Threescore and Ten

Innovation Academy

8th December 2017

viapath

Programme

INTRODUCTION

9.15 Registration

9.45 Welcome
Prof Jo Martin
President, Royal College of Pathologists

MORNING SESSION

Chair: Prof Jonathan Edgeworth

10.00 **Prof Frank Kelly**
Director of Analytical and Environmental Sciences Division, King's College London

10.30 **Dr Matt Loose**
Developmental Biologist and Bioinformatician, School of Life Sciences, University of Nottingham

11.00 **Dr Guy Orchard**
Consultant Grade Biomedical Scientist, Viapath

11.30 BREAK

CQI in Healthcare Chair: Chris Gunn

11.55 **Dr Tom Lewis**
Consultant Microbiologist and Lead Consultant for Pathology, Northern Devon NHS Trust

12.25 **Dr Rhydian Phillips**
National Director, Policy & Implementation
Getting It Right First Time (GIRFT)

12.55 **Panel Discussion**

1.00 LUNCH

Excellence in Pathology – 2017 finalists and voting

2.00 **Amy Slater**
Entering the precision medicine era - a next generation sequencing test for lung and colorectal cancer

2.05 **Ruth Wheeler**
The application of high throughput sequencing to the diagnosis of thrombocytopenia

2.10 **Charlotte Lee**
Skewed T Follicular Helper Cell Subsets in Common Variable Immunodeficiency

AFTERNOON SESSION

Chair: Nick Parkin

2.15 **Mahiben Maruthappu**
Doctor and Co-founder of Cera

2.45 **Prof Owen J Guy**
Head of Systems Process and Engineering Centre (SPEC)
Director (Engineering) Centre for Nanohealth,

3.15 **Dr Norman Taylor**
Consultant Clinical Scientist, Viapath

3.45 **Winners of 'Excellence in Pathology' announced**

4.00 CLOSE

Innovation Academy

Dr Dominic Harrington

CHIEF SCIENTIFIC OFFICER, VIAPATH

It gives me great pleasure to welcome you all to our seventh Innovation Academy Scientific Symposium, 'Threescore and Ten'. At our sixth symposium we focussed on the recent rapid advances in technology and data science, and reflected on how unlocking the clinical utility of vast quantities of data is dependent on successful integration and rapid analysis. Today we build on that theme and consider how technology can best serve the National Health Service as it reaches threescore years and ten.

It is remarkable to think that life expectancy in the United Kingdom when the NHS was founded in July 1948 was just 66 years for men and 71 years for women. Big issues of the day included tuberculosis and polio. Such infections favoured overcrowded unsanitary environments – the poor were most affected. Poverty also gave rise to rickets – another common cause of disability in childhood. Before the NHS, treatment and care depended predominately on charity and philanthropy. Seventy years on, life expectancy has increased to 79 and 83 years for men and women respectively. Today it is obesity, diabetes, coronary heart disease, cancers and dementia that must all be tackled. All of which are driven less by those diseases of the middle of the last century and more by lifestyles favoured by those living in the 21st century. To help ensure that the NHS celebrates fourscore years, pathology providers must support and promote the leading of healthier not just longer lives.

Welcome: Prof Jo Martin

PRESIDENT, ROYAL COLLEGE OF PATHOLOGISTS

Professor Martin Qualified Cambridge University and London Hospital Medical College 1984, MRC Training Fellowship 1988, MRC Fellowship 1990, Wellcome Trust Advanced Research Training Fellowship 1991. PhD in cellular pathology of MND 1997. Kings Fund programme MA in Leadership in 2005.

Jo has over 100 published papers including Nature group and Science journals and is Professor of Pathology at Queen Mary University London. She is a founder of Biomoti, a drug delivery platform technology company, and has created a suite of apps including an elearning platform, eCPD.

She has very broad experience in healthcare management ranging from running clinical departments and divisions to acting as Medical Director, and subsequently Chief Medical Officer at Barts Health NHS Trust, and covering for the Chief Executive.

As Director of Academic Health Sciences she is responsible for CRN North Thames, hosted by Barts, for research across the Trust and for the training and education of 16,000 staff across Barts Health. Her clinical specialist expertise is in the pathology of gastrointestinal motility disorders.

National Clinical Director of Pathology for NHS England April 2013-16, Jo has worked across a broad range of programmes and projects in all the pathology disciplines including genetics, transfusion, digital pathology, data, networks and working with the diagnostic professional bodies.

Jo became President of the Royal College of Pathologists on 16th November 2017.

Morning Session

Chair: Prof Jonathan Edgeworth

MEDICAL DIRECTOR, VIAPATH

Jonathan started as a medical student at Guy's Hospital but quickly got drawn into research doing an intercalated BSc and then PhD in immunology and macrophage biology at Cancer Research UK, before deciding to return to medicine to complete basic clinical training.

After qualifying he went back to the laboratory to do post-doctoral research for two years and then became a clinical microbiologist combining his interest in immunology with bacterial infections. After becoming a consultant he did a further postdoctoral fellowship in Shigella disease pathogenesis at the Pasteur Institute in Paris and then on return to the UK took up a Clinical Microbiology consultant post at Guy's and St Thomas' in 2002. Seeing the dramatic rise in MRSA that had occurred within just a few years he focussed his research interest in that field.

At the same time as beginning his research on MRSA, and having spent almost as long in the laboratory as on the wards, he increasingly recognised the importance of leadership in helping make things better and therefore applied and was appointed to the position of Clinical Director of Pathology in 2006. One main objective from the start was to help bring pathology scientists and clinicians closer together to build critical mass for our energies, talent and resources in improving delivery and development of services for patient benefit. To this end, in 2009 he led the creation of Viapath (then GSTS) as a novel partnership to catalyse laboratory modernisation, service improvement and growth.

Prof Frank J Kelly

DIRECTOR OF THE NIHR HEALTH PROTECTION RESEARCH UNIT ON ENVIRONMENTAL HAZARDS, KING'S COLLEGE LONDON

Prof Kelly holds the chair in Environmental Health at King's College London, where he is Director of the Environmental Research Group, Director of the NIHR Health Protection Research Unit on Environmental Hazards and Deputy Director of the MRC-PHE Centre for Environment & Health.

Prof Kelly leads a substantial research activity which spans all aspects of air pollution research from toxicology to science policy. He has led studies of the urban airshed within London including the impact of the introduction of London's Congestion Charging Zone and Low Emission Zone. Other work examines the toxicity of PM associated metals and quinones, diesel and biodiesel exhaust emissions, wood smoke and the identification of biomarkers of traffic exposure.

Prof Kelly has published over 300 peer-reviewed papers as well as many conference papers and books (as author or editor) on the toxicology and health effects of ozone, nitrogen dioxide and particulate pollution. In addition to his academic work Prof Kelly is past President of the European Society for Free Radical Research and past Chairman of the British Association for Lung Research. He provides policy support to the WHO on air pollution issues and he is Chairman of COMEAP the UK's Department of Health's Expert Committee on the Medical Effects of Air Pollutants.

Air pollution and public health: emerging hazards and improved understanding of risk

Air pollution is a significant public health problem, responsible for a growing range of health effects that are well documented from an extensive research effort conducted in many regions of the world. Rapid urbanisation has led to us being exposed to unhealthy concentrations and a more diverse variety of ambient air pollutants than ever before. We occasionally experience smog hanging over our cities when poor air-flow and dispersal allows pollution to build up – and it is during such episodes that susceptible individuals (e.g. those with asthma, COPD or heart disease) may undergo an acute exacerbation requiring increased medication or admission to hospital. Of greater concern however, is the inherent, modern type of pollution in today's urban environments, which unlike the pea-soup smog's, is invisible at ground level but is linked with a wide range of chronic health effects. This 'invisible killer' contains nitrogen oxides, ozone (O3) and exceptionally small particulate matter (PM). PM10 and the more abundant PM2.5 constitute particles with diameters less than 10 and 2.5 microns respectively – the latter being approximately 25 times less than the width of human hair. Of the modern day air pollutants, PM has been held responsible for the majority of health effects. In urban areas the major source is fossil fuel combustion, primarily from road transport, however there are also contributions from a number of other sources both inside and outside cities.

Dr Matt Loose

DEVELOPMENTAL BIOLOGIST AND BIOINFORMATICIAN, SCHOOL OF LIFE SCIENCES, UNIVERSITY OF NOTTINGHAM

Dr Matt Loose is based at the School of Life Sciences, University of Nottingham. A developmental biologist and bioinformatician, he also heads up DeepSeq, the University of Nottingham Next Generation Sequencing service. DeepSeq actively encouraged Nottingham Academics to apply to join the MAP and in return, supported MAP participants with both library prep and bioinformatics. This led to the development of minoTour, a real time platform for analysing minION reads, which is now in use at multiple sites around the world for minION data analysis. Matt went on to develop the first demonstration of 'read-until' or selective sequencing on the MinION and has contributed to the MinION Analysis and Reference Consortium, the 'porecamp' series of Nanopore training camps and, most recently, co-led the first efforts to sequence a human genome on the MinION.

Nanopore sequencing is beginning to move beyond the first wave of 'early adopters' and become a useful tool for analysis of genomes at multiple different scales. We have recently sequenced a human genome to 30x and an NG50 exceeding 6 Mb using MinION technology alone and, although largely a bespoke process, this highlights the rapid rate of progress on this platform in the last 12 months. Nanopore sequencing enables real time analysis of data whilst sequencing is in action and, at an extreme, this data can be used to disrupt the sequencing process itself removing unwanted molecules from the sequencer. We will consider the implications of true real-time genomics and the potential impacts on human genomics. Finally, Nanopore sequencers can sequence any nucleic acid, including RNA. Recent efforts to capture a reference human transcriptome using 'direct RNA' sequencing without first generation a complementary DNA strand will be discussed.

Dr Guy Orchard

CONSULTANT GRADE BIOMEDICAL SCIENTIST, VIAPATH

Guy is responsible for providing and developing the dermatopathology, Mohs' micrographic surgery, and Head and Neck Pathology Services for Viapath.

Guy completed his Fellowship to the Institute of Biomedical Science in Cellular Pathology in 1990 having gained the highest pass in the UK across all disciplines and being awarded the RJ Lavington Prize. Guy completed his Master's in immunology at Surrey University gaining a distinction in 1995 and achieved his PhD in 2010. He has worked at St. John's for nearly his entire working career, which now spans over 30 years' service. Guy received chartered scientist recognition in 2005.

Guy has been involved in research and development activities for the department involving immunocytochemistry techniques and Mohs. Guy is professionally active and sits on four editorial boards and peer reviews for several other journals. Guy is an immunocytochemistry UK national external quality assurance (UKNEQAS) assessor for both Immunocytochemistry and Cellular Pathology Technique. He has been a council member for the Institute of Biomedical Science (IBMS) and is a specialist advisor for cellular pathology and Chief Examiner for Cellular Pathology for the IBMS. Guy sits on the advanced Specialist examination con-joint boards for the IBMS and Royal College of Pathologists. Guy is the Chairman for the British Society of Mohs Histologists and the examiner for the Diploma of Expert Practice specialist examination in Mohs for the IBMS. Guy has edited and contributed to Oxford University Press (OUP) 'Histopathology' text book in the Fundamentals in Biomedical Science series and a second book ' Cellular Structure and Function' in the same series for OUP and is about to start a third entitled ' Cellular Pathology'.

Dying for a tan

The incidence of skin cancer is rising. Data on malignant melanoma from cancer research UK (2014) indicated that there were 15,419 cases of malignant melanoma in the UK, with 2,459 deaths. The reasons for this increase are multi-factorial but principally evolve around the effects of sunlight on skin and involve wavelengths of light from the UVA and UVB part of the spectrum. In terms of photobiology the key sequences that result in carcinogenesis involve signal transduction pathways, oncogene and tumour suppressor gene interactions, DNA damage and repair processes, immunological surveillance and the significance of chemo-preventive and/or therapeutic agents. What is becoming increasingly apparent is that cumulative 'sun burn episodes' do a great deal of harm to our skin over our life time and these effects are often non reversible. Studies in to the effects of 'sun burn episodes' have formed the basis of understanding the long term effects of sun damaged skin changes.

Histological evaluations of trials based on assessments of minimal erythemal dose (MED) sun burn episodes on skin provide an insight into the cellular changes that can be seen immediately following a sun burn episode and then the subsequent repair processes that enable the skin to return back to a normal state. Antibody panels to assess cellular changes include markers for cellular proliferation, DNA damage, oncogene expression, immune surveillance of Langerhan's cells within the epidermal compartment and apoptosis regulators. The evidence indicates that sun tans are in fact contributing to the sun damage effects.

CQI In Healthcare

Chair: Chris Gunn

DIRECTOR OF OPERATIONS FOR CORE SERVICES, VIAPATH

Chris joined Viapath in September 2015 as the Business Operations Manager, supporting the Chief Operating Officer. After about a year Chris became the Director of Operations for Core services in Viapath. In October 2017 Chris was promoted into the role of Director of Operations for Viapath, a role that covers transformation, service improvement and performance and acts as deputy to the COO.

Prior to moving into healthcare Chris trained in engineering, moved through various careers ending up in financial planning. Seeking a more fulfilling career, Chris retrained as an Operating Department Practitioner in 1997, he was drawn to emergency work becoming an adult, paediatric and neonatal advanced life support instructor, later becoming a Resuscitation officer in 2005. This role involved training all groups of Healthcare professionals, in real and simulated environments, treating medically unwell, cardiac and trauma patients and also attending events.

In 2009 Chris was invited to take on the role of Clinical Lead for Theatres, this involved transformation, introduction of lean processes and was a pilot site for the Safer Surgical Checklist, and the Productive Operating Theatre.

As part of a development programme Chris was seconded to PWCs Health wing for a few months returning back to Surgical Management, concentrating on orthopaedic pathways. Chris, in 2012 was then asked to support pathology, which has extended to his career to date, becoming the cross site general manager for the North Kent Pathology Service, employed by Dartford NHS Trust soon to include the Medway NHS FT.

Tom Lewis

CONSULTANT MICROBIOLOGIST, NORTHERN DEVON HEALTHCARE NHS TRUST

Following a degree in Natural Sciences, I studied for a PhD in Dundee, followed by a post-doctorate in Bordeaux. I studied medicine in the West Midlands and have published on a variety of topics, from assessment of hospital cleaning to the first description of using whole genome sequencing of MDR-Acinetobacter to study a hospital outbreak.

I was appointed as Consultant Microbiologist in North Devon in 2010. As Lead Clinician for Antibiotic Stewardship, I have been involved in a number of interventions to improve prescribing habits, focussing particular on the behavioural science behind this. Most recently, a local Facebook campaign developed with Public Health, using social marketing techniques, has been adopted as part of a national programme to improve patient understanding of antibiotic harms.

Over the last few years, I have been particularly interested in how pathology can be used to redesign health systems. Working closely with colleagues in primary and secondary care, we have shown that paying attention to the needs of the patient is an effective way to improve quality and reduce costs.

Although what matters to individual patients is almost infinitely varied, when we talk to people about diagnostic tests we find some common themes. In particular, they want to feel cared for, they want to trust those looking after them, and they want to know if they are normal. Assessing laboratory performance against these criteria is challenging, but we have derived some universal measures of quality that would have to be true if we were delivering a patient focussed service. We call this the Clean Framework. In particular, there needs to be a well-framed clinical question and each diagnostic test needs to be aligned to answering this question. To do this, there needs to be an understanding of normality, the features of significant deviation from normality, and how certain we are about any conclusions that can be drawn from results. We need to find new ways of imparting this information to both clinicians and patients. Viewed through this lens, standards such as ISO15189 tell us very little about how services perform. In this talk we will consider ways in which laboratories could assess and improve their effectiveness.

Dr Rhydian Phillips

GIRFT POLICY & IMPLEMENTATION DIRECTOR AND DEPUTY SRO, NHS IMPROVEMENT

After qualifying from the University of Wales College of Medicine, Rhydian spent five years working as a clinician in hospitals in Cardiff, Carmarthen, Bath and Bristol, gaining experience in a wide range of specialties including general and acute medicine.

He joined the diplomatic service in 2000 and served for eleven years in a variety of postings including at the British Embassy, Tokyo, as well as working on the NATO counter terrorism and counter-proliferation policy.

After the FCO he spent six years as a senior civil servant, first at the Department of Energy & Climate Change, where he led a national nuclear emergency planning improvement programme, then at the Department for Transport where he oversaw Network Rail's delivery of its £15bn rail enhancement programme.

Rhydian returned to the NHS to join NHS Improvement as the Director of Policy & Implementation and Deputy SRO for Getting It Right First Time. His role includes ensuring that GIRFT evolves from the successful orthopaedics pilot into a national programme delivering improvements in more than 30 specialties across all English hospital trusts.

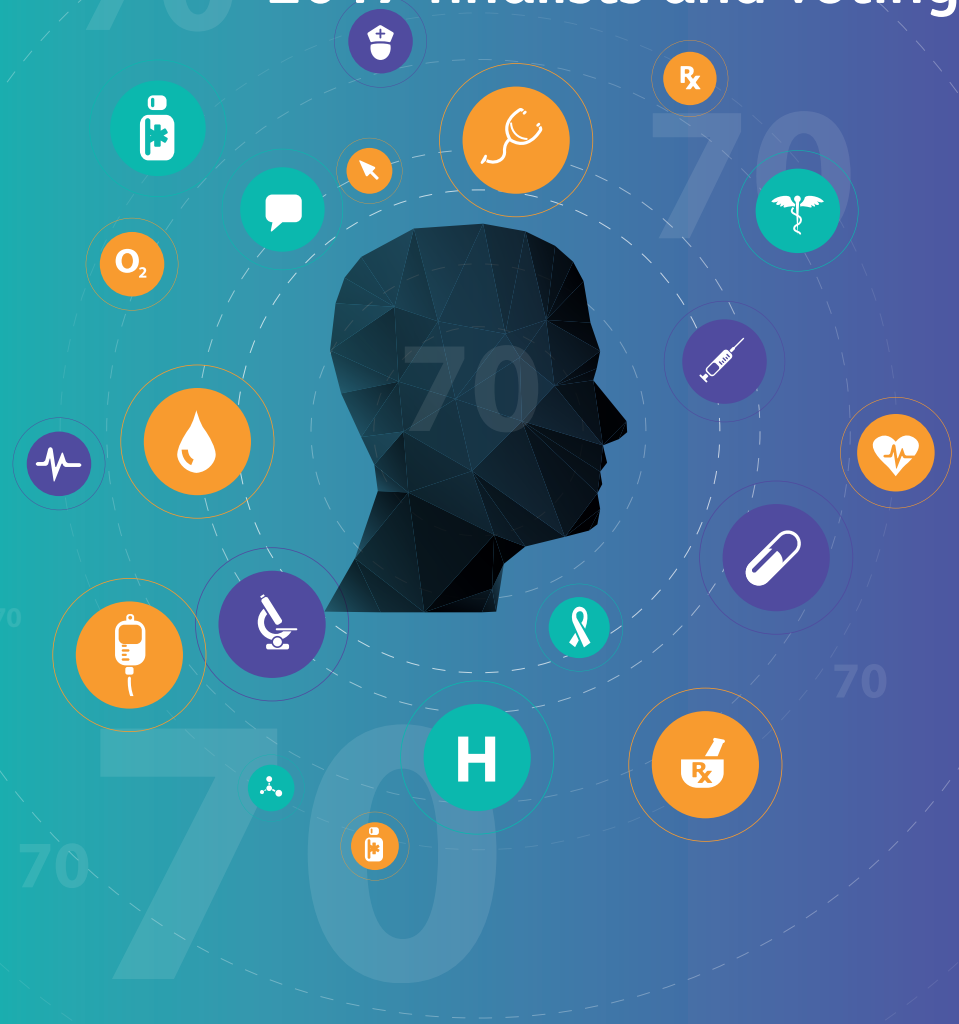
Getting It Right First Time (GIRFT) is a national programme designed to improve surgical and medical care within the NHS by reducing unwarranted variations. By identifying variations in the way services are delivered across the NHS, GIRFT aims to improve the quality of care and patient outcomes, and deliver efficiencies such as reducing length of stay, complications and readmissions.

The programme is run in partnership with NHS Improvement and the Royal National Orthopaedic Hospital NHS Trust which hosted an orthopaedic pilot led by Professor Tim Briggs. The GIRFT methodology, which brings deeper insight of individual specialty performance informed by data analysis across a range of metrics, is now being rolled out to 35 surgical and medical specialties.

Importantly, this review and analysis of data is led by frontline clinicians who are expert in the areas they are reviewing. The programme has recruited more than 40 clinical leads and advisors. This means the data that underpins the GIRFT methodology is being reviewed by people who understand those disciplines and manage those services on a day to day basis.

Policy and Implementation Director Dr Rhydian Phillips is heading the programme's implementation across England with GIRFT regional hubs supporting NHS hospital trusts to interpret their datasets and begin developing plans to improve service delivery, patient outcomes and reduce unwarranted variation. The focus is on sustainable solutions developed at a local level, underpinned by a national programme structure to support trusts and Sustainability and Transformation Partnerships to share best practice across the country.

Excellence in Pathology – 2017 finalists and voting



Innovation Academy

Excellence in Pathology – The Finalists

Amy Slater

Amy is in her third year of the NHS Scientist Training Program (STP) in Clinical Bioinformatics, based within the Viapath Genetic Laboratories. During which she has been involved in several projects including building an ordering and tracking system for Whole Exome Sequencing (WES) tests through the laboratory as well as training to analyse and report clinical WES tests.

Prior to starting the STP, she undertook a PhD investigating the epigenetic and genetic variations between different sporadic renal cancers at the University of Birmingham, successfully defending her thesis in December 2015. During her PhD she has presented posters at international conferences in Frankfurt and Liverpool and published in peer review journals.

Whilst studying for her BSc in Pharmacology and Molecular Genomics at King's College London, she developed a love for the theatre and amateur dramatics, particularly the works of Gilbert & Sullivan, which she still regularly perform in and directs. Outside of the theatre Amy enjoys training and competing her dog Cadbury in dog agility, and is a keen sewer and seamstress.

Aled Jones

Aled joined the Viapath Genetics Laboratories in 2013 as a trainee clinical scientist in Bioinformatics. He has since gained professional registration and is currently a Clinical Bioinformatician in the Genetics lab.

In this role Aled writes computer programs using Linux, Python and SQL to process, store, interrogate or display genetic data. Recently, he has been involved in implementing cloud compute, automating data analysis pipelines and is involved in the 100,000 genomes project. Outside of work he enjoys rugby, running, curries, travelling and gadgets.

Entering the precision medicine era - a next generation sequencing test for lung and colorectal cancer

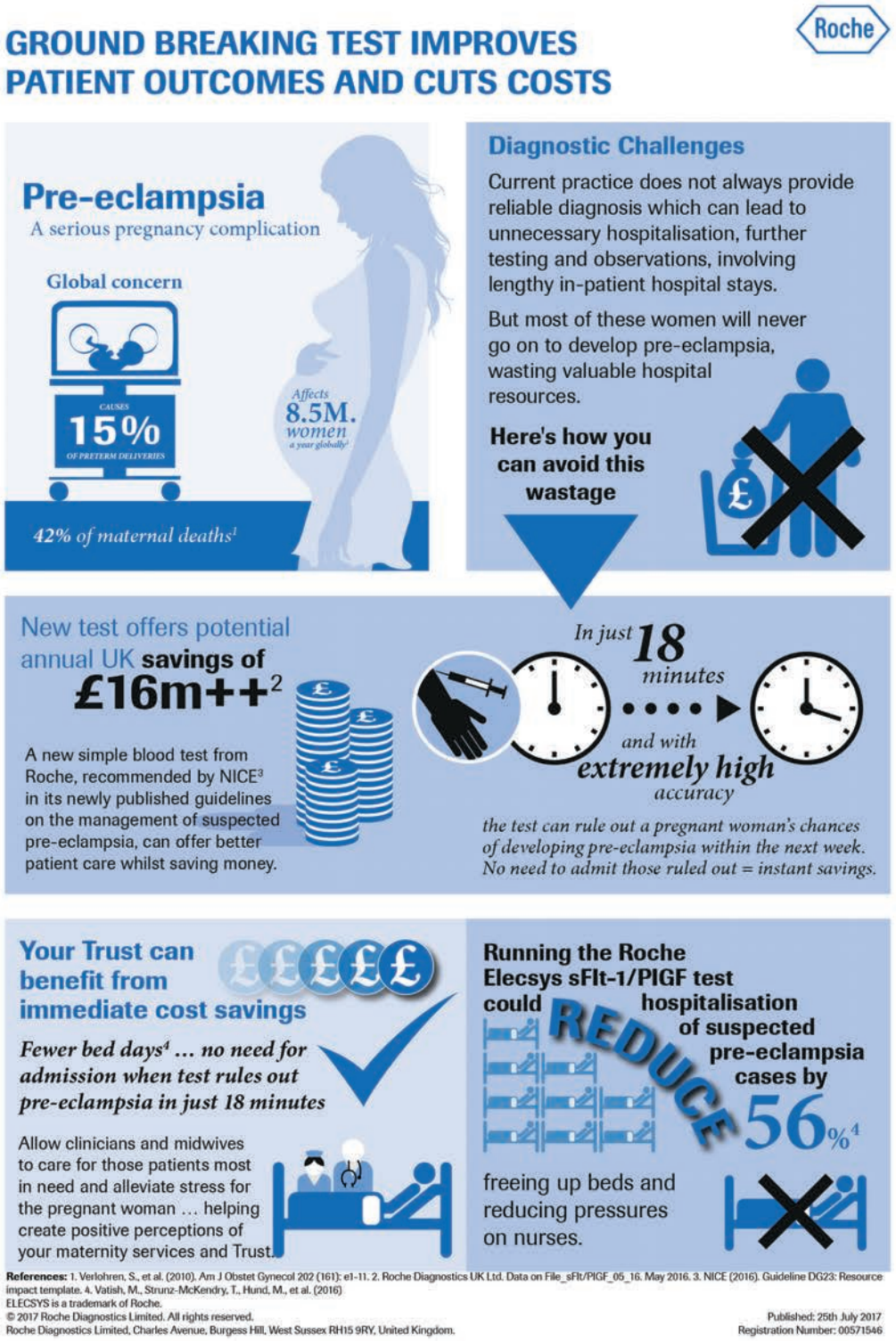
Until recently, the oncology service at Guy's Hospital used high resolution melting (HRM) analysis to assess non-small cell lung carcinoma and colorectal cancer for clinically relevant variants. This out-dated technology has limited scope and sensitivity and is not suited to routine use in the era of precision medicine.

The oncology and bioinformatics teams at Viapath Genetics Laboratories combined their expertise to implement a new next generation sequencing (NGS) test to replace HRM. As NGS is a less labour intensive, more sensitive and scalable approach, it is realising patient benefits from targeted therapies.

We validated the Accel-Amplicon NGS panel (Swift Biosciences) that covers 17 well characterised hotspots in 4 genes of the EGFR cancer pathway, on 150 previously genotyped samples, achieving full concordance. As tumour biopsies can be very small, with differing levels of tumour content, we also assessed the DNA input requirements, showing that the assay performed reliably and reproducibly, with as little as 10ng of DNA, and could detect variants at allele frequencies as low as 1 %.

Data analysis and variant calling was fully automated to run on the DNAnexus genomics cloud platform and the results are available for clinical scientists to interpretation within an hour of sequencing completion.

Since services began in July, 126 samples have been through the NGS test. The NGS test covers more targets than the HRM test it replaces, significant reducing the cost to investigate the same number of genes, achieving a >99 % success rate. It has recently been successfully inspected for ISO15189 accreditation.



Ruth Wheeler

Ruth is a senior Clinical Scientist in the Molecular Haemostasis Laboratory at St Thomas' Hospital and specialises in the molecular diagnosis of inherited bleeding disorders.

She joined the department in 2005 after spending ten years in academia as a post-doctoral research fellow, first at UCL, in the Department of Paediatrics and Child Health where she worked on the genetics of a group of rare childhood neurodegenerative disorders (Neuronal Ceroid Lipofuscinosis) and then at Cancer Research UK where she worked in the Developmental Patterning Laboratory on the genetics of bowel cancer.

Ruth has always had a keen interest in the genetics of human disease and is passionate about the application of new technologies to the diagnosis of such disorders. She has recently been involved in setting up a robust test for the diagnosis of platelet disorders using next generation sequencing technology which will be the focus of this presentation.

The application of high throughput sequencing to the diagnosis of thrombocytopenia

The inherited platelet disorders form a heterogeneous group of rare diseases associated with altered platelet size, structure and/or function, reduced platelet count and mucocutaneous bleeding of varying severity. Phenotypic tests are not always able to provide a definitive diagnosis so molecular analyses are often undertaken. However to date more than 50 genes have been implicated in the aetiology of platelet disorders which makes screening by conventional methodologies costly and time consuming. In our laboratory we currently analyse 15 genes known to be associated with platelet disorders and out of the 68 patients investigated by Sanger sequencing we have been able to identify a causative mutation in only 34 cases which leaves 50 % of patients without a molecular diagnosis.

To improve our diagnostic "hit rate" we devised a study to investigate the application of high throughput sequencing to the molecular diagnosis of familial thrombocytopenia and macrothrombocytopenia. We used a targeted exome sequencing approach to investigate 14 patients who have been previously analysed (6 with an identified mutation and 8 without). All 6 of the previously identified mutations were recapitulated. In addition we were also able to identify causative mutations in a further 5 patients and potential pathogenic variants in 2 others.

These findings clearly demonstrate that high throughput sequencing using a focused clinical exome is able to provide a rapid molecular diagnosis in patients with inherited platelet disorders even in the absence of detailed phenotypic data and we are now adopting this process which will significantly improve patient treatment and prognosis.

Charlotte Lee

After having completed the NHS Scientist Training programme, whilst based in the Immunology department at King's, Charlotte got herself a job in Cytogenetics at Guy's. During her training she rotated round lots of lovely departments, so she may have one of those familiar faces. At this time she also completed her MSc project, which was presented as a poster at IBMS Congress and now she looks forward to presenting it at the Excellence in Pathology Awards. The project looked at differences in particular subsets of cells within the immune system, comparing their numbers in healthy individuals alongside patients with a specific immunodeficiency called Common Variable Immunodeficiency.

Apart from being a self-confessed science nerd, she also ticks other nerdy boxes including board gaming. However, having recently moved into an old house, she now spends her spare time decorating and B&Q has become her second home! Any DIY tips are welcome.

Skewed T Follicular Helper Cell Subsets in Common Variable Immunodeficiency

Common variable immunodeficiency (CVID) is one of the most common, clinically significant primary immunodeficiencies. It is a heterogeneous collection of disorders characterised by impaired antibody secretion and is associated with varying morbidity and mortality, so there is a need to accurately stratify patients.

Given that T follicular helper cell (Tfh) subsets differentially influence isotype switching and antibody secretion, the aim of the present study was to determine whether Tfh subset defects were present in CVID, and whether such analysis could aid stratification.

Circulating Tfh subsets were compared between 31 healthy controls and 24 CVID patients, as well as between CVID EUROclass classifications, using a novel whole blood, 9 colour flow cytometric assay, utilising CXCR3, CCR6, PD1, and ICOS expression to define three subsets, Tfh1, Tfh2, and Tfh17, and their activation status.

Despite overall Tfh percentages being higher in CVID patients compared to healthy controls, the percentages and counts of the Tfh17 subset were significantly lower. There were significant positive correlations between switched memory B cell counts and Tfh17, which suggests interdependence of the two populations irrespective of the elevated total Tfh. Additionally, the percentage of PD1-ICOS+ Tfh1, and PD1+ICOS+ expressing Tfh, Tfh1 and Tfh2 were significantly higher in CVID patients compared to healthy controls. This suggests that preferential activation of these subsets, to the detriment of Tfh17, and imbalance between the Tfh subsets may compromise antibody secretion. This dysregulation is therefore a possible mechanism underlying defective immune responses and may serve as a useful biomarker for prognostic stratification in CVID.

Afternoon Session

Chair: Nick Parkin

CLINICAL SCIENTIST, VIAPATH

I studied human genetics at the University of Newcastle upon Tyne, graduating in 2007. From there I went straight onto my Clinical Scientist training in molecular genetics at the Wessex Regional Genetics Laboratory. I moved up to the Viapath South East Thames Regional Genetics laboratory in 2011 focussing on inherited rare disease, specifically Amyotrophic Lateral Sclerosis and neuromuscular conditions using next generation sequencing. Since 2016 I have been at the Viapath Molecular Pathology department based at Kings College Hospital focussing on inherited disorders of the red blood cell and inherited anaemia. The red cell next generation sequencing panel has been a remarkable success, not only providing diagnosis for our patients in south east London, but also across the UK, Ireland and internationally. As of Autumn 2017 I have just started my Higher Specialist Scientific Training towards becoming a consultant Clinical Scientist based at Manchester University.

Mahiben Maruthappu

BEN IS A LONDON-BASED DOCTOR AND CO-FOUNDER OF CERA, A MULTI-AWARD WINNING TECHNOLOGY COMPANY TRANSFORMING SOCIAL CARE.

He advised the CEO of NHS England on £100 billion of health spending, co-founding the NHS Innovation Accelerator (NIA) which benefitted 3 million people in its first six months.

He has a strong interest in research with over 100 peer-reviewed publications and 50 academic awards. Ben has advised a range of organisations, from startups to multilaterals, including the Swiss government, the Experiment Fund and the WHO. He is Chairman of the UK Medical Students' Association (UKMSA), and has authored three medical books.

Ben was educated at Oxford, Cambridge and Harvard universities. He was listed in WIRED's top 10 Innovators in Healthcare, ranked amongst the 100 most influential leaders in health technology globally, and was recently named Disruptive Leader of the Year.

Here, Dr Maruthappu explores the uses and opportunities for technology in healthcare. Touching on his own startup's efforts in this space, and experience as co-founder of NHS Innovation Accelerator; Ben explores the ways in which Technology can be used to better improve healthcare within the NHS.

Prof Owen J Guy

DIRECTOR OF THE CENTRE FOR NANOHEALTH IN THE COLLEGE OF ENGINEERING AT SWANSEA UNIVERSITY

Prof. Owen J Guy (OJG), is Director of the Centre for Nanohealth in the College of Engineering at Swansea University; a unique facility applying device fabrication & cleanroom semiconductor processing to healthcare problems in collaboration with industry. OJG is also head of the Systems Process & Engineering Centre (SPEC) one of 3 research centres within of Engineering. OJG's group has 14 years' experience in clean room device fabrication (silicon, graphene & MEMS technology). OJG has developed graphene and microfluidics technology through EPSRC and Innovate UK projects. Owen Currently leads EPSRC and Marie Curie sensor projects at Swansea – in collaboration with Plymouth University – and a Newton fund project developing sensors for hepatitis. OJG has PI grant income of more than £4 million. OJG has published 60 papers and holds 2 granted patents (WO2011004136 and P100072GB).

Graphene is a 2D material with unique electrical and mechanical properties. Graphene devices and sensors promise to be a disruptive technology in next generation electronics and sensors - due to graphene's exceptional electronic properties and aptitude for chemical modification. Novel graphene sensor technology used to develop sensors, based on chemically functionalised graphene microchannels, and their application in lab-on-chip POC (Point-of-Care) diagnostics will be presented. There are several advantages of graphene sensors over alternative sensor platforms such as carbon nanotubes (CNTs) or silicon nanowires (SiNWs). The main benefits of graphene for sensing applications will be highlighted in a comparison with other materials. Important considerations for processing of samples using microfluidics and lab-on-chip technology will be discussed.

Topic: Lab on chip graphene biosensors for rapid biomarker detection

Sub topics:

- Graphene device fabrication for biosensor platform.
- Chemical modification of graphene devices for biosensor applications using bioreceptors (antibodies, nucleic acid probes, enzymes).
- Integration of graphene sensor with microfluidics and packaging technology.

Dr Norman Taylor

CONSULTANT CLINICAL SCIENTIST, VIAPATH

Nothing prepared me for spending 46 years (so far) analysing steroids. Once I'd learned some biochemistry, they still seemed far too obscure and unimportant to pay much attention to. Going back a bit, I was born a year before the start of the NHS. I well recall my mother's passionate support of its principles and with gratitude the local GPs, who would consent to visit whenever one of us boys developed any kind of childhood illness. I grew up in rural Gloucestershire and loved nature in all its forms – birdwatching, fishing, growing things. Aged nine, I spent a week in hospital with appendicitis, returning home with a proud scar and a determination to become a doctor. Soon after, my best friend developed a sharp pain and after checking him and asking questions, pronounced that he had appendicitis, which he did, but my scar was neater than his. My A levels didn't get me into medical school, so I settled for applied biology. After an HND and 2 years of VSO in Africa I returned to find jobs suddenly scarce but landed one at St Thomas' Hospital as a technician tasked with analysing one steroid. After a year, I transferred to the newly opened Clinical Research Centre where Cedric Shackleton, just returned from a post-doc, had started a lab for multicomponent steroid analysis, being the first to use capillary column gas chromatography for this in the UK. He coined the term 'urine steroid profiling'. I have been practising it ever since.

The first known steroid was crystallised from human urine in 1929. Their hormonal effects on many body systems were soon unmasked. Treatment with synthetically produced steroids, starting in the 40s, revolutionised several areas of medicine, including suppression of the immune system, fertility and contraception. The first inborn error of steroid metabolism was characterised in the 50s. It was clear that methods were needed to measure natural steroids in body fluids in order to define disorders due to deficiency or excess and to discover the reasons. Steroid hormones in blood were the major target, but urinary metabolites proved to be very informative in providing a composite picture of steroid metabolism. This required methods to separate and detect them. My mentor, Cedric Shackleton, went through chromatography on paper, thin layer plates, and finally gas chromatography-mass spectrometry within a mere 4 years (1966-70). By the time I joined him in 1972, the techniques were all in place and have not changed in principle since. A service to provide steroid profiling on patients was never planned but simply grew from a creative interaction with clinicians and clinical biochemists. The organisation and ethos of the NHS has been critical to this: we have learned together in a free, non-hierarchical exchange that continues to this day, enabling new disorders to be uncovered and known ones to be more securely identified. Few countries in the World can match this. We now also have an accurate method for targeting multiple steroids in blood and so have to learn afresh..

Close

We would like to extend our sincere thanks to all the speakers, sponsors and those who attended this seventh Innovation Academy symposium and to the members of the wider team who have made this event possible.

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