A Centre for Infectious Diseases and Microbiology - Public Health (CIDM-PH), and

Marie Bashir Institute (MBI) publication

A special issue dedicated to Professor Lyn Gilbert who initiated the first BSP in 2004

The Broad Street Pump

Research Symposium and Festschrift in Honour of Professor Lyn Gilbert:

Advancing Control of Communicable Diseases through Innovation and Translational Research

Professor Tania Sorrell

MBI, University of Sydney

This festschrift celebrates 25 years of Lyn Gilbert's outstanding career at the Centre for Infectious Diseases Laboratory Services ICPMR, Westmead Hospital, Westmead Local Health District and the University of Sydney, interspersed with major roles in most of the communicable diseases & microbiology advisory committees at local, state and national levels. Lyn was recruited to Westmead in 1991, having already distinguished herself as Director of highly-regarded infectious diseases and microbiology services in which research informed by practice gaps was prominent, at the Royal Women's Hospital and then at Royal Children's Hospital in Melbourne.

Lyn's many research and other professional accomplishments and the high esteem in which she is widely held, both personally and professionally, will be highlighted at today's symposium.

Not that Lyn is retiring exactly! She will continue with active research projects, postgraduate teaching and, no doubt, expert advisory or consultancy roles. Furthermore, undertaking a PhD in Bioethics will compete with her grandchildren, family, friends, labradoodles and other hobbies, for her attention.

We wish Lyn well in her (non)-retirement and thank her for her leadership, humanity and wise counsel over the years.

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CONTACT US

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CIDM-PH

Centre for Infectious Diseases and Microbiology - Public Health
Mailing Address: PO Box 533
Wentworthville NSW 2145
Phone: (612) 9845 9870
Website: www.wslhd.health.nsw.gov.au/CIDM-PH
Email: WSLHD-CIDM-PH@health.nsw.gov.au

Contact: Ms Lou Orszulak

MBI

Marie Bashir Institute
Mailing Address: Level 4, Westmead Institute for Medical Research
176 Hawkesbury Road, Westmead NSW 2145
Phone: (612) 8627 3402
Website: www.sydney.edu.au/mbi/
Email: mbi@sydney.edu.au

Contact: Ms Christine Aitken

Celebrating the career of Professor Lyn Gilbert

Professor Lyn Gilbert was Director of laboratory services at the Centre for Infectious Diseases and Microbiology (CIDM), Institute of Clinical Pathology and Medical Research (ICPMR) at Westmead Hospital, from 1991 until 2010. Under her leadership the CIDMLS has become one of the largest integrated clinical and public health microbiology service providers in the country with strong emphasis on innovation and translational research. Public health and infection control have been major interests of Professor Gilbert and she has played a major role in strengthening the control of communicable diseases in NSW and nationally. In 1997 she contributed to a successful tender, by colleagues at Children's Hospital Westmead, to host the National Centre for Immunisation Research and Surveillance (NCIRS). Since then Professor Gilbert was responsible for the NCIRS' national serosurveillance program. She was instrumental in establishing the national Public Health Laboratory Network and served as its first chair between 1997 and 2001. In 2003 Professor Gilbert established the CIDM-Public Health and successfully led this translational research arm of the CIDMLS for more than a decade with support from NSW Health Capacity Building Infrastructure Grants, which provided salaries or stipends for support staff, postdoctoral fellows and postgraduate students. Throughout her career, Professor Gilbert has been focused on fostering links with other pathology service providers around the country as well as on building multi-disciplinary partnerships with academia.

Professor Gilbert has been a chief investigator on numerous NHMRC and ARC grants, including three Centres for Research Excellence. Professor Gilbert has published more than 300 papers in refereed journals, authored numerous invited reviews and book chapters and been contributing editor or sole author of 6 books on infectious diseases and/or clinical microbiology. Her research has focussed on the clinical and molecular epidemiology, rapid diagnosis, prevention and control of infectious diseases of public health importance, including: infections in pregnancy and the newborn infant; vaccine preventable diseases; enteric and respiratory infections; and healthcare-associated infections. Her group has developed novel strain typing methods for a number of bacterial pathogens, including group B streptococcus, Salmonella, *Streptococcus pneumoniae* and MRSA, with the aims of improving surveillance, outbreak investigation and control of infections in the community and hospital and monitoring the effects of preventive interventions. This microbiological research has been combined with development, by others in the group, with development of informatics tools to manage and analyse data, monitor spatio-temporal distribution of infections and provide information for clinical and public health action. The translation of the results of this research has been aided by her own and other group members' membership in many State and Commonwealth expert panels and advisory groups, over the past 15 years. More recently Professor Gilbert's research has included investigation of the ethical and political implications of and barriers to healthcare-associated infection prevention and control.

Lyn has been a mentor for several generations of microbiology registrars and infectious disease trainees at Westmead and supervised many PhD and Masters in Science candidates, achieving 100% completion rate. Lyn has fostered a strong collaboration with the Centre for Health Informatics, University of New South Wales, to establish expertise in infectious disease informatics at CIDM-Public Health. She completed a Master of Bioethics degree, in 2003, and has established collaborations with the Centre for Values Ethics and the Law in Medicine, the University of Sydney.

After stepping done from her role as Director of CIDMLS and CIDM-Public Health, Professor Gilbert has continued to serve Westmead Hospital and our community as an infectious disease physician and clinical microbiologist. Since 2010, she has been Director/ Clinical Lead in Infection Prevention and Control for Western Sydney Local Health District. Professor Gilbert has been one of the senior fellows and strong supporters of recently established Marie Bashir Institute for Infectious Diseases and Biosecurity.

Antimicrobial resistance: the need for an international and a one health approach

Professor Chris Baggoley - Commonwealth Department of Health

This presentation will focus on national and international understandings of, and responses to, antimicrobial resistance.

Australia is taking a strong One Health approach to AMR, building on past initiatives which include JETACAR, EAGAR, the Australian Commission on Safety and Quality Healthcare Associated Infections Program, and its National Safety and Quality Health Service Standards. The Australian AMR Prevention and Containment Steering Group comprises the Secretaries of the Departments of Health and of Agriculture and Water Resources as well as the Chief Veterinary Officer and the Chief Medical Officer.

This Steering Group is formed and supported by the Australian Scientific and Technical Advisory Group which includes representatives from animal health, agriculture and food, human health who have clinical, research, regulatory, policy, industry or organisational roles.

Australia's first National Antimicrobial Resistance Strategy was launched by Ministers Joyce and Ley in June 2015 with objectives in seven key areas. They are surveillance, antimicrobial stewardship, infection prevention and control, communication and education, research and development, international partnerships and governance.

Examples of key activities will be provided for each of these seven objectives.

Infectious diseases in Australia-Fairfield Hospitals role

Professor Ian Gust - The University of Melbourne

From 1904 to 1996 when it closed, Fairfield Hospital Melbourne occupied a unique role in infectious diseases in Australia, training many of its most distinguished practitioners, serving as a centre for teaching and research and linking to global efforts to control a number of vaccine preventable diseases. Ian Gust who worked there for 25 years will reflect on its legacy.

Practice and politics of communicable disease control

Dr Jeremy McAnulty - NSW Health Protection

Communicable disease risks have changed substantially over the last two and a half decades in NSW. In 1992, hepatitis A (899 case notifications), legionaries disease (103), Hib (217), measles (804), meningococcal disease (120), salmonellosis (751), pertussis (217), gonorrhoea (491) and HIV infection (678) were significant threats. In 1995, only 54% of children 3 months to 6 years were estimated to be fully immunised.

In the early 1990s NSW Health established a new system for the surveillance and control of communicable diseases, including public health units (PHUs) in each local area, laboratory notification of infectious diseases, a public health training program that assisted in outbreak investigations, and the use of expert panels.

Through the 1990s large outbreaks of measles, pertussis, hepatitis A, cryptosporidiosis and legionnaires disease were regularly reported, and PHUs were often called upon to provide preventive antibiotics and information to contacts in child care centres to control Hib and meningococcal disease.

As 2000 approached, improved surveillance and investigation tools lead to the detection and investigation of major outbreaks and threats, including legionnaires disease linked to cooling towers, hepatitis A linked to oysters, cryptosporidiosisis linked to swimming pools and contamination of Sydney drinking water with C*ryptosporidium*. These investigations required close partnerships between epidemiologists, microbiologists, clinicians and environmental experts to successfully understand and develop control measures. Through the 2000s, NSW Health continued to develop early detection and response systems to control risks associated with the Olympics, the Rugby World Cup and World Youth Day, resulting in better tools to track and control diseases in the wider community.

The successful partnerships forged during these events, the prevention programs they spawned (related to shellfish safety, drinking water quality, swimming pool management and legionella control) along with new immunisations and laboratory technologies, and government investment in communication, immunisation, food safety, and HIV prevention programs have led to important public health gains in NSW.

As a result, despite better surveillance, by 2015 just 68 cases of hepatitis A, 96 cases of legionaries disease, 5 cases of Hib, 9 cases of measles, 45 cases of meningococcal disease and 346 cases of HIV infection were notified in NSW. Vaccines now protect 92% of 1 year old children, and protect them against a much wider range of diseases, and vaccines are routinely given to pregnant women to protect their babies from pertussis and influenza.

Yet much remains to be done. There have been big increases in notifications of pertussis (to 12237 in 2015), gonorrhoea (5445) and salmonellosis (4060) and although much of this may relate to more sensitive diagnostic tests, these diseases remain rife. Threats continue to emerged, most recently pandemic influenza, SARS, MERS, ebola and zika virus. As the threats evolve, our public health, diagnostic and clinical approaches must adapt and our partnerships remain robust.

Throughout the past 2 and half decades, Lyn Gilbert has been integral in understanding and responding to communicable disease threats, and in building the public health/laboratory/clinical partnership in NSW.

Childcare centre infections

Professor Dennis Clements - Global Health Institute, Duke University, USA

Day care (crèche) has become a requirement for many families to survive - for personal growth or for financial survival. Typically this means environments where children are in close contact and hence at increased risk of sharing infections. From 6-30 months of age in particular, children's naïve immune systems make them susceptible to acquire virtually every new virus to which they are exposed. This was the situation in 1989 in Melbourne when we launched a study to understand how *Haemophilus influenzae* type b (HIB) came to devastate so many young children.

In previous work in Chapel Hill, NC we had shown that we could culture a new virus from an individual day care child every 3 weeks. In addition, when children acquired a new virus some old viruses were reactivated (Herpes Simplex, CMV). Because these children live in close proximity and day care is a perfect example of clustering susceptibles – infections run rampant through the classrooms. In fact, in the United States it was common that once varicella appeared in a day care the usual age barriers were eliminated and a room was designated for children with chickenpox. This allowed the children and parents to continue their normal day.

Other groundbreaking work has shown that if a marked virus is placed on a toy in a day care room of toddlers in the morning, the marker can be detected on 80-100% of the children by the end of the day and 33-50% of the parents by the next morning. Obviously transmission can be extremely rapid. Additionally, the marked viral antigen could be detected for up to 2 weeks in the day care setting.

This repeated acquisition of infections in day care may not allow a child's physiology to return to a steady state so that some children appear to be prone to chronic infections such as otitis media. And the frequency of illness and possible secondary bacterial complications (pneumonia, sinusitis, cellulitis) make these children much more likely to have had antibiotic treatment which contributes to the appearance of antibiotic resistant organisms.

This was the setting for our case-control study looking at risk factors for acquisition of *Haemophilus Infleunzae* type b meningitis and epiglottitis. 210 cases of HIB disease were documented during the study. Of 580 cases and controls only 3 refused to participate in the study. The cases of meningitis mirrored the ethnic background of the population but the cases of epiglottitis were almost entirely in children whose parents were from Northern Europe (save one). The estimated incidence of meningitis for children less than 5 years of age was 23.5/100,000 and for epiglottitis was 20.1/100,000.

We discovered that the most significant associations for acquisition of disease related to day care attendance (OR 8.26), the presence of a sibling less than 6 years of age in the home (OR 3.21), the presence of an ill sibling (OR 2.27), and for epiglottitis (the birthplace of the mother (OR 2.72).

Thus, day care was shown to be a risk factor for *Haemophilus infleunzae* type b disease.

Key legacies of Lyn Gilbert to VPD surveillance - the National Serosurveillance Program and enhanced pneumococcal surveillance

Professor Peter McIntyre - National Centre for Immunisation Research and Surveillance of Vaccine-Preventable Diseases

Australia's laboratory capacity to monitor gaps in population immunity and the impact of vaccine programs has been greatly enhanced over the past 20 years by two key initiatives – establishment of a national serosurveillance program and capacity for serotyping of pneumococci. The national serosurveillance program, the fourth round of which was completed in 2012-13, was the brainchild of Margaret Burgess and funded under the successful 1997 bid for a National Centre. Lyn Gilbert was the senior applicant with Margaret, and steered the challenging process of engaging with scores of public and private sector laboratories around Australia, which were asked to supply residual sera submitted for routine diagnostic tests by age and gender. The process had to be rapid, because the Measles Control Campaign (MCC) was conducted in 1998, and demonstration of changes in age-specific immunity to measles and rubella was a key component of evaluating its early success. The MCC was one of the largest immunisation campaigns ever conducted in Australia, including all primary schools, and the serosurvey was able to show that the "immunity gap" had been closed, providing important evidence for the later declaration of the elimination of indigenous transmission of measles and rubella in Australia. In addition to measles and rubella, over 3 rounds of the serosurveillance program, a wide range of current and potentially vaccine-preventable diseases have been studied including diphtheria, tetanus, polio, mumps, varicella, Hepatitis A, Hepatitis B, pertussis, meningococcus type C, HPV, helicobacter and CMV. These data have contributed to modelling of likely future patterns of disease outbreaks and in the case of tetanus provide good estimates of immunisation coverage in adults, as the only way to acquire protective levels of tetanus antibody is through receipt of 3 or more vaccine doses - there is no natural immunity. The existence of a national level serum bank is also a valuable resource which may be needed to track future outbreaks, with the recent emergence of Zika virus just the latest example.

The establishment of comprehensive laboratory capacity for characterisation of pneumococci causing invasive disease is the other key surveillance initiative relevant to VPDs which Lyn was responsible for. Initially started as part of an NHMRC grant, and subsequently government-funded in the lead up to pneumococcal conjugate vaccines being included on the National Immunisation Program in 2005, Lyn has led a range of new developments including the first availability of molecular methods for serotyping of pneumococci from mucosal as well as sterile sites. Together with reference laboratories in Queensland and Victoria, this capacity has meant that Australia is a world leader with the US and the UK in the longevity and comprehensiveness of pneumococcal surveillance, which has had an important impact on the development of vaccine programs worldwide.

Infectious diseases in women's and babies' health: with an emphasis on HPV vaccination

Professor Suzanne Garland - Royal Women's Hospital, Melbourne

Firstly, paying tribute to Professor Lyn Gilbert and taking a trip down memory lane, Lyn introduced me to ID in women's and babies' health and as her first registrar in 1979 at the Royal Women's Hospital (RWH), Melbourne. We were challenged with an increase in early onset Group B streptococcus (EOGBS) sepsis of 3.2/1000 births and 40% mortality. We described the epidemiology of GBS in obstetrics/neonatology and developed strategies to prevent EOGBS, including screening and intrapartum chemoprophylaxis for carrier mothers. This resulted in a reduction to 0.25/1000 and mortality rate of 10% by 2002. (Nationwide today 0.38/1000.) Whilst Phase II clinical trials of GBS vaccines have occurred, we still await these in use in obstetrics to replace the extensive use of penicillin chemoprophylaxis to prevent EOGBS.

Secondly, having returned from working in the UK Public Health Laboratory Service, plus with Prof Edward Kass's team at the Channing Laboratories Harvard University, I returned to the RWH with Lyn again in 1983- 84, looking at genital mycoplasmas and bacterial vaginosis [BV] in adverse pregnancy outcomes. Work in this area has continued here at RWH utilizing molecular diagnostics for BV and for *Mycoplasma genitalium* (MG), which has helped define the epidemiology of MG and BV, plus development of rapid assays for resistance markers to appropriately direct antimicrobial treatment.

Thirdly, Lyn's interest in sexual health was another gain for me. Applying clinical expertise (following in Lyn's footsteps working as a Sexual Health Physician at Melbourne Sexual Health Centre) and applying molecular biology techniques I gained at Harvard, I set up a molecular laboratory in the mid 1980's where my team showed the success of self-collected genital sampling utilising PCR for defining the prevalence of various STIs.

Moving forward, our group performed the world's largest case-control study of probiotics to preterm infants showing an absolute reduction of 54% for necrotising enterocolitis: this has translated to routine use of probiotics in NICUs.

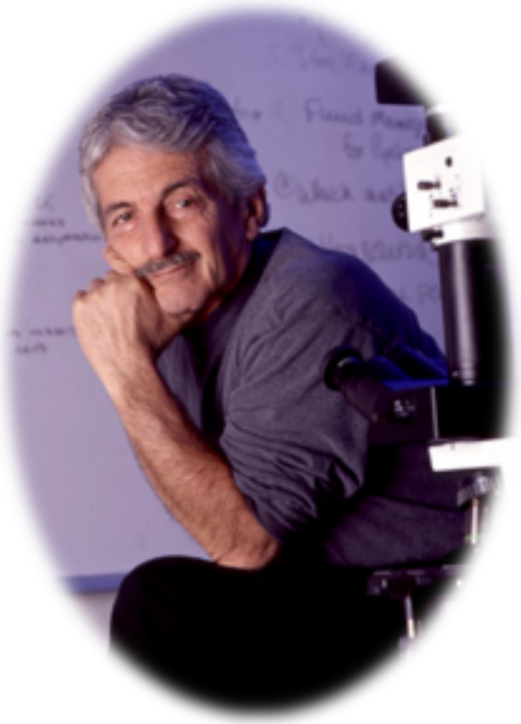
More recently, our team has used information technology innovations to improve young women's health through YFHI (Young Female Health Initiative), a project studying Victorian women 16-25 years of age, tracking lifestyle behaviour, reproductive, physical and mental health to give new insights into health patterns and development of education/intervention tools to improve their health and wellbeing.

Large phase 3 trials for HPV vaccines have shown efficacy, immunogenicity and safety in young women and males 16-26 years. In Australia 2007, a comprehensive public health program (school-based, government-funded) has achieved high coverage and vaccine effectiveness is already being seen for vaccine related infections (~80%), genital warts (90%), and HSIL (47%). Globally however, < 2% of the eligible female population is vaccinated. So, there is a big job ahead in translating these findings and implementing vaccination strategies. Yet this has happened in a relatively short time and considering where my career started with GBS, we still await results from Phase III clinical GBS vaccine trials and implementation as a public health

Novel approaches to the treatment/prevention of *Clostridium difficile* disease

Professor Saul Tzipori - Tufts University, Boston, USA

The presentation will include a brief description of the pathogen and the disease attributed to *Clostridium difficile* infection (CDI), and the therapeutic and control measures currently available to clinicians. The development of vaccines against the hypervirulent strains of *C. diffcile* will be discussed with a focus on the genetic modifications and fusion of the recombinant mutants of the two major toxins, TcdA and TcdB. The protective efficacy of these constructs as potential vaccine candidates, was demonstrated in animal models. The second half of the presentation will focus on the development of immune-based therapy using VHH, a single-domain antibody derived from Camelid which possesses the heavy-chain only. Alpacas were immunized with TcdA and TcdB, and RNA encoding the VHH antibody repertoire was obtained and expressed on phage, and clones that display toxin-binding VHHs were selected. Effective protection against CDI was demonstrated in mice and piglets with mRNA expressed in plasmid or in adenovirus vector. Some significant properties of VHHs which are small proteins (14KDa), include: easy to clone coding DNA with a single domain, functionally express at high levels, are more stable to extreme pHs and temperature, commonly bind conformational epitopes. They can be linked to form a multi-specific proteins that are able to neutralize two or more different toxins/antigens, and are reproducibly possess excellent in vivo antitoxin potencies. They achieve an enhanced serum life by including an albumin binding peptide, and able to promote Ab effector functions by the addition of anti-tag mAb. Finally, the outcome of a recent phase III clinical trial in humans with CDI, treated with TcdA and TcdB human monoclonal antibody (Merck Pharmaceutical), will be compared with observations made in the piglet diarrhea model of CDI.



Infectious disease informatics

A/Professor Vitali Sintchenko - Centre for Infectious Diseases and Microbiology - Public Health, WSLHD and Marie Bashir Institute, The University of Sydney

Professor Lyn Gilbert has been one of the strongest advocates for exploring informatics approaches to control communicable diseases and for building informatics capacity at Westmead. Infectious disease informatics has been defined as a new field that studies knowledge creation, sharing, modeling and management in the domain of infectious diseases. Its emergence has been fueled by rapid increases in the amount of biomedical and clinical data and demands for data analyses. The resulting combinations of experimental and informatics evidence have reshaped the ways of conducting infectious disease research, raising the expectation of better control of infectious diseases. This presentation argues that informatics has not only changed the scale on which the infectious disease research has been done but has also opened new and conceptually different ways to manage individual and population health and to make discoveries in the field of infectious diseases.

Infectious disease informatics has rested on advances in microbial genomics, proteomics and metagenomics. Large-scale sequencing provides new types of data reflecting global genome architecture and the properties of pathogens. Comparative genomics has challenged the traditional view that bacterial genomes never contain 'junk' DNA and that every gene in a bacterial genome must have a function. Instead, we now see every genome as a work in progress, burdened with some non-functional 'baggage of history'.

Informatics has been instrumental in the change from a static to a dynamic view of the microbial world. Informatics methods have become critical for data mining to uncover links between genetic variation and disease pathogenesis in order to define markers of disease progression, to guide the optimum use of therapeutics and to refine the drug and vaccine development. The comparison of chromosomal sequences allowed the identification of unique genomic signatures of pathogens for the purposes of infection control and 'microbial forensics'. Bioinformatics-assisted biosurveillance addresses the inefficiencies in traditional surveillance as well as the need for more timely and comprehensive infectious disease monitoring and control. Informatics approaches when combined with genome-scale phylogenetic analyses offer radically new insights into disease spread and transmission. These insights include elucidation of the mechanisms of cross-species transmission, the potential modes of pathogen transmission, and which individuals in the population contribute most to transmission (i.e. "super-spreaders"). Genomic surveillance should be seen as a new paradigm of practice that can identify determinants of transmission, monitor pathogen adaptation and evolution, ensure the accurate and timely diagnosis of infections with epidemic potential, and refine strategies for their control.

Building research bridges between Australia and China

Dr Fanrong Kong - ICPMR, Pathology West

After graduating from the Beijing Medical University 1991 and receiving my MMed degree in 1994 at the First Teaching Hospital of Beijing Medical University, I was trained as a dermatologist and sexual health physician under supervision of Professor Xue-Jun Zhu. I came to Sydney in late 1998, to pursue my dream to gain new skills in molecular diagnostics of sexually transmitted diseases. I was fortunate to meet Professor Lyn Gilbert and Professor Tania Sorrell who have invited me to join their research groups. Subsequently, Professor Gilbert has become the supervisor of my PhD and, after successful completion of my PhD, offered me the opportunity to become a senior scientific officer at CIDM.

Professor Gilbert has encouraged me to develop further the historical good relationships with clinicians and researchers from China and the CIDM, under her leadership, hosted several visits high level Chinese delegations, including one that included a previous Vice-Minister of Ministry of Health of China, Mr Feng-Lo Zhang and also Professor Qian Liu who later was appointed as Vice-Minister of Ministry of Health. From Chinese political view point, the level of delegates reflects their appreciation of the CIDMLS's important position in the eyes of Chinese clinicians and public health officials. During those visits, both sides acknowledged that high level collaboration between Australia and China should be of mutual fruitful benefit. As an invited speaker to several national conferences in China, Professor Gilbert had shared her life-long experience in infectious diseases and infection control. For her significant contributions, she earned great respect in China. Professor Gilbert also visited China several times to build up and cement the relationship with collaborating institutions, including Peking Union Hospital, Peking University First Hospital, Wuhan First Hospital, Beijing Children's Hospital, Shenzhen Chronic Disease Hospital and Shenzhen CDC, Nankai University & Tianjin Biochip Corporation. Professor Gilbert has also supervised sabbatical visits to CIDMLS of over 28 Chinese physicians and scientists, which led to over 80 joint publications in international peer-reviewed journals. Professor Gilbert's groundwork has also prepared the way for future collaboration between Australia and China. For example, Mr. Meng Xiao (visited CIDMLS five times) and Professor Yingchun Xu from Peking Union Hospital have built a productive partnership with CIDMLS led by Professor Gilbert initially and later on with the current CIDMLS director Professor Sharon Chen. I hope Professor Gilbert will find time to visit China again and to continue sharing her knowledge and wisdom with Chinese clinicians and researchers.

Tracking hospital MRSA pathways

Dr Matthew O'Sullivan - Centre for Infectious Diseases and Microbiology , WSLHD and NSW Health Pathology

In 2006, Lyn decided to "do something about MRSA", which had been a major scourge on the hospital system since its emergence in the 1960s, Westmead Hospital being no exception. I was recruited to undertake a PhD project to develop a rapid, high-throughput, inexpensive and highly discriminatory MRSA strain typing system. The resulting method utilised the multiplex-PCR reverse line blot platform (mPCR/RLB) which had been used effectively by many members of Lyn's research group in other contexts.

This system was successfully implemented, and it was shown that utilised prospectively, typing-based surveillance can strengthen infection prevention and control programs, in work that has since been expanded to other hospitals across NSW. At the same time, the method has been used to comprehensively describe the statewide molecular epidemiology of MRSA clones, and next generation sequencing technology has been utilised to dissect transmission pathways of selected outbreaks identified by mPCR/RLB typing.

While surveillance and prevention efforts have focussed on MRSA (the rates of which appear to be in decline), methicillin-susceptible *S. aureus* (MSSA) has always caused more infections than MRSA. In the latest phase of our research, we are applying the same principles to identify evidence of transmission of nosocomial strains of MSSA, and to evaluate preventative strategies.

Part of the effectiveness of strain typing is to feedback information about cases of nosocomial transmission to the ward staff to enable them to reflect on the potential lapses in infection prevention that may have allowed these events to occur. This sample principle of real-time surveillance and feedback was applied by Lyn to the problem of hospital-onset *Staphylococcus aureus* bloodstream infections (SABSIs). In this initiative, each SABSI case is reviewed, preventable factors identified, and detailed in a letter which is delivered to the responsible consultant and nurse unit manager and displayed prominently in the patient notes. Implementation of this system in August 2008 was associated with a substantial and sustained decrease in the rates of SABSIs across the Western Sydney Local Health District.

Control of communicable disease in Australia: Reflections

Professor Lyn Gilbert - Centre for Infectious Diseases and Microbiology, WSLHD and Marie Bashir Institute, VELiM, University of Sydney

In the 1960s there was a widespread perception, in many western countries including Australia, that vaccines and antibiotics had put paid to infectious diseases. While there had been a dramatic fall in infectious disease illness and death, this optimism soon proved to be tragically misguided: high rates of preventable infectious disease continue in most of the developing world and "new" infectious diseases affecting humans emerged, one after another, often driven by human behavioral or man-made environmental changes or revealed by advances in research and technology. There has been enormous progress in understanding of the causes, zoonotic origins, transmission pathways, epidemiology and pathogenesis, and the ecological, socioeconomic and political factors that drive emergence of infection diseases and new drugs and vaccines have been developed to prevent or treat many of them. At the same time, some previously well-controlled diseases have re-emerged because of antimicrobial resistance or failure of control programs.

Australian scientists have made major contributions to discovery of new pathogens or disease manifestations (e.g. *Coxiella burnetii*; parvovirus B19, congenital rubella, rotavirus, *Helicobacter pylori* and locally enzoonotic viruses affecting humans) and development of new vaccines (e.g. against Q fever, human papilloma virus) and antimicrobials (e.g. zanamivir [Relenza]). Australian governments and health policy makers have introduced a number of progressive control programs that mean that the rates of many infectious diseases in Australia are low by global standards (e.g. most vaccine-preventable diseases; HIV infection particularly among IV drug users; tuberculosis [TB], especially multi-drug resistant TB; *Clostridium difficile* 027 infections). However there are still many challenges including relatively high rates of: sexually transmissible infections, TB and many childhood infections in Indigenous communities; antibiotic consumption in hospitals and the community; and foodborne diseases.

There are confusing inter-jurisdictional differences in routine communicable diseases surveillance and control, communication and information systems, inter-agency co-ordination and implementation of national communicable disease control guidelines, despite effective national disease control networks and centres and specialist disease or disease group-specific expert advisory committees. The consistency, effectiveness and co-ordination of communicable disease control programs vary between States and Territories, in part because they are often of low priority and funding is fragile or inconsistent - at least until there is looming threat. Nevertheless, there have been steady improvements and new initiatives, which, despite their limitations and apparent inefficiencies, have kept Australia's communicable disease rates among the lowest in the world.