



Northeast Branch Newsletter

Number 146

Fall 2024



Global Impact of Emerging Infections

The first program of the year, on January 16, 2024, was presented by American Society for Microbiology Distinguished Lecturer Wun-Ju Shieh, MD, MPH, PhD, DrPH (h.c.), Centers for Disease Control and Prevention, and Visiting Professor,



College of Medicine, Taipei Medical University, Taipei. He spoke on *Global Impact of Emerging Infections*.

Dr. Shieh gave an introduction into emerging infections, and spoke of their global impacts on health, economy and society. Multiple factors have attributed to the distribution of emerging pathogens in nature in the past 30 years, such as human influence on ecosystems and biosystems, population migration, tourism, destruction of public health infrastructure by war, natural disasters, global warming and deforestation. Animal hosts transmit zoonotic infections and there are vector-borne infections. There is also the genetic adaptation of microbial pathogens that increases their virulence or drug. These infections can be because of bacteria, viruses, fungi and parasites; but viruses have been the leading cause of infectious diseases in recent years. Some of these pathogens are novel and have never been identified prior to an outbreak, such as the 1993 rodent-borne Hantavirus outbreak in the US and the 1999 Nipah virus outbreak in Malaysia involving fruit bats and pigs.

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The Point of Care Testing Revolution in Microbiology

Gyorgy Abel, MD, PhD, Director of Molecular Pathology and Genomics, Beth Israel Deaconess Medical Center, Boston, MA spoke on *The Point of Care Testing Revolution in Microbiology* at a March 21 dinner-meeting co-sponsored by the Northeast Branch-ASM and the Northeast Section of the American Association for Clinical Chemistry.

Some work in a traditional microbiology laboratory today, such as looking at petri dishes and using microscopes, still somewhat resembles that in the days of Louis Pasteur. Walking into a chemistry laboratory with all its instrumentation, or a virology laboratory, which is nearly all molecular, would be totally different.

There are technological and industry trends in microbiology such as automated plating, MALDI-TOF, molecular diagnostics, next-generation sequencing, multiplexing, large automated instruments, innovative rapid diagnostic systems and bioinformatics, but microbiology still not a totally molecular field.

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NEB Council Meetings

Council Meetings this year will continue to be held virtually until further notice. Members and all interested microbiologists and scientists are welcome to attend. Please notify Irene George, Secretary at (508) 785-0126 in advance.

Membership Notes

Dues reminders for 2025 will be sent to our membership via e-mail. Members who did not provide an e-mail address will be contacted by postal service. Membership forms may be found on the NEB website or you may join the both the ASM and the Northeast Branch online through the ASM eStore. Please make the necessary corrections to your demographics and return dues to the Treasurer. Emeritus members need to reply if they wish to remain on the mailing list. Changes only may be e-mailed to: NEBranch-ASM@comcast.net. Please check mailing labels on postal correspondence as they reflect existing membership information.

Although membership in a national organization automatically makes you a member of the local branch in some organizations, this is NOT the case in the ASM. *To be both a National Member and a NEB member, you have to join each individually.* Many Northeast Branch are also national ASM members.

Council Election Results

Congratulations to the following NEB members whose terms as Branch Officers began July 2024: President, Ramy Arnaout; President-elect: Thea-Brennan-Krohn, and Local Councilor, Alexander Pyden. Thank you for another great year of programs and we are looking forward to planning a busy 2024-25!

Student Chapters

The NEB is associated with an active student chapter, the Maine Society of Microbiology, Orono, ME.

FUTURE PROGRAMS

Announcements of Local Meetings and registration materials will be posted on our website:

<http://northeastbranchasm.org>

National Meetings:

November 15-17, 2024

ASM Conference for Undergraduate Educators (ASMCUE)

Pittsburgh, PA

<https://asm.org>> Events

Local Programs:

October 29, 2024

New England Microbiology Laboratory Directors Fall Meeting

Location: Publick House, Sturbridge, MA. From 12:00-5:00 PM

Contact: patkludt@aol.com

<https://asm.org>> Events

December 4, 2024

(Virtual, 7pm): Microbial and Maternal Bile Acid Metabolism Determine Heightened Newborn Susceptibility to Norovirus Disease

with Stephanie Karst, PhD

Professor, Department of Molecular Genetics and Microbiology

College of Medicine, University of Florida, Gainesville, FL



SAVE THE DATE

Joint Meeting

Northeast and Connecticut Valley Branches
of the American Society for Microbiology

April 25, 2025

Rediscovering Microbiology

Topics include:

Metagenomics, Antimicrobials, Gene Regulation, Microbial Communities and Interactions, and more!

Featuring: Symposia, Posters & Prizes, Exhibitors

Location:

Worcester State University
Student Center
486 Chandler St, Worcester, MA
01602

Announcements and registration materials will be posted on our website when available:

<http://northeastbranchasm.org>



Global Impact of Emerging Infections (continued)

Dr. Shieh spoke of known pathogens with new disease manifestations, such as the 2015 Zika virus in Central/S. America. There are also old pathogens with new geographic distribution or epidemiology such as the 2003 Monkeypox outbreak that was the first such occurring in the Western Hemisphere outside of Central and Africa where it is endemic. Pathogens can also have an atypical mode of transmission; in May 2004, we had the first report of rabies transmission through solid organ transplantation in three Texas patients. The route of transmission in the 2022 Monkeypox (M-pox) virus global epidemic was human to human, while the virus is usually transmitted from African rodents or primates to humans.

In this first quarter of the 21st century we have already had four pandemics; SARS- CoV-1 in 2003, H1N1 influenza in 2009, the 2020 SARS-CoV-2, that is still ongoing as the virus evolves, and most recently in 2022 Monkeypox. The etiologic agents were either transmitted from various animals such as bats or mice, or vectors such as mosquitos and ticks. Therefore, overall, emerging infectious diseases are highly likely to be associated with zoonotic and vector borne infections.

Throughout history, infectious diseases have been a constant companion of humans as they spread across the world, and still are today. Dr. Shieh touched upon a number of these deadly pandemics from the Antonine Plague 165-180 AD to Covid 19 2020-23 AD. The emerging infections can cause tremendous casualties, social turmoil, and economic loss, and constantly pose challenges to global health.

Dr. Shieh described some local epidemics and their impact on public health, such as the Ebola Outbreak, 2014-2015 in West Africa, mainly in Sierra Leone, Liberia and Guinea, where Ebola was a surprise.

Even when an outbreak occurs in a local geographic region it can cause fear and confusion in other distant countries and areas. Pathogens can be carried by infected humans, animals, and materials to infect others in different geographic locations. One case elsewhere can cause turmoil.

Dr. Shieh also spoke of the global impact of emerging infections, whether local, regional, pandemic or epidemic, on economy. Long term effects can occur and may take years to recover. The 2020-2023 Covid-19 epidemic economic reports estimate a cost of \$16.2 trillion dollars in the U.S. alone, and about half of the loss was lost gross domestic product. Outbreaks may involve daily food consumption, such as meat products that can be involved with emerging pathogens. A common meat source of disease is chicken, and there are several influenza viruses that have been transmitted to and caused human disease, even fatal. These viruses occur naturally among wild aquatic birds worldwide and can infect domestic poultry and other animal and avian species. Large numbers of animals may have to be culled, causing a heavy impact on the economy.

Emerging infections also impact society. Smart phones and social media apps now play a key role in information distribution and sharing clinical information. In 2020 the Covid-19 pandemic dominated the media domestically and internationally, and among them was a viral spread of Covid-19 fake news online, that spread faster than the real virus itself. Misinformation can be expected in a major event, but can also cause damage to the public. About 36% of frequent social media users held at least 1 false belief about Covid-19.

There are also psychosocial effects of the Covid-19 pandemic, as the virus has been elusive and unpredictable, and there is confusion with all kinds of gossip, fake news, and false information in the social media and internet. There is intense uneasiness, fear, anxiety and feelings of losing control of personal life; infected patients feel guilty about endangering their families' health and adding burden to their families. The community is also affected; people were wary of others and of the environment, leading to mistrust, negative emotions and alienation of colleagues due to long-term remote work. Masks may block the virus, but also block friendliness, trust and smiling faces.

Dr. Shieh presented lessons learned from emerging infections: It's never too late to learn and it's never too early to prepare.

Global Impact of Emerging Infections (continued)

He summarized his presentation with this slide:

1. Emerging diseases are highly likely to be associated with zoonic and vector-borne infections.
2. Emerging infections can produce profound impact on human and animal health, economy and society.
3. Increasing the awareness of these emerging infections is important in practice of modern medicine and public health.
4. Expect the unexpected.
5. Never say never.
6. There are pathogens we have never seen before and when have an unusual or unexplained outbreak, we may have to think out of the box. Traditional methods may not work; is this a new pathogen or old one with new tricks?

The Point of Care Testing Revolution in Microbiology (continued)



Gyorgy Abel, MD

Infectious disease diagnostics in a central laboratory involve specimen collection, transportation, processing, testing, interpretation, and a result returned to the physician can take a long time. On site, rapid point of care testing (POCT), i.e. molecular diagnostics, has certain undeniable advantages, and provides a shorter time to a clinical (presumptive) diagnosis that can be confirmed by the laboratory within about 24 hours, provides earlier accurate treatment, and can save a second visit. POCT can also help improve patient management decisions and health surveillance data can be obtained from rapid testing. A short turn-around is needed for major clinical impact and a POC testing system

needs to be easy to operate. However, it is also more expensive.

The key driver for rapid testing is largely innovation, which can include unmet needs, long turnaround times, lack of a laboratory, poor infrastructure, etc. Technology and innovations have led to advanced immunoassays, nanotechnology, molecular biology, miniaturization, micro-machining, microfluidics, biosensors, and numerous other diagnostics. Wireless connectivity and a cellular network are critical to innovation and POCT. This is important within a hospital system, but outside, such as in Africa, cell phones allow connections to health centers with results. Data collection and analytics allow information exchange worldwide in case of unusual and unexpected events, as the movement of people from continent to continent contributes to unexpected problems anywhere.

Dr. Abel showed and reviewed the operation of a number of instruments used in molecular POCT in microbiology laboratories, emergency rooms and physician's offices. One instrument, for example, has rapid cartridge-based PCR diagnostics with a high throughput and a diagnostic turnaround time of less than 60 minutes. Testing can be done for multiple organisms, such as Covid, RSV, influenza, and bacteria, including antimicrobial resistance, making such a system quite versatile and valuable. Other instruments use multiplexing, and large, very expensive panels compared to single pathogen panels/tests or smaller panels, however, you are also testing for many unlikely pathogens. He also mentioned instruments using next-generation sequencing, in which bacterial genome sequencing occurs in a short time, and multiplex lateral flow POCT, in which an immunoassay targets the organisms.

Handheld sequencers, no larger than a cellphone, are a technology in development. They are capable of identifying multiple resistance genes by gene sequencing in less than three hours and are useful in whole genome sequencing. They can be used in the field in a tent, such as for ebola in Africa. He spoke of paper-based, chip based, and disc-based POC diagnostics, some of which will come to market. There is also NMR POCT, an interesting tiny instrument for nuclear magnetic resonance spectroscopy.

The Point of Care Testing Revolution in Microbiology (continued)

Infectious diseases and antimicrobial resistance provide many opportunities for innovators to develop new strategies, new technologies and diagnostic systems to optimize workflow. Dr. Abel recommended that anyone wanting to develop POC devices should have a target product profile as a guide; having an idea is not enough, certain parameters need to be met. BACHMANN et al created a Target Product Profile (TPP), an Interaction Network Diagram, that includes test descriptions, technical performance, intended use, assay protocols, performance, commercial side of things, materials to be used, etc.

Rapid bacterial diagnostics are critical in life-threatening situations such as bloodstream infections, sepsis and ventilator associated pneumonia. Blood culture is still the gold standard, but takes time. PCR for MRSA and other pathogens, MALDI, and other rapid multi-diagnostics such as molecular testing, are now used to complement culture, and their use is increasing. Testing directly from the primary specimen would be best, but these are mostly mixed specimens and direct testing is still problematic. Hospital acquired infections remain a huge problem and include multi-drug-resistant gram-positive and gram-negative infections. Dr. Abel spoke of the National Action Plan for Combating Drug Resistant Bacteria and the ESKAPE pathogens. POC-type rapid diagnostic devices would be of tremendous help in curbing these infections.

Dr. Abel also spoke of the unprecedented challenge of Covid, that hit laboratories hard in 2020. Testing was done manually and was very labor-intensive, among other numerous issues. There was a huge pressure on laboratories and manufacturers and the rapid evolution of technologies. Rapid testing and high throughput were required, thus laboratories moved from central laboratory testing to point-of-care testing. A list of SARS COV-2 POC and rapid tests that can be used in POC settings can be found on the US FDA website. He highly recommended the paper *Testing for SARS-CoV-2: lessons learned and current use cases* by Theel, Kirby,



Alexander Pyden, MD, NEB Local Councilor and Gyorgy Abel, MD

and Pollock, *Clinical Microbiology Reviews*, Vol. 37, No. 2, June 13, 2024.

Dr. Abel lastly spoke of POCT trends around the globe that are influenced by local factors such as high prevalence of certain infections, economy, geography, and health care programs/campaigns. There is no financial incentive for POCT for laboratories in the United States, because it is considerably more expensive than central laboratory testing, as POCT is very resource intensive, involving a POCT team, training of personnel, etc. However, we can expect an increase in POCT and an overall decentralization of healthcare. There will be fewer doctor appointments, more telemedicine, pharmacy and in-home testing and monitoring.

Europe uses POC more heavily than we do, up to 25% of testing in large hospitals in Western Europe is POC, and a greater increase is expected. Dispersed populations in Australia can certainly benefit from POC but it is not promoted much. POCT is just coming into focus in Japan; most laboratory testing is done in large central hospitals or reference laboratories, with more specialty testing performed. POCT is expensive in Africa, and an effort is being made to develop inexpensive POC solutions, such as paper, textile, or foil-based chips, for tuberculosis, HIV, malaria and dengue, etc. Cell phones play an important role here, and disease outbreaks have caused manufacturers to address the issue.



Antibiotic Discovery from a Single Bacterial Colony



The annual joint meeting co-sponsored by the Northeast Branch-ASM, The American Society for Clinical Laboratory Science of Central New England, and the University of

Massachusetts Dartmouth Department of Medical Laboratory Science was held at Rachel's Lakeside in Dartmouth, MA, on April 24, 2024.

American Society for Microbiology Distinguished Lecturer Brian T. Murphy, PhD, presented "Antibiotic Discovery from a Single Bacterial Colony". Dr. Murphy is a Professor in the Department of Pharmaceutical Sciences at the University of Illinois at Chicago (UIC) and earned his degrees in chemistry from the University of Massachusetts Dartmouth (BS/MS) and Virginia Tech (Ph.D.) The Murphy Lab focuses on applying high-throughput robotics and bioinformatics toward the discovery of antibiotics from aquatic bacteria.

Dr. Murphy detailed the process scientists use to collect environmental bacteria from around the globe, which are a major source of antibiotics. Nearly one half of the small molecule drugs on the market today are natural products or are related to a natural product, and about three quarters of antibiotic drugs on the market either are natural products or were inspired by or derived from natural products. Small molecules produced by actinomycete bacteria provide us with more than half of the antibiotics used in the clinic. We have a crisis today with antibiotic discovery, the rate of drug resistance is greater than the rate of discovery.

Agar continues to be critical role in isolating bacteria and testing for antibiotic activity such as the agar overlay and intruder assays. However, these platforms have drawbacks, such as unwanted chemical interactions between microorganisms, incompatibility with high throughput screening, and reliance. A diagram of a discovery pipeline for microbes includes sample collection from the environment, isolation, extraction, and

creation of a natural product library of microbes. These are screened against the disease of interest to find how many will produce both known and unknown compounds, then eliminating the knowns and then working on the unknowns.

He argues that this process, while incredibly successful, is wasteful, time-consuming, and extremely expensive. This may be one reason why few new antibiotics have been discovered. His laboratory wants to innovate the way we search for/discover antibiotics, in particular, sample collection, microbe library generation and biological screening.

His lab therefore developed a bioinformatics pipeline to generate microbial libraries, and uses a high throughput colony-picking robot, that can pick about 2100 colonies per hour from a plate. However, time consuming biological screening is not done on the colony itself, but on a downstream product of the colony. This appeared to be a bottleneck, therefore they developed the dual sided plate assay (DAPA) , a 3D printed plate, autoclavable, reusable, inexpensive, and amenable to automation. Agar is solidified after pouring into a 96-well plate, and a test bacterium is inoculated on one side of the agar plug; after several days, the test pathogen is inoculated on the other side. This avoids same surface interactions and growth inhibition can easily be detected by various methods such as fluorescence and optical density.

He argued that this method is more a more efficient and inexpensive way to screen for new antibiotics, and described how they use their bioinformatics pipeline to create a smart library of bacteria. He described how they innovated and built the DAPA assay to screen the library against pathogens, and how they elucidated the structure of a small molecule using chromatography to isolate it, and spectrometry to identify it.

The samples the Laboratory tested came from various locations in Iceland over 5-6 years, where they collected sediments, microalgae, sponges etc. in both fresh water and marine sites. Morphology on an agar plate is traditionally used to guide a library, however, redundancy is a problem with plates and much chemistry can be missed. They had to rethink the way to create libraries, and used matrix-assisted laser



ASMDL Speaker Brian Murphy and UMA Dartmouth Students

Antibiotic Discovery from a Single Bacterial Colony (continued)

desorption ionization-time of flight mass spectrometry (MALDI-TOF) to analyze colonies that look alike; he described the process and described it as a fingerprint of an organism, as it is more accurate than 16 S sequencing because it can identify species, subspecies and even detect antibiotic resistance, and is faster and less expensive. However, the Bruker and BioMerieux MALDI systems are expensive and their databases contains only clinical pathogens, not environmental or other organisms.

To process the data from hundreds of organisms, they built their own mass spectrometry-based bioinformatics system in 2018, IDBac, a bioinformatics platform for analyzing protein and small molecule MALDI-TOF MS data. This was a free downloadable application; a second web version will be available soon. IDBac can be used in multiple ways, whether it be for library generation for drug discovery, or microbial ecology comparing microbial populations between two different sponges, etc.

Every colony isolated from agar plates is put through IDBAC, a smart library is created, and then screened against diseases. A dendrogram is first generated from the protein data and organisms are further grouped, then screened for small molecule production. These visualizations allow making decisions about how to move forward with the creation of a library.

The laboratory had 1616 isolates of which 302 were added to the library; 65 genera were phylogenetically distinct as were their natural products. Generally, these would be grown in liquid culture, analyzed, and screened against pathogens. However, they used DAPA, allowing for high-throughput screening. They also screened 217 of the Iceland environmental bacteria grown on four different media against three different pathogens (~2600 assays), and had 55 hits; 9 known compounds were found, and a new antibiotic, Demethoxytetrone, was isolated from a *Streptomyces* sp.

The Murphy laboratory also partnered with the Boys and Girls Club of Chicago to perform high-end biomedical research. Dr. Murphy described a project in which the students were taught to do all the steps done in the laboratory, either in the laboratory or virtually from the Club. Students grew colonies from environments in their own neighborhood, and a middle school student and her mentor team discovered a new cyclic lipopeptide and are in the process of publishing the data! Dr. Murphy's program has been featured in *Chemical and Engineering News*, NPR, *Science Daily*, *Toronto Star*, among others. Dr. Murphy believes that this environment to bioassay antibiotic discovery pipeline actually will work better than old methods. DAPA can be used to screen, dereplicate, and prioritize bacteria directly from solid support in the front end of antibiotic discovery pipeline. IDBac can be used to

Antibiotic Discovery from a Single Bacterial Colony (continued)

generate a dendrogram and to target understudied bacteria. The laboratory plans to launch a web version of the open-access IDBac database and create a public repository of known pathogen MS fingerprints.



ADDITIONAL NEB ACTIVITIES

Science Fairs

The NEB annually donates an award of \$100 to each of five MA regional fairs and \$300 to the MA Science Fair. Congratulations again to the students for their outstanding work.

New England Microbiology Laboratory Directors Meetings

The New England Microbiology Laboratory Directors group has been meeting at the Publick House in Sturbridge twice a year for over thirty years in order to share information and their experiences in the laboratory. The informal half-day agenda consists of presentations by attendees. The spring meeting was held on April 30, 2024. The agenda at the fall meeting on October 29, included *FDA Final Rule on LDTs, Improving Mycobacterial Smear and Culture Utilization, Biosafety/Lab Handling of MPOX Rule Out Specimens, Introducing the Biothreats Emergence, Analysis and Communications Network (BEACON), Current Practices on Lyme Disease Testing, and Metagenomics.*

The meetings are attended by physicians, laboratory directors, epidemiologists and laboratorians from New England, and are supported in part by the Northeast Branch.

Please contact patkludt@aol.com if you would like to receive meeting information.



America's First Public Health Museum



The Public Health Museum is an independent 501(c)(3) organization, housed in the historic Richard Morris building (also known as the Old Administration Building) of Tewksbury Hospital in Massachusetts. The Museum strives to preserve artifacts and records of our nation's history in public health and serve as a resource to the community to educate and promote public health initiatives that address current health issues.

Opened on May 1, 1854, the State Almshouse at Tewksbury was a venture by the Commonwealth of Massachusetts to provide economical care for state paupers. Originally intended to accommodate 500 residents, by the end of 1854 the almshouse had admitted well over 2,200 paupers, thus necessitating future expansion. The name would later be changed to Tewksbury State Hospital to reflect the inclusion of the mentally ill, the sick, and those suffering from infectious disease as patients. Today, the hospital remains operational in providing specialized care in the Thomas J. Saunders Building while also serving as host to various governmental agencies and community organizations like the Public Health Museum on its historic campus. Although many of the early structures were demolished in the 1970s, the Tewksbury State Hospital remains an active institution brimming with architectural beauty and a rich public health history (growth) curve in the future.

From: The Public Health Museum Newsletters





**Northeast Branch of the
American Society for Microbiology**

MEMBERSHIP RENEWAL FORM
January 1, 2025 – December 31, 2025

Please check personal information.

Name: ASM Member? ASM Membership No

Preferred Mailing Address

 Home/Business Address

Phone (Day) Preferred Email:
Phone (Other) Other Email:

Professional Position:
 Specialty:

Primary Area of interest: Biotechnology Education Marketing/Sales
 Clinical/Public Health Industrial Other: _____

Are you interested in any of the following Branch activities? Working on Committees Running for Office

MEMBERSHIP OPTIONS:

Individual (\$ 15.00 annually) Individual (\$ 40.00 / 3 years) Student (\$ 10.00 annually)

Emeritus* (No Charge) *Emeritus membership is defined as a member who is in good standing for 20 consecutive years, and who is retired from their profession.

UPDATE ONLY ENCLOSED (changes can be emailed to NEBranch-ASM@comcast.net)

Renewals postmarked after September 1, 2024 will be effective 9/1/25-12/31/25.

Please renew either with your annual ASM membership or mail this form and dues check (payable to NORTHEAST BRANCH-ASM) to:

Patricia E. Kludt
6 Abigail Drive
Hudson, MA 01749

Date Dues Received: _____

Check No.: _____

Sept 2024