The Future of Pathogen Genomics in Public Health

ICEID Advanced Molecular Detection Pre-Conference Symposium
Sunday, August 26, 2018
Omni Atlanta Hotel at CNN Center

Association of Public Health Laboratories (APHL)
Office of Advanced Molecular Detection (OAMD), NCEZID, CDC
# The Future of Pathogen Genomics in Public Health

**Sunday, August 26, 2018**
**8:30 am – 4:00 pm**

## AGENDA

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<tr>
<th>Time</th>
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| 8:30 am | Welcome | Introduction to Next Generation Sequencing (NGS) and Its Application of the Technology in Public Health | Christin Hanigan, APHL
          |                                                 | Duncan MacCannell, CDC                                                                                                                                       |
| 9:00 am | Preparing for a Post-Culture Future: Global Implementation of NGS for Surveillance and Diagnosis of Drug Resistant Tuberculosis | Lauren Turner, VA DCLS
          |                                                 | Tim Rodwell, FIND                                                                                                                                          |
| 9:30 am | Genomics: At the Forefront of Influenza Vaccines                                             | Rebecca Gartner, CDC                                                                                                                                         |
| 10:00 am | Break                                                                                       |                                                                                                                                                |
| 10:30 am | Foodborne Disease Surveillance, Outbreak Detection and Response in the Genomics Era: Promise and Practice | Heather Carleton, CDC
          |                                                 | Celine Nadon, PHAC (Canada)                                                                                                                                     |
| 11:10 am | The Global Microbial Identifier: Promoting Open DNA Sequence Data Sharing                   | Joergen Schlundt, Global Microbial Identifier                                                                                                                   |
| 11:40 am | Keeping Your Head in the Cloud and Your Feet on the Ground: Developing Bioinformatics Capacity for Public Health | Joel Sevinsky, Colorado PHL                                                                                                                                     |
| 12:10 pm | Lunch                                                                                        |                                                                                                                                                |

**1:10 pm** Current and Future Applications of Next Generation Sequencing for Understanding Antimicrobial Resistance
Moderator: Alison Halpin-Laufer, CDC
Amy Mathers, University of Virginia

**1:40 pm** Outbreaks Ignite!
Four 5-minute presentations in Ignite! format, followed by Q&A
Moderator: Christin Hanigan, APHL
- Ebola: Lauren Cowley, Harvard University
- Seoul Virus in Pet Rats: John Klena, CDC
- HCV Outbreak: Marty Soehnlen, Michigan PHL
- Legionella: Dave Boxrud, Minnesota PHL

**2:10 pm** Break

**2:40 pm** Panel: Approaches to Introducing Sequencing: Challenges, Priorities and More
Moderators: Jill Taylor, Wadsworth Center
Derrick Crook, University of Oxford
Panelists: Greg Armstrong, CDC (US)
Enrique Pérez Gutiérrez (PAHO)
Mark Struelens, European CDC
Celine Nadon, PHAC (Canada)

**3:40 pm** Concluding Remarks
Jill Taylor, Wadsworth Center
Derrick Crook, University of Oxford

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**Lunch:** Roche, illumina

**Coffee Breaks:** ARC BIO
Moderators

Heather Carleton
Microbiologist, Enteric Diseases Laboratory Branch
Centers for Disease Control and Prevention

Christin Hanigan
Senior Specialist, Advanced Molecular Detection
Association of Public Health Laboratories

Alison Laufer-Halpin
Epidemiologist, Division of Healthcare Quality Promotion
Centers for Disease Control and Prevention

Lauren Turner
Foodborne and Advanced Pathogen Characterization Lead Scientist
Department of General Services, Virginia Division of Consolidated Laboratory Services

Speakers

Greg Armstrong
Program Director, Office of Advanced Molecular Detection
Centers for Disease Control and Prevention

Gregory Armstrong, MD, lead’s CDC’s Advanced Molecular Detection (AMD) initiative, a $30m-per-year innovation and modernization program established in 2014 to bring next-generation genomic sequencing, bioinformatics, and related technology into public health in the United States. An infectious diseases physician by background, he has particular expertise in the epidemiology of viral infectious diseases and in mathematical modeling of disease incidence and burden. Since joining CDC in 1997, he has worked in the fields of viral hepatitis and refugee health, served as chief of CDC’s viral vaccine-preventable diseases epidemiology branch, and led CDC’s component of the Global Polio Eradication Initiative during a critical intensification of the program from 2012 through 2015.

Dave Boxrud
Enterics Unit Supervisor, Infectious Disease Laboratory
Minnesota Department of Health

Dave Boxrud is the Enterics Unit Supervisor for the Infectious Disease Laboratory at the Minnesota Department of Health Public Health Laboratory. Dave has been active in foodborne disease surveillance since 1992 and has participated in many local and national outbreaks. Dave has been involved with the adoption of new technologies to identify better methods to characterize pathogens. Dave is the current co-chair of the Association of Public Health Laboratories Food Safety Committee. Dave has been involved with whole genome sequencing and other advanced molecular technologies for many years.

Lauren Cowley
Postdoctoral Research Fellow
Harvard T.H. Chan School of Public Health

Lauren Cowley is a postdoctoral research fellow at the Harvard T.H. Chan School of Public Health. She is working with Bill Hanage in the Department on Epidemiology. Lauren was previously at Public Health England (PHE) where she was based from 2012–2016 while she completed her PhD. While at PHE, Lauren became involved in the implementation of the routine use of whole genome sequencing in the surveillance and investigation of gastrointestinal bacteria in the UK by working as a bioinformatician in Tim Dallman’s group that used genomic epidemiology to monitor gastrointestinal bacteria in the UK. During her time at PHE, Lauren also became involved in the UK response to the Ebola epidemic and travelled to west Africa twice to volunteer in both the diagnostic labs and the mobile sequencing lab. At the mobile sequencing lab, Lauren first discovered her love of nanopore sequencing technologies and was able to provide real time sequencing results to epidemiologists working in the field to track the transmission of Ebola throughout Guinea.

At Harvard, Lauren has been using bioinformatics to investigate the success of certain population groups of Streptococcus pneumoniae within the context of several publicly available and CDC funded datasets. She has been using sequencing data to investigate virulence in the pneumococcus using GWAS techniques. Lauren is also a keen user of twitter for science communication and can be found at the handle @laurencowley4.

As of September 2018, Lauren will become prize fellow of Bioinformatics at the University of Bath in the UK.

David Crook
Director, National Infection Service, Public Health England
Professor of Microbiology, Nuffield Department of Medicine, University of Oxford

He studied Medicine at the University of Witwatersrand, Johannesburg, South Africa; obtained the Diploma of Tropical Medicine (London), specialised in internal medicine at the University of Virginia, Charlottesville, VA and completed a fellowship in infectious diseases at the Tufts New England Medical Center, Boston, MA. He obtained his boards in both internal
medicine and infectious diseases. He trained in clinical microbiology at the John Radcliffe Hospital Oxford and obtained both his FRCP and FRCPath. He is a practicing clinical microbiologist and infectious diseases physician at the Oxford University Hospitals NHS Trust.

He is the Director of the National Infection Service, Public Health England and oversees communicable disease control for England, UK. He is also co-director of the Oxford Biomedical Research, Infection Theme, and leads a large research consortium, Modernising Medical Microbiology, which focuses on translating whole pathogen sequencing into routine practice. He is the principle investigator of a large 15-country international research programme, CRyPTIC, which aims to comprehensively describe the genomic variation that confers antituberculosis drug resistance.

**Rebecca Gartner**  
**Research Microbiologist, Virology, Surveillance and Diagnosis Branch**  
**Influenza Division, Centers for Disease Control and Prevention**

Rebecca J Garten, PhD, is the lead of the Genomics Analysis Activity within the Virology, Surveillance and Diagnosis Branch of the CDC Influenza Division. She completed her Doctor of Philosophy degree in Molecular Microbiology and Immunology studying the genotype diversity of Hepatitis C viruses in injection drug users from Southern China at the Johns Hopkins Bloomberg School of Public Health. She completed an APHL/EID postdoctoral fellowship studying influenza A(H5N1) genotype diversity with the then Influenza Branch at CDC. She has been studying the genomic evolution of seasonal influenza viruses for the Influenza Division since 2007. Her research interests are genomic evolution of seasonal influenza viruses as it relates to public health areas of vaccine composition, antigenicity, antiviral susceptibility, host-specificity, pathogenicity and diagnostics using a multidisciplinary approach of genetics, bioinformatics, virology, molecular biology and epidemiology.

**Enrique Pérez Gutiérrez**  
**Unit Chief, Department of Health Emergencies**  
**Pan American Health Organization**

Dr. Perez received his DMV from the National University in Costa Rica in 1981, a MPVM from The University of California in 1991, Davis and a PhD in Epidemiology from the University of Utrecht in the Netherlands in 1994. Since 2001, he works with the Pan American Health Organization, the Regional office for WHO for the Americas. He is the Unit Chief, Health Emergency Information & Risk Assessment, in the Department of Health Emergencies responsible for providing coordination in tracking, analyzing and reporting information on all health hazards. Lead the teams responsible for risk assessment of all acute public health events including outbreaks, and contribute to global intelligence and risk assessment for response.

**Christin Hanigan**  
**Senior Specialist, Advanced Molecular Detection**  
**Association of Public Health Laboratories**

Dr. Christin Hanigan is Sr. Specialist for Advanced Molecular Detection at APHL. She oversees the overarching programmatic aspects to the implementation and use of next generation sequencing (NGS) in public health laboratories. She is the staff liaison for the NGS subcommittee and on the steering committee for the state public health bioinformatics working group (StaPH B). Dr. Hanigan received her bachelors of science in biochemistry and math from Seton Hill University in Greensburg, PA and her Ph.D. from Johns Hopkins School of Medicine in Cellular and Molecular medicine, focusing on cancer epigenetics. Her post-doctoral fellowship was also at Johns Hopkins and looked at whole epigenome and transcriptome changes related to the loss a histone demethylase.

**John Klena**  
**Microbiologist, Viral Special Pathogens Branch**  
**Centers for Disease Control and Prevention**

Dr. John Klena is the Team Lead for Viral Hemorrhagic Fever (VHF) Core Diagnostics and Research and Development. In this capacity, he provides direction and organizes daily laboratory activities for a team of nine scientists. The team develops short- and long-term strategies and interventions for laboratory capacity building for detection, containment and control of VHF agents domestically and overseas, and leads the performance and reporting of reference diagnostic assays for VHF viruses circulating in the United States. Dr. Klena is recognized within and outside CDC as a laboratory expert and represents Viral Special Pathogens Branch during inter-agency US government meetings. Previously, John was the Senior Laboratory Team Lead for CDC in Beijing, China where he directed and organized daily laboratory coordination activities with China CDC and other Chinese governmental agencies, represented CDC as a laboratory expert and participated in programs designed to improve the quality of laboratory data used for public health decision-making. John contributed to the West Africa Ebola response as an EOC senior Laboratory Task Force Member and a Field Laboratory Staff member over three tours; prior to this, he was a Laboratory Team Technical Consultant in Vietnam for the Global Health Security Agenda and the Laboratory Chief, Clinical Trials and Military Studies Unit, with the United States Navy at NAMRU-3, in Cairo, Egypt.
Duncan MacCannell
Chief Science Officer, Office of Advanced Molecular Detection
Centers for Disease Control and Prevention

Duncan MacCannell is the chief science officer for the CDC’s Office of Advanced Molecular Detection (OAMD), where he helps coordinate the implementation and support of pathogen genomics, bioinformatics, high-performance computing and other innovative laboratory technologies across the CDC’s four infectious disease centers. With a broad focus on public health laboratory science and strategic innovation, he manages the agency’s high performance computing center of excellence, and works to integrate standardized, sustainable capacity for advanced laboratory technologies and scientific computing into routine public health practice.

As a public health microbiologist and molecular epidemiologist, Duncan has worked with the PulseNet program on the development and validation of next-generation subtyping and characterization methods for Shiga-toxin producing *Escherichia coli* (STEC), as a general subject matter expert in bacterial molecular epidemiology and antimicrobial resistance, and as the CDC laboratory surveillance lead for healthcare-associated pathogens such as methicillin-resistant *Staphylococcus aureus* (MRSA) and *Clostridium difficile*. His current research interests include the application of comparative pathogen genomics and metagenomics to public health microbiology, and the development, validation, and implementation of molecular diagnostics, next-generation strain typing and bioinformatics for pathogen identification, outbreak investigation and large-scale molecular surveillance.

Amy Mathers
Associate Professor, Infectious Diseases and International Health
University of Virginia

Dr. Amy Mathers MD, ABMM is an Associate Professor of Medicine and Pathology at the University of Virginia. She is Clinical Director of the Adult Antimicrobial Stewardship Program and is Associate Director of Clinical Microbiology for the University of Virginia Medical Center.

Focusing on the urgent clinical problem of increasing carbapenem resistance in Enterobacteriaceae she has been evaluating detection methods in clinical microbiology and molecular transmission of carbapenemase genes for the last ten years. Molecular characterization has included analysis of mobile resistance mechanisms with evaluation of plasmid evolution and mobility across species with next generation sequencing paired with more traditional techniques. With current support for the Centers for Disease Control and Prevention she has been recently investigating the role that the hospital environment can play in evolution and dissemination of carbapenemase genes.

With additional interest in antimicrobial susceptibility testing and its relation to antimicrobial use and stewardship, she is a current voting member of the Clinical Laboratory and Standards Institute (CLSI) Antimicrobial Susceptibility Testing Committee. She is the Infectious Diseases Society of America liaison for the CLSI.

Celine Nadon
Chief, Surveillance, Outbreak Detection and Response,
Public Health Agency of Canada
Adjunct Professor, College of Medicine, University of Manitoba

Celine Nadon is the Chief of Enteric Disease Surveillance, Outbreak Detection and Response at the Public Health Agency of Canada’s National Microbiology Laboratory, where she is responsible for all national laboratory-based foodborne disease surveillance activities in Canada, including the application of next generation sequencing. Dr. Nadon also works in the development of globally accessible and standardized NGS-based foodborne disease surveillance. She has a PhD from Cornell University (New York) and completed post-doctoral studies at the USDA Food Safety and Inspection Service (Washington, DC). Dr. Nadon has been at Canada’s National Microbiology Laboratory (Winnipeg) since 2006, and she is also an Adjunct Professor of Medical Microbiology and Infectious Diseases at the University of Manitoba.

Tim Rodwell
Associate Professor, Division of Medicine
University of California, San Diego

Timothy Rodwell MD, PhD, MPH is an associate professor and physician in the Division of Global Health at UCSD and an adjunct assistant professor at the Biomedical Informatics Research Center at San Diego State University. He received his PhD from UC Davis, his MD from Stanford University and his MPH and Preventive Medicine Residency at SDSU and UCSD. He has training in medicine, infectious disease ecology, epidemiology and molecular epidemiology.

Since 1995, his work has been primarily focused on tuberculosis (TB), with an emphasis on emerging infectious disease and the molecular epidemiology of drug resistance. Dr. Rodwell recently completed a study on the binational transmission of MDR-TB (K01AI083784) and is currently the Project Director of Molecular Epidemiology for the Global Consortium for Drug-resistant TB Diagnostics (GCCD), a multinational study of the molecular basis of TB drug resistance and rapid TB diagnostics (U01AI082229). He is also currently a co-investigator on two recently funded NIH projects exploring the evolutionary and functional significance of novel mutations in drug M/XDR-TB isolates (R01AI105185) and point of care molecular diagnostics (R44EB01127403). As Project Director of Molecular Epidemiology for GCCD.
he is supervising the phenotypic and molecular characterization of over 1,500 M/XDR-TB isolates collected from India, Moldova, Philippines and South Africa. He currently oversees the phenotypic drug susceptibility testing (DST), genotyping (spoligotyping/MIRU), Sanger sequencing, Whole Genome Sequencing (WGS) and analysis of resistance-conferring mutations.

Dr. Rodwell is also an attending physician for the Refugee Health Assessment Program and co-founder of Utopia Scientific, a 501(c)(3) non-profit organization focusing on promoting awareness of the importance of science, public health and conservation through research, education and community development.

Joergen Schlundt
Director, Nanyang Technological University Food Technology Centre

Joergen Schlundt is Professor of Food Science at Nanyang Technological University (NTU), Singapore and Director of the new NTU Food Technology Centre (NAFTEC). Dr. Schlundt has a PhD from Copenhagen University, Denmark in 1983. He has worked nationally in research-based regulatory food safety in Denmark 1983–1999, including 3 years in Zimbabwe. 1999–2010: Director, Department for Food Safety and Zoonoses at the World Health Organization, including one year as Interim Director, Department Nutrition. 2011–14 Director National Food Institute of Denmark, and 2014-15 Professor Risk assessment, DTU. Dr. Schlundt has participated in the international development of food safety risk analysis principles and initiated the Joint FAO/WHO Expert Meetings on Microbiological Risk Assessment (JEMRA), the WHO International Food Safety Authorities Network (INFOSAN) as well as the first-ever WHO estimation of the global burden of foodborne diseases. Dr. Schlundt initiated (2011) and now heads the Global Microbial Identifier, suggesting a global database of DNA-sequences of all microorganisms.

Joel Sevinsky
Head of Molecular Science Laboratory
Colorado Department of Public Health and Environment

Dr. Sevinsky has more than 10 years experience in genomic and metagenomic sequencing. Prior to his time at CDPHE he worked in industry and non-profit, developing systems biology techniques for clinical, biofuel and biochemical applications. In his two years at CDPHE, he has designed, built and developed their Advanced Molecular Detection Platform for infectious disease surveillance using automated nucleic extraction, NGS on Illumina MiSeq instruments, and bioinformatic processing and analysis using Cloud-based resources. He is a strong advocate of workforce development, both in the lab and at the computer, as evidenced by numerous trainings and presentations on topics ranging from genomic library preparation to complex bioinformatics analysis of NGS results. His group at CDPHE has trained laboratorians and bioinformaticians both regionally and nationally, and their Google Cloud virtual machine image is used throughout the PulseNet Mountain Region for microbial characterization and outbreak analyses, as well as several other states beyond the PulseNet Mountain Region.

Marty Soehnlen
Director, Infectious Disease
Michigan Department of Health and Human Services

Dr. Marty Soehnlen is the Director of Infectious Disease at the Michigan Dept. of Health and Human Services, Bureau of Laboratories. Dr. Soehnlen began her laboratory career at Ohio State University where she received her BS in Medical Technology followed by an MPH in Hospital and Molecular Epidemiology with a sub-specialization in public health genetics. Marty went on to the Centers for Disease Control and Prevention as an APHL/CDC Class XII Emerging Infectious Diseases (EID) Fellow with the Rabies group. After the fellowship she completed her PhD at Pennsylvania State University in Pathobiology. Marty spent 4 years in Landstuhl, Germany as the Chief of the Micro & Molecular Biology Division of the US Army Public Health Command Region Europe. In 2015 she joined the State of Michigan as the head of the Microbiology Section and now leads the Infectious Disease Division.

Mark Struelens
Chief Microbiologist, Head of Microbiology Coordination Section
European Centre for Disease Prevention and Control

Marc Struelens (MD, PhD, FSHEA, FESCMID) is Chief Microbiologist and Head of Microbiology Coordination Section at the European Centre for Disease Prevention and Control (ECDC). He is also Professor of Medical Microbiology at the Faculty of Medicine, Université Libre de Bruxelles, Belgium. After a research fellowship at the International Centre for Diarrhoeal Diseases Research, Bangladesh in 1981–1984, Marc led an academic career in clinical microbiology at Erasme University Hospital from 1985 to 2009. His research focus was on molecular epidemiology and control of infectious diseases and antimicrobial resistance. He is a former President of the European Society of Clinical Microbiology and Infectious Diseases, of the Belgian Infection Control Society and founding chair of the ESCMID Study Group on Epidemiological Markers. At ECDC, he is leading cross-disease integration of molecular and genomic methods into European surveillance and alert systems. His team is collaborating with National Microbiology Focal Points on shared commitment to EU common approaches in public health microbiology. They jointly monitor convergence across EU countries towards implementing critical laboratory capabilities for epidemic preparedness and advanced surveillance of communicable diseases and antimicrobial resistance.
Jill Taylor 
Director, Wadsworth Center 
New York State Department of Health

Jill Taylor was educated in Australia and received her PhD in Microbiology from the University of Queensland. Jill first joined the Wadsworth Center in 1986 as a research affiliate in a laboratory focused on studies of vaccinia virus. In 1990, she joined Virogenetics Corporation where she was responsible for the successful development of multiple poxvirus-based recombinant vaccine vectors for veterinary use. Jill rejoined the Wadsworth Center in 1999 as director of the Viral Genotyping Laboratory where she oversaw clinical research studies of HIV drug resistance and hepatitis C virus, and became Director of the Clinical Virology Program in 2002. As Deputy Director of the Wadsworth Center since September 2005, and Director since May 2014, Jill ensures the effective day-to-day operation of the Center, both as a state public health laboratory and as an institution for basic and applied research. Her particular scientific interests are in the use of advanced molecular technologies in public health preparedness, disease surveillance and outbreak monitoring. Jill serves on the CDC Board of Scientific Counselors for the Office of Infectious Diseases and co-chairs the Laboratory Workgroup that is currently focused on the AMD initiative. She also serves on the National Library of Medicine Board of Regents and is a Member of a National Academy of Sciences, Engineering and Medicine Committee focused on Strategies for Identifying and Addressing Biodefense Vulnerabilities Posed by Synthetic Biology.

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