

Fiscal Year 2019 Report

Bureau of Laboratories



BUREAU OF LABORATORIES



Our Vision:

The Bureau of Laboratories is a strong, more diverse team within an integrated public health system. We utilize advanced technology and innovative leadership to provide comprehensive public health services in our dynamic global community.

Our Mission:

The Bureau of Laboratories is dedicated to continued leadership in providing quality laboratory science for healthier people and communities through partnerships, communication, and technical innovation.

The Bureau of Laboratories is established under the provisions of revised Public Health Code – Act 368 of 1978, Part 96 (3333.9601).



Sandip Shah, Ph.D., HCLD(ABB)
Laboratory Director

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Introduction

Founded in 1907, the Michigan Department of Health and Human Services Bureau of Laboratories (BOL) is the State of Michigan Public Health Laboratory. The BOL provides laboratory support for a variety of programs, for local health departments, other state health departments, and for hospitals, and physicians throughout the State of Michigan. In addition, the BOL works closely with other states and federal agencies such as the Centers for Disease Control and Prevention (CDC) by serving as a testing laboratory for chemical terrorism (LRN-C); biological Select Agents (LRN-B); and food safety (FERN).

The BOL is composed of two divisions: **Division of Chemistry and Toxicology** and **Division of Infectious Disease**.

The **Division of Chemistry and Toxicology** consists of two sections, Analytical Chemistry and Newborn Screening.

Analytical Chemistry provides testing of clinical and environmental specimens for evidence of chemical exposure such as lead and mercury. Analytical Chemistry consists of the three units: Trace Metals, Environmental Organic Response, Clinical Organic Response. This section tests fish for mercury and organic pollutants such as pesticides, polychlorinated biphenyls (PCBs), and other pollutants. Analytical Chemistry also serves as a Tier 1 laboratory for CDC in the event of a regional chemical exposure.

The Newborn Screening (NBS) section has two units, Metabolic and Endocrine. The NBS laboratory performs tests for 50+ disorders on all newborns in the State of Michigan to identify congenital and metabolic disorders such as cystic fibrosis and sickle cell anemia. The laboratory testing is part of a comprehensive program for newborns that includes referral to specialty clinics and follow up care to prevent and treat serious health problems.

The **Division of Infectious Disease** (DID) supports local, state, and national public health agencies. It provides high quality reference and specialized testing services for rapid and effective detection and surveillance of emerging and existing communicable diseases such as Ebola, Zika, tuberculosis, along with food-borne illness, and sexually transmitted infections. The DID is composed of two sections, Microbiology and Virology. The Microbiology section consists of the Mycobacteriology/Mycology unit and the Enteric-STD-Chromatography/Reference Bacteriology unit. The Virology section consists of the Bacterial & Viral Serology unit and the HIV/Viral Isolation/Molecular unit.

The Safety Office, Data and Specimen Handling unit, Quality Assurance Section, and the Laboratory Systems Section supports all areas of the laboratories with safety trainings, specimen receipt, data entry, laboratory information management systems, and chemical, biological terrorism, K-12 education/training programs.

Accomplishments

The Bureau of Laboratories (BOL) participated in 165 proficiency test events from 10 different providers.

The BOL organized and hosted the “*South-Central Association of Clinical Microbiology*” meeting in September 2019.

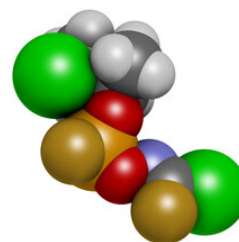
The Data and Specimen Handling Unit (DASH) developed and implemented a new online ordering system, Laboratory Kit Order Tracking System (LKOT), for test collection kits and components. This system will allow better support and assistance to our public health partners.

The BOL received re-accreditation by the College of American Pathologists (CAP) after a meticulous external inspection. This prestigious accreditation is held by only a handful of state public health labs and covers all clinical testing performed at the laboratory.

Laboratory Information Management System Administrators performed a successful upgrade to the STARLIMS Runtime System.

After an external inspection by the American Industrial Hygiene Association (AIHA-LAP, LLC), the BOL received re-accreditation. This rigorous accreditation to International Organization for Standardization (ISO) standards covers food testing and environmental lead testing.

BOL laboratory staff are actively involved and represent the State of Michigan Public Health Laboratory on American Public Health Laboratory (APHL) committees or subcommittees along with participating in speaking engagements and poster sessions at various national conferences.



Division of Chemistry and Toxicology - Newborn Screening Section

The Newborn Screening section validated and added X-linked adrenoleukodystrophy (X-ALD) to Michigan’s Newborn Screening (NBS) panel.

A 2nd tier test for X-ALD was developed and validated.

The adenosine deaminase deficiency test was validated and added to Michigan’s NBS panel.

The Newborn Screening section assisted with the PerkinElmer Food and Drug Administration validation of NeoBase2 on the QSight platform.

To minimize identification of false positive cases, the Newborn Screening section worked to optimize the procedure for detecting Galactosemia.

The Newborn Screening section received a \$75,000 grant through Cure Spinal Muscular Atrophy (SMA).

The Newborn Screening section acquired new instrumentation and performed proof of concept studies for the addition of SMA testing.

Validation was initiated for SMA testing.

Division of Chemistry and Toxicology - Analytical Chemistry Section

The Analytical Chemistry (AC) section developed a method for measuring blood lead on filter paper and whole blood on an Agilent 880 ICP-MSMS.

The AC Section brought three methods into the AIHA-LAP, LLC/ISO 17025 accreditation, one in the trace metal units and two in the environmental organic unit.

Two hundred sixty-seven spices, teas, and supplemental samples were analyzed for a panel of metals.

One hundred seventy-six Food Emergency Response Network (FERN) surveillance samples were analyzed for a panel of metals and organic compounds.

Four hundred thirty-five serum samples and 275 water samples were analyzed for the North Kent County Risk Assessment.

A new method was validated for new Nerve Agent metabolites and agents.

The AC team successfully completed one surge exercise for Tetramine in urine.

AC received grant funding from the CDC for five years to conduct statewide biomonitoring for polychlorinated biphenyls (PCBs), pesticides, metals, per & polyfluoroalkyl substances (PFAS), and conduct a PFAS-only study on firefighters.

A method was developed for determining levels of opioids in serum and urine

Division of Infectious Disease - Microbiology Unit

The Microbiology unit successfully completed the BLOWATCH inspection.

Accomplished major statewide outbreak surveillance, most notably *Salmonella carrau* associated with cut melons and *Salmonella* strains associated with pig ear treats and chick paper. Whole genome sequencing (WGS) was successfully performed on >100

Salmonella strains with tremendous coordination with food borne epidemiologist, CDC and other regulatory agencies.

WGS and Antimicrobial Susceptibility Testing services were provided to support ongoing Disseminated Gonococcal Infection outbreak.

The Microbiology unit successfully completed food defense testing for the National Special Security Event Super Bowl Sampling Activity.

The Microbiology unit tested 528 surveillance samples using Ricin ELISA, *Bacillus anthracis*, Staphylococcal enterotoxin, and *Yersinia pestis*. The unit also tested 9 food defense samples for Staphylococcal enterotoxin and *Bacillus anthracis*.

The Microbiology unit participated in the Yankee Papa 2010 Environmental Protection Agency Analytical Preparedness Full Scale Exercise for the Detection of *Yersinia pestis* in Spiked Water Samples.

The Microbiology unit participated in Wisconsin State Health Laboratory proficiency test and successfully renewed its certification and sustaining the Lead site for the detection of *Legionella*.

Microbiology successfully completed WGS on NDM -1 positive 30 Enterobacteriaceae isolates

The Mycobacterium unit successfully genotyped 8,443 *Mycobacterium tuberculosis* strains submitted from other clinical and public health laboratories across the United States .

Histoplasmosis surveillance was completed successfully in collaboration with MDHHS epidemiologists and CDC.

Mycobacterium unit was awarded a new \$3.6 million contract for TB genotyping.

Division of Infectious Disease – Viral Serology Unit

The Viral Serology unit participated in the ongoing Genital Ulcer Disease Study.

Nine test validations and verifications were performed.

The unit participated in an ongoing the Hepatitis C virus antibody stability study.

Nine new tests were introduced.

Staff presented four 4 posters at various national conferences.

BOL's Exp!ore Lab Science Exhibit Wins Award

Exp!ore Lab Science was again voted the favorite exhibit to visit by the children of the Michigan Department of Health and Human Services (MDHHS) employees, during the annual "MDHHS Bring Your Child to Work Day," held in August 2019.

Exp!ore Lab Science is the K-12 science education program sponsored by the Bureau of Laboratories (BOL). The program offers science demonstrations as requested by schools and a website, www.michigan.gov/explorelabscience, filled with fun science activities for K-12 grade students. The goal of the program is to introduce students to laboratory science and promote laboratory and public health careers.



This year's theme was "Camp MDHHS." The Exp!ore Lab Science exhibit offered five engaging activities for participants.

Bats, ticks, and other camping nuisances were on display. Observers were able to examine different types of bats found in Michigan that could carry the rabies virus. Using a stereoscope, interested participants could take a

close look at different kinds of ticks and identify the tick that could transmit Lyme's Disease. The students were also introduced to a parasite found in unsafe drinking water called *Giardia lamblia*, which causes Giardiasis, a severe stomach illness. Students could make a Shrinky Dink model of their favorite camping nuisance – a bat, a tick, or a *Giardia* parasite. The Shrinky Dink model was connected to a key chain to be used as a decoration for their backpack and to serve as a reminder about wildlife hazards they might encounter while camping.

"Make Your Own Bug Spray," using essential oils, introduced the participants to a natural way to repel ticks, fleas, and other insects. The children learned which essential oils were the best repellents to use for



insects commonly found in Michigan. Each participant had the opportunity to make their own unique bug spray mixture using scientific techniques such as laboratory volumetric measuring and transfer pipetting for each ingredient.




A popular camping treat is the s'more made over a campfire. With a pizza box, aluminum foil, plastic wrap and black construction paper along with some artificial sunshine, the Explore Lab Science team demonstrated how to make s'mores using a solar oven to melt the chocolate and soften the marshmallows.

The last exhibit was the Drinkable Density tower. A tasty red, white and blue drink made from different flavored Gatorades. Each liquid has its own density based upon the sugar content, the Gatorade with the highest sugar content remained on the bottom of the glass, with subsequent flavors resting on the layer with the most sugar content. Using the properties of density as a scientific concept, along with a few graduated cylinders, and the art of accurate measurement, the students created a refreshing drink of their own.

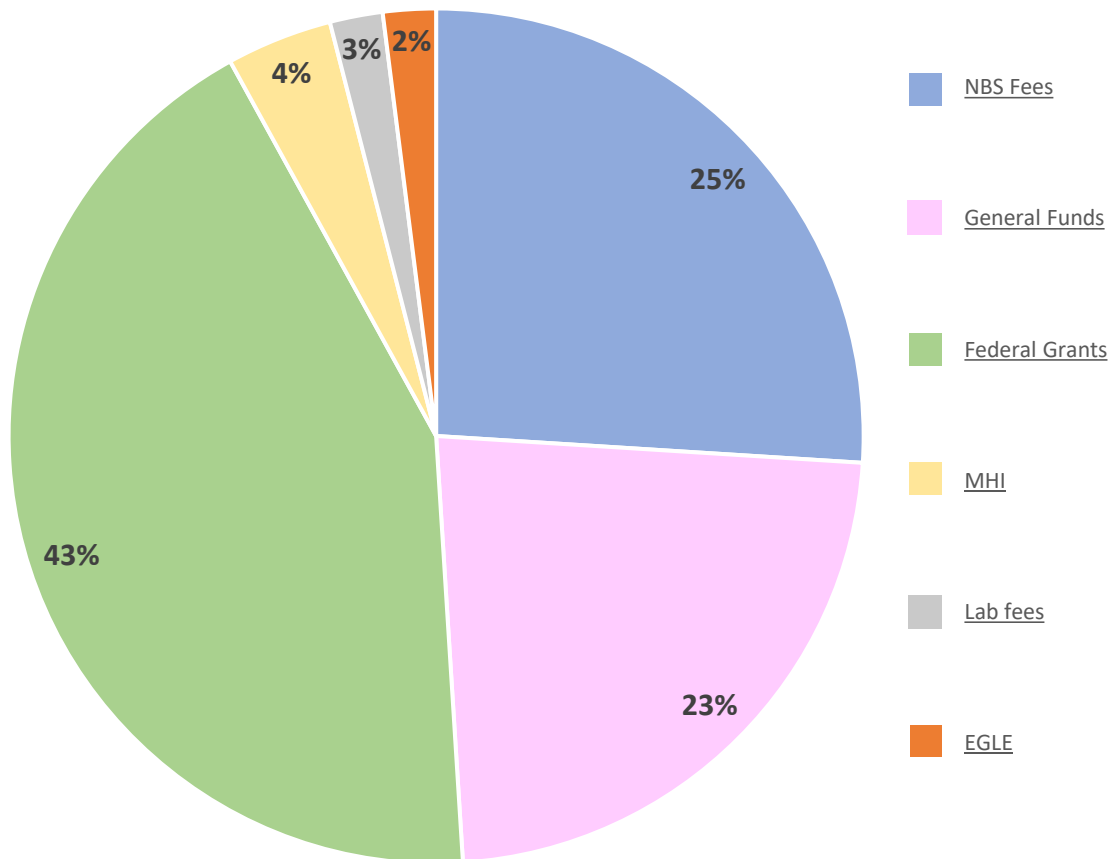


The BOL and Explore Lab Science looks forward to sharing more hands-on activities to engage future laboratory scientists. For more information about the Explore Lab Science Program visit our website at www.michigan.gov/explorelabscience.

2019 By the Numbers

	6.8 million tests For State of Michigan Residents	
Infectious Disease	129,465 specimens 386,507 tests	71,000 individuals
Newborn Screening	6,463,985 tests	117,528 Newborns
Blood Lead & Environmental Lead	23,669 tests for blood lead & environmental lead	16,000 individuals & households
Chemistry & Toxicology Division Fish Testing	800 fish tested for PCB & chlorinated pesticides 1,100 fish tested for heavy metals	All Michigan Residents Eat Safe Fish Guide
Per & Polyfluoroalkyl Substances	710 serum & water samples 1,100 fish 350 deer Unknown liquids for MDOT	All Michigan Residents

2019 Funding Sources



Training and Tours

Laboratory Tours:

- Fifty two hours in laboratory tours and visitor meet and greets

K-12 Outreach:

- Three career fairs reaching approximately 2,900 students
- Twenty three science demonstrations with approximately 2,300 students participating
- Thirteen college student interns volunteered to assist with K-12 outreach

Biosafety:

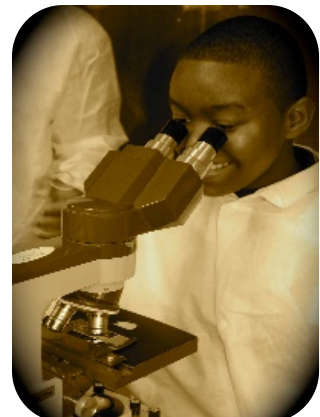
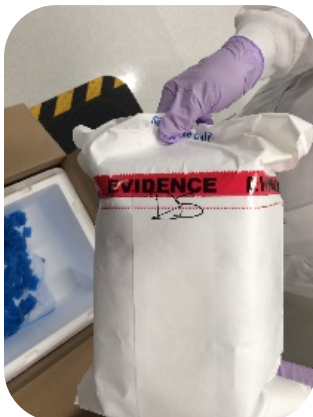
- Ten in-house biosafety trainings held for 163 staff
- Six external biosafety trainings completed for 19 participants
- Total of 182 participants trained in biosafety

Biological Threat (BT) Packaging & Shipping Training:

- Thirty six classes held at 61 facilities throughout the State of Michigan
- Total of 380 participants certified in BT packaging and shipping

Chemical Threat (CT) Training:

- Ten classes held throughout the state of Michigan
- Eighty four participants from 8 hospitals and Public Health Departments attended
- Public Health Emergency Preparedness Cooperative Agreement annual benchmark exercises successfully completed
 - CDC, Laboratory Response Network-Chemical (LRN-C), Specimen Packaging and Shipping Exercise (SPaSE)
 - CDC, LRN-C bi-directional communication drill
- Regional Laboratory partners exercised mini SPaSE with MDHHS BOL
- Two healthcare facilities exercised with MDHHS BOL for a mini SPaSE



Publications

[Trends of Shiga toxin-producing *Escherichia coli* \(STEC\) strains recovered from patients in Michigan, 2001-2018.](#) Blankenship, Mosci, Dietrich, Burgess, Wholehan, McWilliams, Pietzeran, Benko, Gatesy, Rudrik, Soehnlén, Manning. 2019. In submission.

[Analysis of whole genome sequencing for characterization and outbreak identification of Shiga toxin-producing *Escherichia coli* \(STEC\) strains, 2015-2018.](#) Blankenship, Dietrich, Burgess, Soehnlén, Manning. 2019. In Submission.

[Highlights from the 2019 HIV Diagnostics Conference: optimizing testing for HIV, STIs, and HCV, STD.](#) Chavez, Soehnlén, Van Der Pol, Gaynor, Wesolowski, Owen. 2019. In Submission.

[Shigella sonnei outbreak investigation in the setting of a municipal water crisis – Genesee and Saginaw counties, Michigan, 2016.](#) McClung, Karwowski, Castillo, McFadden, Collier, Collins, Soehnlén, Dietrich, Trees, Wilt, Harrington, Miller, Adam, Reses, Cope, Fullerton, Hill, and Yoder. 2019. AJPH. In Submission.

[Comparative genomic and physiological analyses reveal habitat-specific traits, antibiotic-resistance and pathogenesis mechanisms](#) PLoS One. Chen, Soehnlén, Blom, Terrapon, Henrissat, Walker. 2019. Doi: 10.1371/journal.pone.0222648.

[Onsite investigation at a mail-order hatchery following a multistate Salmonella illness outbreak linked to live poultry – United States 2018.](#) Robertson, Sidge, Koski, Hardy, Stevenson, Signs, Stobierski, Bidol, Donovan, Soehnlén, Jones, Robeson, Hambley, Stefanovsky, Brandenburg, Hise, Tolar, Nichols, Basler. 2019. Poultry Science. Doi: 10.3382/ps/pez529.

[Identification of four patients with colistin-resistant *Escherichia coli* containing the mobile colistin resistance *mcr-1* gene from a single health system in Michigan.](#) Henig, Rojas, Bachman, Rudin, Brennan, Soehnlén, Jones, Mills, Dombecki, Valyko, Marshall, Bonomo, Kaye, Washer. 2019. Infection Control and Hospital Epidemiology. Doi: 10.1017/ice.2019.177.

[Live poultry shipment box sampling at feed stores as an indicator for Salmonella infections in people.](#) Sidge, Signs, Bidol, Jones, Robeson, Soehnlén, Stobierski. 2019. MMWR Notes from the Field. Doi: 10.15585/mmwr.mm6817a6.

[Environmental Investigation of a multi-state Salmonellosis outbreak in humans linked to live backyard poultry from a mail-order hatchery – 2018.](#) Hardy, Robertson, Sidge, Signs, Stobierski, **Jones**, **Soehnen**, Stefanovsky, Habley, Bradenburg, Martin, Lauer, Fields, Koski, Stevenson, Pabilonia, Nichols, Basler, Ribor, Hise. 2018. MMWR 2019; 67: 1430-1431. Doi: 10.15585/mm675152a5.

[Disease management at the wildlife-livestock interface: using whole genome sequencing to study the role of elk in Mycobacterium bovis transmission in Michigan, USA.](#) Salvador, O'Brien, Cosgrove, Stuber, **Schooley**, Crispell, **Church**, Grohn, Robbe-Austerman, Lao. 2019. Mol Ecol. Doi: 10.1111/mec.15061.



Measles and Mumps in Michigan

By Jessica Jenkins, MLS(ASCP)

Measles and mumps are viral infections that afflicted hundreds of thousands of children each year prior to the development of an effective vaccine. Measles virus causes an acute respiratory illness with cough, inflammation of nasal mucosa, conjunctivitis, fever and rash. Mumps infection is characterized by swelling in one or both parotid glands, that spreads downward with increased fluid buildup. Mumps patients can also present with fever, loss of appetite and headache.

Indigenous measles virus was declared eliminated from the United States in 2000. However, measles is still endemic in other parts of the world. International travel and incomplete vaccination contributed to the ongoing presence of measles in Michigan. With 19 confirmed cases, 2018 has had the highest rate of measles infections since 1994. Several of these cases have been linked to travel to Israel and Europe where ongoing measles outbreaks are occurring. Continued outbreaks illustrate the importance of full vaccination; two doses of the measles vaccine are 97% effective at preventing measles infection, but a single dose may not provide adequate seroprotection.

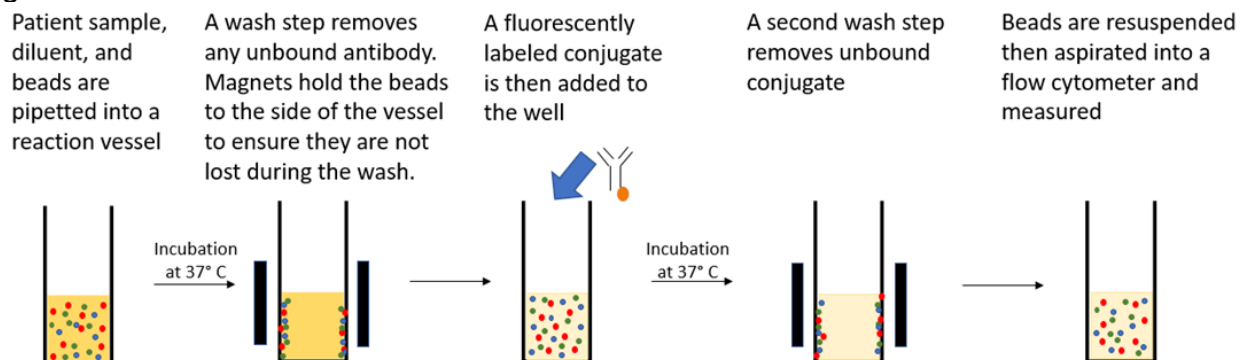
The frequency of mumps infections has dropped by 99% since the introduction of the mumps vaccine in 1967. Outbreaks in the United States still occur sporadically with a few hundred to 2,000 cases reported on average each year. As recently as October 2018, Michigan saw a small outbreak of mumps in students attending the University of Michigan. To date, there have been 11 confirmed and 26 probable cases of mumps in Michigan in 2018. While mumps may occur in highly vaccinated populations. It will propagate more rapidly and widely in unvaccinated groups. A single dose of the mumps vaccine is approximately 78 % effective at preventing mumps. Two doses increased vaccine effectiveness to 88 %.

Testing for measles and mumps at MDHHS Bureau of Laboratories is performed using both molecular and serological methods. Molecular methods are intended to detect the measles or mumps virus directly, while serological methods evaluate the immune response to the pathogens. MDHHS has validated a Real-Time RT-PCR Assay for measles. In this assay, RNA is extracted from an oropharyngeal, nasopharyngeal or throat swab, then reverse transcribed into cDNA. The real-time PCR instruments detect fluorescence from a fluorescent dye that is proportionate to the amount of target nucleic acid present in the sample and produces a qualitative result. Mumps RNA detection is performed by real-time PCR. This allows for analysis of products as amplification is occurring. Acceptable specimens for mumps PCR testing include oral/buccal swabs, cerebrospinal fluid, and viral cultural. The proper timing of the specimen collection for PCR is essential; measles RNA is detectable for up to three to five days after rash onset, and mumps RNA is most likely to be detected closest to parotitis onset as the viral load decreases rapidly after that time.

Serological evaluation for measles and mumps consists of IgM testing for acute cases and IgG testing for immune status concerns. Measles and mumps IgM tests are performed on serum using a classic manual enzyme immunoassay (EIA). Results are based on optical density which is evaluated by a spectrophotometer and may be negative, equivocal or positive. To determine immune status, measles and mumps IgG testing is performed by multiplex flow immunoassay (MIA). This technology allows for the simultaneous detection of multiple analytes. The microspheres are color-coded, magnetic beads coated with an antigen specific to measles, mumps, rubella, or varicella. Serum specimens are added into a reaction vessel and incubated with the antigen coated beads. If the specimen contains antibodies specific for the antigen (because of vaccination or previous infection), the antibody will bind to the beads. The beads are then washed, a fluorescently labeled conjugate is added, and the mixture is incubated again. A final wash step removes any unbound conjugate. Once the beads have been fully resuspended, they are passed singly through a flow cytometer that identifies the bead and measures its fluorescence. Possible results are negative, equivocal or positive. Through the molecular and serological testing at MDHHS, patients can be evaluated for the presence of measles and mumps RNA, IgM antibodies and IgG antibodies allowing physicians to accurately diagnose or rule out infections with these pathogens.

Measles and mumps IgG testing using the multiplex flow immunoassay (MIA).

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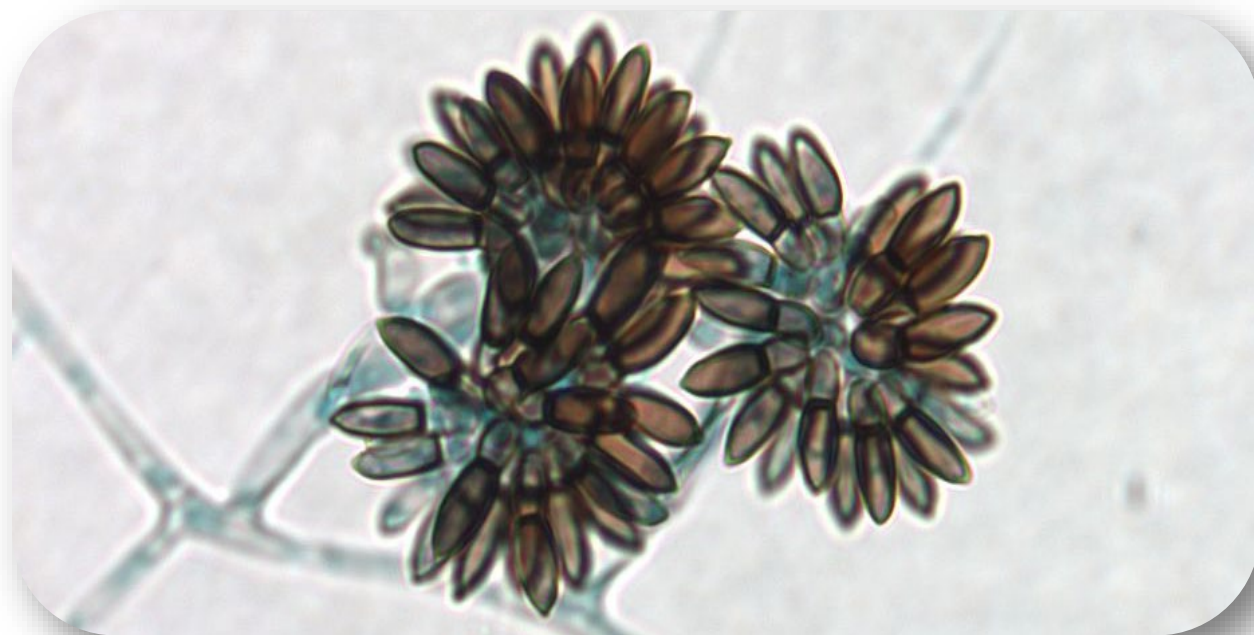


Protocols Validated

21 test validations and verifications performed

Analysis of Serum for Perfluoroalkyl Substances (PFAS) by Automated 96-well Solid Phase Extraction High Performance Liquid Chromatography Tandem Mass Spectrometry (SPE-HPLC-MS/MS)
Measles PCR
Identification of Nocardia species grown on Solid Media using MALDI-TOF
Comparison of replacement BioFire Film Array Instrument to current in-house instrument
Performance Verification of Quanta PerfeCTa Multiplex qPCR SuperMix on the non-Variola Orthopox RealTime PCR
Performance Verification of new BioRad Geenius reader
Metals in Spices, Teas and Supplements
FERN GC-MS Screening of Food Matrices Using TOX1
Validation of CD4/CD8 Weekly vs. Daily Color Compensation
Tandem Mass Spectrometry for the Detection of Amino Acid (AA), Fatty Acid Oxidation (FAO), and Organic Acid (OA) Disorders using the NeoBase2 Kit
Validation of the Roche MagNA Pure24 for Pertussis
Spin Boil DNA Extraction Method for Detection of stx1 and stx2 from GN Broth Cultures
Validation of Thermo MS Compared to Agilent for Tetramine Analysis by GC/MS/MS
RT Polymerase Chain Reaction for the Detection of Trypanosoma cruzi from extracted blood samples

MALDI-TOF for identification of Campylobacter to species level
Identification of Poisons and Toxins Using LC-MSMS
Nerve Agent Biomarkers in Human Serum
Verification of Multitest swabs for rectal and pharyngeal specimens
Agilent 5110 ICP-OES Method extension Verification Study
Validation of NP swabs in Measles PCR (addendum to 18-280-014-295)
Mumps RNA Detection (VM,14) Update



Safety

The Bureau of Laboratories is actively committed to preserving the health and safety of its laboratory staff and to protecting the environment and the community. Below are 2019 safety statistics and activities.

Laboratory Building Upgrades

Steam Line Replacement Project October 2018

Chiller Water System replaced March 2019

Damper Replacement on 2 Exhaust Fans

Low Oxygen Sensors installed where liquid nitrogen is present

Laboratory Safety Actions

One Noise Complaint Investigation

One Biosafety Accident investigation

Two chemical spills/splashes

One MIOSHA Recordable Injury

Conducted Tornado Drill on 3/27/19 and a Fire Drill on 7/31/19 (Included participation by DTMB Infrastructure Protection, Fire Controls Crew and Safety Coordinator, Lansing Fire and EMS and Michigan State Police Capital Post)

Onsite Influenzae Immunization and TB skin test clinics

Five Laboratory safety committee meetings

Safety Training

Twenty six staff received safety orientation and 2 staff received additional safety training due to job transfer

Thirteen individuals attended State Lab Emergency Monitors Training

Six individuals had Hazardous Chemical Waste Transportation and Storage training

Twenty five individuals had Fume Hood Safety Training

One hundred twenty individuals received Annual Bloodborne Pathogens and Chemical Safety Refresher Training

Forty two individuals trained in agent specific biosafety, biosecurity, incident response and insider threat for the select agent program

Eight individuals attended HAZWOPER 8 Hour refresher training

Contact Us:

Michigan Department of Health and Human Services

Bureau of Laboratories

Phone: 517-335-8063

Fax: 517-335-8051

Email: MDHHSLab@michigan.gov

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