11b, CD19, CD34, CD45, HLA class II antigen) and showed statistically significant differentiation potential into adipocytes, osteoblasts, chondroblasts whereas LStC in FM did not fulfil the criteria.
Conclusion: This work demonstrates that MM plays an important role in promoting and maintaining MSC properties of LStC compared to FM. This work implies that the MSC properties can be manipulated based on culturing conditions which can theoretically be used as potential therapy for ocular surface regeneration.

11: Histochemical Staining of Corneal Nerves in Mice

VK Dhillon, O McIntosh, J Lowe, HS Dua

Division of Ophthalmology and Visual Sciences, University of Nottingham

Introduction: Recently, the anatomy of human corneal nerves was studied comprehensively *in vitro* in both normal and diseased states using the acetylcholinesterase staining method. This method provided excellent images for enabling both quantitative and qualitative analysis of corneal nerves.
Aims: To evaluate the effectiveness of the non-specific acetylcholinesterase staining method in visualising corneal nerves in a mice model. 10 corneas obtained from 5 normal CD1 mice were stained as whole mounts using the Karnovsky & Roots direct coloring thiocholine modification of acetylcholinesterase technique. Each specimen is then scanned enface using the Hamamatsu Nanazoomer digital pathology microscope to view corneal nerves in multiple layers. High resolution, magnified, color images were produced to allow detailed analysis of nerve architecture, thickening, tortuosity and nerve sprouting of stromal and sub-basal nerves and its terminal bulbs.
Results: This method is easily reproducible, effective and comparable to other methods used to study corneal innervation in mice. This makes the *in vitro* study of corneal nerves feasible in pathological states where human samples are unobtainable.

12: Lymphocyte Proliferation Assays for Ophthalmological Based Tissue Engineering

Branch M, McIntosh O, Jones D R E, Dua H.S and Hopkinson A.

University of Nottingham, Division of Ophthalmology and Visual Sciences

Introduction: Allogeneic transplantation of cells, tissue and organs requires HLA matching and unsuccessful transplantation is often a result of rejection of donor material. Lack of a suitable donor is often an issue, how to reduce this deficit is the objective of significant clinical research. Tissue engineering is targeted at regenerating lost or damaged tissue where there are currently insufficient donor supplies or inadequate treatments. Many of these approaches using allogeneic material or novel synthetic substances may be immune inert, examples in ophthalmology research perspective include amniotic membrane, mesenchymal stem cells (MSC) and decellularised corneas. Furthermore MSC are thought to exact an immunomodulatory effect on lymphocytes via secreted factors. These properties can easily be tested *in vitro* prior to the animal model/clinical trial stage.

Methods: Lymphocyte ($CD3^+$) proliferation assays using CFSE labelling and flow cytometry can detect whether constructs are immunogenic and therefore identifies if a tissue engineering construct is likely to cause a response in a human recipient. Mixed lymphocyte proliferation assays can be used to gauge the immunomodulatory effects of an MSC construct. Both these assays may be used on any transplantable material sample. TNFα and IFNγ are employed to simulate inflammatory conditions in each case. PHA stimulation was used to stimulate lymphocytes as a control.
Outcomes: These procedures are more sensitive, safer and much easier to run than previous methods (tritiated thymidine uptake). They provide information on the potential immunogenicity of a developing therapy which may aid in reducing rejection and immune suppression.

13. Comparative protein expression profiling of selective tight junction proteins in choroidal and retinal endothelial cells

Saker Saker, Elizabeth Stewart, Winfried Amoaku

Division of Ophthalmology and Visual Sciences, University of Nottingham

Background/Aims: To determine, in vitro, the effects of hyperglycaemia on the adhesion molecule expression of the human retinal and choroidal micro-vascular endothelial cells (REC and CEC respectively).
Methods: Human micro-vascular retinal and choroidal cells were derived from UK transplant within 72hrs of death as described elsewhere. HUVEC cells were served as positive controls. The expression of the selective tight junction proteins was determined using western blotting. This was measured and compared to that of retinal and choroidal endothelial cells under normal and hyperglycaemic conditions. The experiments were repeated on 3 independent occasions, with different endothelial samples corresponding to RECs and CECs respectively.
Results: In normoglycaemia, microvascular ECs from the retina and choroid expressed JAM C and Occludin. Their expression was however significantly different between the 2 cell types with much more expression in RECs. Claudin 5 and JAM 1 were also expressed in these cells although at a slightly weaker intensity than Occludin. The RECs exhibited higher expression of Occludin and JAM C in normoglycaemic conditions compared to hyperglycaemia. In contrast, there was no significant difference between the expressions of both occludin and JAM-C in CECs in hyperglycaemia compared to normoglycaemia.
Conclusions: RECs and CECS show different expression profiles of different tight junction molecules in normoglycaemia. Exposure of human RECs to hyperglycaemia for 72hrs or longer results in significant reductions in the expression of selective tight junctions as opposed to the slight alterations observed in choroidal cells.

PREVIOUS NORMAN GALLOWAY LECTURES

2011: Professor F Kruse, Erlangen, Germany. *Descemet membrane Endothelial Keratoplasty, the Thinner, the Better*

2010: Professor D Wong, University of Liverpool and Hong Kong. *East and West*

2009: Prof IG Rennie, Sheffield. *The Good, the Bad and the Ugly: The Metastatic Potential of Uveal Melanoma*

2008: Professor A Fielder, London. *Paediatric Ophthalmology – where next?*

2007: Professor J-J De Laey, Ghent, Belgium. *Paraneoplastic Retinopathies*

2006: Mr JKG Dart, Moorfields Eye Hospital, London. *When topical steroids fail: Managing severe anterior segment inflammation*

2005: Professor D Azar, Massachusetts Eye Infirmary, Harvard University, Boston, USA. *Wavefront-guided keratrorefractive surgery: Advantages and limitations*

2004: Professor R Hitchings, Moorfields Eye Hospital, London. *Normal Tension Glaucoma*

2003: Professor CNJ McGhee, University of Auckland, NZ. *Exploring the topographic and inner world of the cornea to the horizon of the iris plane: contemporary imaging of the anterior segment of the eye*

2002: Professor AC Bird, Institute of Ophthalmology, University College London. *Prospects of treating inherited retinal diseases*

2001: Professor JV Forrester, University of Aberdeen. *Classification and Treatment of Posterior Uveitis*

2000: Professor PR Laibson, Wills Eye Hospital, Philadelphia, USA. *Herpes Simplex Viral Keratitis : What HEDS (Herpetic Eye Disease Studies) has taught us*

1999: Mr JRO Collin, Moorfields Eye Hospital, London. *Management of Traumatic Ptosis*

1998: Professor LA Donoso, Wills Eye Hospital, Philadelphia, USA. *Stargardt's Macular Degeneration*

1997: Professor DB Archer, Queen's University, Belfast. *Diabetic Retinopathy – a tolerable disease*

PREVIOUS PRIZE WINNERS

NOTTINGHAM RESEARCH TROPHY

A rolling trophy and an individual shield awarded to the best presentation in the clinical research category considered by a panel of judges on the day.

2011: M G Thomas, Leicester. *High resolution in-vivo imaging in achromaptosia*

2010: M Al-Aqaba, Nottingham. *Architecture and Distribution of Human Corneal Nerves*

2009: M G Thomas, Leicester. *Voluntary modulation of involuntary eye movements during reading*

2008: A Bhan-Bhargava, Nottingham. *Glaucoma in an elderly Caucasian population (The Bridlington Eye Assessment Project)*

2007: A Shwe-Tin. *Digital infrared pupillometry for comparing cocaine with apraclonidine testing when investigating Horner's syndrome*

2006: M J Hawker. *Linear regression modelling of rim area to discriminate between normal and glaucomatous optic nerve heads: The Bridlington eye assessment project*

2005: M Awan, Leicester. *Can patching be improved in amblyopia treatment?*

2004: V S Maharajan, Nottingham. *Amniotic membrane transplantation for ocular surface reconstruction: A seven year retrospective analysis*

2003: M Awan, Leicester. *Effect and compliance of strabismic amblyopia monitored with the occlusion dose monitor*

2002: D Squirrell. *A prospective, case controlled study of the natural history of diabetic retinopathy and maculopathy after uncomplicated phacoemulsification cataract surgery in patients with Type 2 diabetes*

2001: J Morgan, Nottingham. *The detection of T-Cell activation by retinal autoantigen in uveitis patients using cytokine flow cytometry*

2000: C Weir. *Spatial localisation in esotropia - is extraocular muscle proprioception involved?*

1999: P Hossain. *A method to visualise leukocytes in the retinal and choroidal circulation in vivo*

1998: C M Sloper, Nottingham. *Tacrolimus in high-risk corneal and limbal transplants*

1997: A R Sarhan, Nottingham. *Rapid suture management of post-keratoplasty astigmatism*

DAVID MEYER RESEARCH TROPHY

A rolling plaque and an individual shield awarded to the best presentation in the basic science research category considered by a panel of judges on the day.

2011: P Dhillon, University of Nottingham. *Characterisation of Corneal Stromal Cells as a Novel Mesenchymal Stem Cell Source*

2010: M G Thomas, Leicester. *High resolution spatial and temporal expression profile of FRMD7 in neuronal tissue provides clues for pathogenesis and treatment*

2009: I Mohammed, Nottingham. *Interleukin-1 beta induced RNase-7 expression requires MAPK but not NF-kB signalling*

2008: E A Stewart, Nottingham. *Human Choroidal Endothelial Cell Growth Factor signalling in Age-Related Macular Degeneration*

2007: S Thomas, Leicester. *Mutations in FRMD7, a Novel Gene, Cause X-linked Congenital*

Idiopathic Nystagmus

2006: A Hopkinson, Nottingham. *Amniotic membrane for ocular surface reconstruction: Donor variations and handling affect membrane constituents*

2005: K H Weed. *In vivo confocal microscopy: Corneal changes following retinal detachment surgery with intra-ocular silicone oil*

2004: A Browning, Nottingham. *The isolation and characterisation of adult human sub-macular inner choroidal endothelial cells*

2003: R D Hamilton, Nottingham. *Characterisation of an in vitro model for studies into age related macular degeneration*

NOTTINGHAM POSTER PRIZE

An individual shield awarded to the best poster presentation considered by a panel of judges on the day.

2011: U Fares, Nottingham. *Correlation of Central and Peripheral Corneal Thickness in Healthy Corneas*

2010: I Mohammed, Nottingham. *Human defensin 9, a 'functional' host defence protein*

2009: A M Otri, Nottingham. *Expression Pattern of Anti-microbial peptides (AMPs) in Acanthamoeba Keratitis*

2008: M Mathew, Nottingham. *Malignancies after Tacrolimus Therapy in the management of ocular inflammatory disease*

2007: J-J Gicquel, Poitiers, France. *A 24-months follow-up of severe ocular burns with impression cytology*

2006: P Ji. *Retinal features in children with Down's syndrome*

2005: H Kolli. *Intravitreal triamcinolone acetonide in the management of refractory uveitis*

2004: I Choudhari, Leicester. *National survey of management of acquired nystagmus*

2003: P Tesha, Leicester. *Interactive teaching in ophthalmology*

2002: D Thomas. *The taut thickened posterior hyaloid (TTPH)*

2001: R Amankwah, Nottingham. *Hyaluronic acid promotes the migration of corneal epithelial cells in vitro*

2000: I A El-Ghrably, Nottingham. *Quantitative assessment of cytokine mRNA and secreted protein in proliferative vitreoretinopathy*

1999: A Pearson. *Does ethnic origin influence the incidence or severity of keratoconus?*

1998: R Ahmed, Nottingham. *Modified Sheridan Gardiner vision test with semi-transparent card*

1997: D Raj, Nottingham. *Stem cell deficiency of the corneosleral limbus: a new approach to surgical management*

HONORARY DELEGATES

Nomination of delegates as “Honorary delegates” of the Symposium was considered for the first time in 2006. This was to recognise individuals who had supported the meeting and contributed to it over the years. These delegates have the privilege of full participation and attendance in the meeting as guests of the Symposium.

Mr Nicholas R Galloway, Nottingham (2006)

Professor Larry Donoso, Wills Eye Hospital, Philadelphia (2010)

Mr A A Zaidi, Rotherham, UK (2011)

Professor Martin Rubinstein, UK (2012)

NEXT MEETING

The 17th Nottingham Eye Symposium and Research Meeting
***featuring the Norman Galloway Lecture* will be held on**
Friday, 25th January 2013 (provisional date)

- *Research trainee abstract presentations (oral and poster) and prizes*
- *Guest presentations by leading optometrists*
- *A symposium with talks from prestigious ophthalmologists*
- *The Norman Galloway Lecture*
- *Excellent conference facilities including free parking*
- *Tea, coffee and a hot buffet lunch provided*
- *All for a very reasonable registration fee!*

Contact the NES Meeting Co-ordinator: nes@nottingham.ac.uk to receive details on the next meeting and check out the website for details of previous and next year's meetings.
http://www.nottingham.ac.uk/scs/divisions/ophthalmologyvisualsciences/nes/index.aspx