Wisconsin State Laboratory of Hygiene
UNIVERSITY OF WISCONSIN–MADISON

2022-2023 Annual Report

TRANSFORMING CHALLENGES FINDING SOLUTIONS

Letter From Our Director

The past several years have presented transformative challenges to public health and environmental protection in Wisconsin, around the country and around the world. The Wisconsin State Laboratory of Hygiene (WSLH) has played a critical role in support of COVID-19 pandemic response including COVID-19 diagnostic testing, COVID-19 variant testing, wastewater surveillance for COVID-19, and occupational safety training to reduce COVID-19 transmission.

Simultaneous with the COVID-19 response efforts, the WSLH continued the laboratory's core public health and environmental testing services and greatly expanded testing for opioid abuse surveillance, environmental testing for "forever chemicals (PFAS)" in the environment, and infectious disease testing for Afghani evacuees who were temporarily settled at Fort McCoy in Wisconsin.

I am so proud of the critical role of the WSLH in supporting these public health and environmental responses and many more, which embody the Wisconsin Idea. Although these challenges are far from over, we have landed in a space that allows us time to reflect over the past several years and plan for future challenges. The staff at the WSLH are the laboratory's most precious resources and their innovation and resilience were critical to the ability of the WSLH to successfully respond to these parallel challenges.

As I look forward, I am committed to further strengthening the WSLH partnerships across UW-Madison, UW System, the State of Wisconsin and beyond. If you have ideas about partnering or would like to know more about the WSLH, please let me know and I would be happy to meet with you.

Kind regards,
James Schauer, PhD, PE, MBA

Director, Wisconsin State Laboratory of Hygiene
Peterson-Rader-Hawnn Professor
William C. Boyle Professor of Environmental Engineering
Civil and Environmental Engineering
University of Wisconsin-Madison

Solving Big Picture Problems

Photo by Jan Klawitter | WSLH

THE CONTINUUM OF COVID-19

When WSLH scientists and staff were paying attention to news stories in late 2019 about a mysterious respiratory virus in China it was concerning, but they never imagined that years later we would still be responding to the COVID-19 pandemic. For the WSLH, pandemic response activities are a continuum – past, present and into the future.

In January 2020, scientists and staff in the WSLH Communicable Disease Division (WSLH CDD), in collaboration with the Wisconsin Department of Health Services (DHS), began coordinating the shipping of samples from suspect cases to the Centers for Disease Control and Prevention (CDC) in Atlanta for testing.

Then in early February, Wisconsin had its first case confirmed by CDC. By early March, WSLH CDD scientists started testing patient samples – one of only two labs in Wisconsin at the time.

And thus began months of extended workdays and 7-day workweeks as WSLH CDD scientists tried to keep up with testing demands while assisting clinical labs throughout the state to bring up their own testing, as well as working with the Wisconsin Veterinary Diagnostic Laboratory to begin testing for UW-Madison students, faculty and staff.

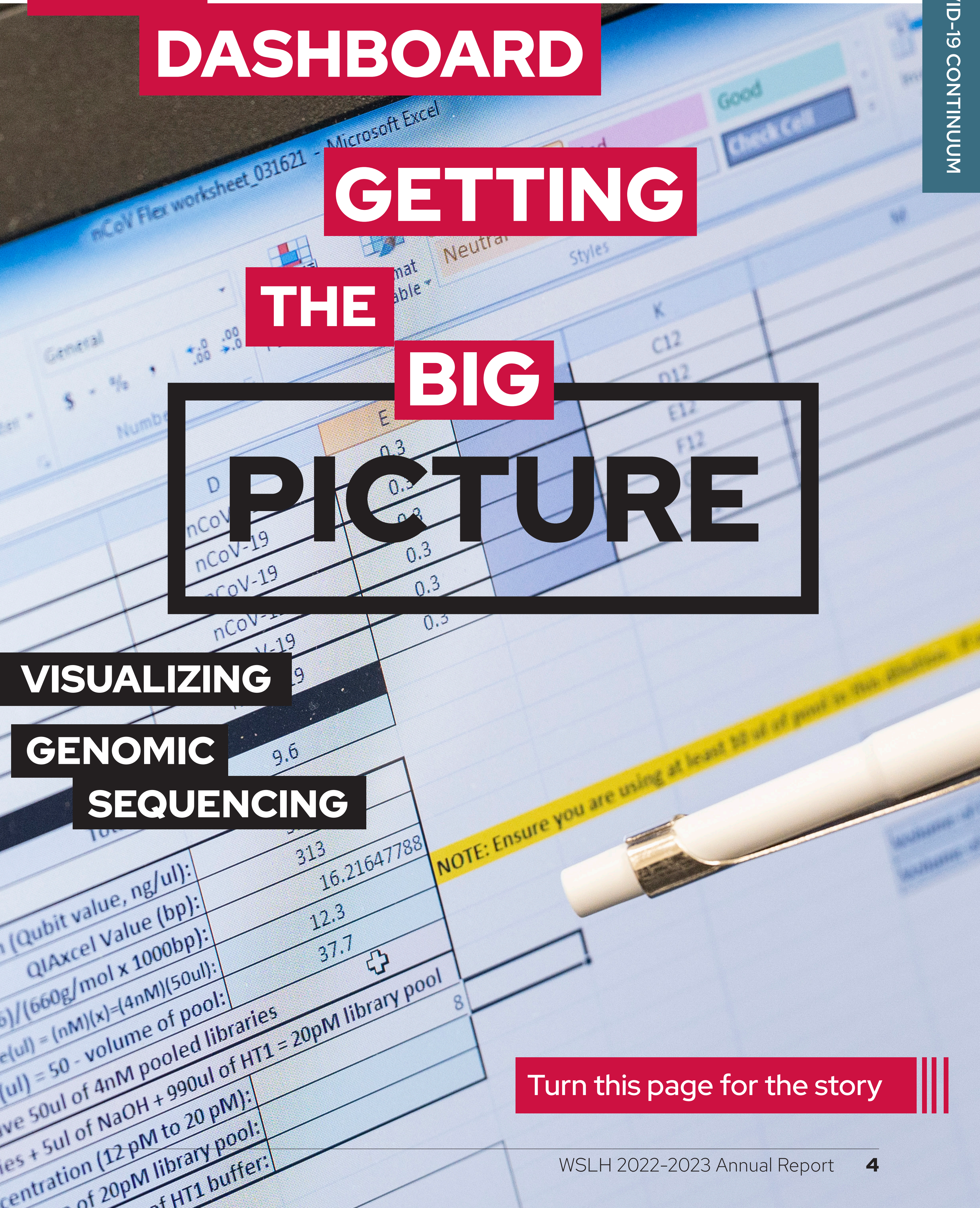
As months stretched into years, the workweeks moved back to six days then five. And while the story for the first year or so was one of testing patient samples in the WSLH Communicable Disease Division, the WSLH's support of pandemic response expanded to include genomic sequencing of COVID variants, tracking disease through wastewater, and helping businesses, including long-term care facilities, protect their workers.

Here are those stories on pages 3 - 6 ...

WSLH DASHBOARD

GETTING THE BIG PICTURE

VISUALIZING GENOMIC SEQUENCING



Turn this page for the story

Visualizing Genomic Sequencing Together

Imagine reading over 75,000 books over the past three years. During the COVID-19 pandemic, our scientists have been voracious readers - of DNA.

Reading the DNA of SARS-CoV-2, also known as "genomic sequencing," is how the WSLH Communicable Disease Division monitors the virus and its variants.

In response, Kelsey Florek, senior genomics and data scientist at the WSLH, created a dashboard for displaying SARS-CoV-2 genomic surveillance in Wisconsin: WI SARS-CoV-2 Genomic Dashboard.

Finding ways to display this information in near-real time has provided the public health community with a fuller, more nuanced picture of pandemic data, mapped across the state of Wisconsin.

The WI SARS-CoV-2 Genomic Dashboard provides near real-time information about the currently circulating SARS-CoV-2 variants in Wisconsin. By sharing this data portal, residents of Wisconsin are able to better understand which variants are in their community and make informed decisions.

For example, clinicians may use this data to estimate the effectiveness of monoclonal antibody therapies, given which variants are circulating at the time.

"The data portal has been a great way for us to share our work with the public. We hope to continue adding new data and dashboards to share more of the great work that is happening here at WSLH," said Florek.

Photo by Bryce Richter | UW-Madison

"The data portal has been a great way for us to share our work with the public. We hope to continue adding new data and dashboards to share more of the great work that is happening at WSLH."

Kelsey Florek
Senior Genomics and Data Scientist

This project is part of Florek's work to build up the genomics and data analytics capacity at WSLH and in the public health community.

Wisconsin ranks 5th among states that sequence SARS-CoV-2 the most, with many leading states having much higher populations. Our success is a result of our genomic leadership in the state and the Wisconsin Clinical Laboratory Network (WCLN), which the WSLH coordinates.

The 130+ clinical labs statewide in the WCLN collaborate with the WSLH for disease surveillance, laboratory diagnostics, training, and emergency preparedness. We could not get the full geographic picture of the virus and its variants in Wisconsin without WCLN's clinical testing, collection, and transport of specimens for sequencing.

In the future, Florek and her team will add more reports and dashboards to the data portal for a variety of different pathogens. The Communicable Disease Division (CDD) will continue to scale up their efforts in DNA sequencing and analytics by training more staff and developing new sequencing and analysis approaches.

For a national picture of the virus, view the dashboard at the Centers for Disease Control and Prevention (CDC).

Hands-On Solutions

Photo by Bryce Richter | UW-Madison

Workplace Safety During Uncertain Times

Stay safe. Do your part.

We remember the challenge of protecting ourselves and others during the onset of the COVID-19 pandemic. In particular, healthcare workers, first responders, and small businesses needed a lot of help staying safe. WSLH occupational safety and health consultants were an important part of Wisconsin's pandemic relief efforts.

The Wisconsin Department of Health Services (DHS) asked us to help them expand SARS-CoV-2 testing and pandemic relief services. As part of that effort, they provided additional funding to the Wisconsin Onsite Safety and Health Consultation Program (WisCon). This funding enabled WisCon to help small businesses and healthcare facilities implement COVID-19 safety protocols.

WSLH is home to WisCon, our state's largest consulting agency in workplace safety and health. They help small businesses maintain safety standards set by the U.S. Department of Labor's Occupational Safety and Health Administration (OSHA).

Through the first two years of the pandemic, WisCon helped hundreds of small businesses develop and implement COVID-19 safety protocols. They built and sent N-95 respirator fit tests to many of Wisconsin's skilled nursing and residential care facilities. During a nationwide shortage of masks, they also helped communities sanitize N95 respirators for reuse.

"We were glad we could be plugged into the COVID relief efforts in this way. It's been rewarding," said Ernie Stracener, WisCon program manager. Stracener attributes their success to their wealth of technical expertise and the strong relationships developed over 40 years of service.

Today, WisCon continues to provide free and confidential workplace safety and health consultation services, including COVID-19/infectious disease control planning through virtual and in-person assessments.

MEET THE SEWAGE SLEUTHS

Everyone poops — a universal fact that has long provided information on disease spread in communities.

For the past three years, the Wastewater Surveillance Team at the WSLH has proven wastewater surveillance is an important epidemiological tool, helping track COVID-19 levels and its variants.

Our laboratory's findings in wastewater have provided public health officials in Wisconsin with a more detailed picture of the virus that other forms of testing cannot easily capture. This nuanced data can lead to a timelier public health response to outbreaks in the future.

During the pandemic's first year, a partnership between the Wisconsin Department of Health Services, the WSLH, the University of Wisconsin-Milwaukee School of Freshwater Sciences and communities across Wisconsin resulted in the creation of a robust statewide wastewater surveillance system.

The participation of wastewater treatment plants and municipal workers in the program is crucial for sample collection and data analysis to track SARS-CoV-2 variants. The WSLH team says keeping wastewater treatment plants (WWTPs) enrolled in the program may be the biggest challenge going forward.

"Their [WWTP] participation needs to be better recognized and acknowledged because they are essential to the program," said Adelaide Roguet, WSLH water microbiology scientist. "No samples, no data."

As they strengthen their collaborations in Wisconsin, the Wastewater Surveillance Team is working with other surveillance networks in the United States to coordinate a nationwide effort, helping other public health laboratories develop their own wastewater surveillance systems. Last year, the Association of Public Health Laboratories (APHL) released a guide to help public health labs build wastewater surveillance programs. Expanding wastewater surveillance efforts across the United States can help direct public health efforts to lessen the spread of variants.

"We are particularly excited about following seasonal flu and RSV in winter and adding gastrointestinal and antibiotic-resistance pathogens in the near future," said Roguet.

Roguet and the rest of the Wastewater Surveillance Team hope the benefits of this program to Wisconsin communities will inspire more laboratories nationwide to join the wastewater surveillance journey.

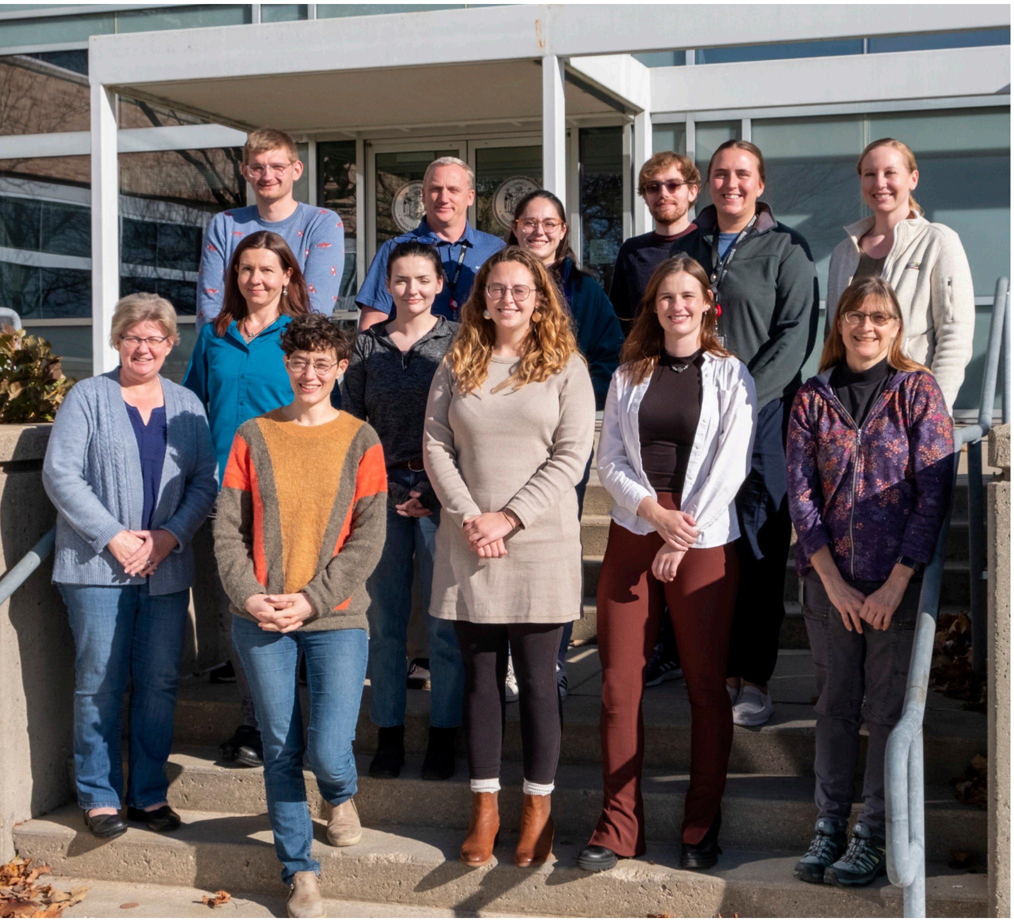


Photo by Jan Klawitter | WSLH

Newborn Screening Program On UW–Madison Campus Helps Millions

Since 1978, more than 2.5 million Wisconsin babies have been touched by the University of Wisconsin–Madison within their first few days of being born.

These newborns have had their dried blood spot samples tested at the Wisconsin State Laboratory of Hygiene (WSLH) on the University of Wisconsin–Madison campus for a variety of rare, serious disorders that, left untreated, can lead to severe health issues and sometimes death. All these disorders are unrecognizable at birth by routine physical examination and require specialized laboratory testing to detect.

Every year about 125-140 of these babies will be confirmed to have one of these serious disorders.

The Wisconsin Newborn Screening (NBS) Program is a collaborative partnership between the WSLH at UW–Madison, the Wisconsin Department of Health Services, hospitals, midwives, physician consultants, genetic counselors and nutrition professionals from around the state. It is a comprehensive public health program encompassing initial specimen collection by birth hospitals and midwives, specimen transport to the WSLH, disorder identification through screening testing at the WSLH, confirmatory testing at hospitals/clinics and, if needed, treatment. Many of the disorders can be treated with medical intervention or special diet management.

"Newborn screening is life-saving and life-changing because it can help babies begin life healthy," explains Mei Baker, WSLH newborn screening laboratory director and UW professor of pediatrics.

When newborn screening testing was consolidated at the WSLH in 1978 there were fewer than 10 disorders on the newborn screening panel. Today, WSLH scientists test for 48 disorders, with two being added in the last few years and another being considered for addition (see box below).

"As knowledge of the causes of genetic disorders increases, detection technologies advance, and better treatment regimens emerge, we expect that more diseases will be added to the NBS panel," Baker said.

Spinal Muscular Atrophy (SMA) affects the motor neurons in the spinal cord that send signals to the muscles to tell them what to do. When these nerves are defective, muscles don't do their job, and become wasted. People with SMA may have difficulty walking, eating, and breathing because of insufficient muscle function. Since October 2019 when the WSLH started screening for SMA, 21 newborns have been identified and confirmed to have the disorder, and all have received appropriate treatment with most of them receiving gene therapy.

Pompe Disease is a lysosomal storage disorder that can damage the body's muscles leading to impaired mobility, as well as impaired breathing and heart function. Newborn screening for Pompe disease started in January 2022, and so far seven newborn babies have been identified with Pompe disease. Currently two FDA-approved drugs are available to treat the disease.

X-linked Adrenoleukodystrophy (X-ALD) is a genetic disorder primarily affecting males in the nervous system and adrenal glands. The myelin sheath that protects nerves in the brain and spinal cord can deteriorate, reducing the nerves' ability to relay information to the brain. X-ALD can result in severe childhood cerebral adrenoleukodystrophy (CCALD). Early detection and subsequent treatment are key as left untreated these children usually live only a few years after symptoms begin. X-ALD screening is being considered for addition.

DEMAND FOR PFAS TESTING ONLY EXPECTED TO GROW IN WISCONSIN

Photo by Jan Klawitter | WSLH

PFAS – the acronym is short but the list of chemicals it represents is long – more than 3,000.

PFAS stands for Perfluoroalkyl and Polyfluoroalkyl Substances. They are human-made chemicals used in a variety of consumer and industrial products, including water-repellant clothes, non-stick cookware, fast food containers and firefighting foam. As with some other manufactured chemicals, they were created for a useful purpose, but they don't break down easily in the environment earning them the moniker of "forever chemicals" and they can potentially cause adverse health problems in people.

Since 2018, the Wisconsin State Laboratory of Hygiene's Organic Chemistry section has focused on developing and implementing test methods for 18 PFAS chemicals in drinking water and 33 different PFAS chemicals in surface water, groundwater, soil samples, and fish. Test results are used by the Wisconsin Department of Natural Resources (DNR) and Department of Health Services (DHS) as they develop regulatory standards, as well as for community PFAS contamination investigations.

Some of the WSLH's test data from fish samples also was used in a national study showing that eating just one freshwater-caught fish was equal to drinking PFOS (one of the major PFAS chemicals) contaminated water for a month. Great Lakes fish had the highest concentration of the chemical.

PFAS TESTING IN WISCONSIN

Q & A

In this brief Q&A WSLH Organic Chemistry Supervisor Erin Mani and PFAS Testing Supervisor Alex Schwartz explain what has happened so far with PFAS testing and what they expect for the future.

How has PFAS testing at WSLH evolved since our start?

PFAS testing has advanced in a lot of ways since we first started testing for it. Initially we were working with the US EPA 537.1 Drinking Water method and a tissue testing method. Eventually DNR released guidelines for PFAS analysis in Wisconsin that expanded the list of compounds being tested for from 18 in 537.1 to 33. Based on these guidelines, we developed methods for surface (non-potable) water, tissue, wastewater, and soils/solids.

These methods have continued to advance and improve as we have worked on them over the years. We have additionally worked with groundwater and precipitation. EPA is in the process of validating a new method, 1633, which is applicable to water, solids, and tissue matrices and we anticipate bringing this method on at some point in the near future.

Aside from updates to the methods/matrices we test, we have also seen a huge increase in demand. As we start to understand the extent of PFAS contamination around the state, country, and world, there is a growing need for testing to determine where the most serious problems are.

The WSLH plays a critical role in developing that understanding through the processing and analysis of samples from bodies of water, fish samples, and public water suppliers (PWSs) around the state.

What does the future of PFAS testing look like?

The future of PFAS testing is a little unclear. We do not anticipate the demand to decrease anytime soon, and in fact expect it to increase.

Now that there are enforceable regulations in the state and federal limits are expected shortly, every public water supplier in the state is required to test. While they have multiple options of which labs to use, we anticipate that as the state public health lab, we will see a good portion of this work come our way.

Additionally we expect DNR, DHS and other state or tribal agencies may want to explore how PFAS impacts different areas of the state and there might be additional projects for these agencies.

With PFAS chemicals emerging as widespread contaminants, WSLH scientists are involved in not only testing for state and national governmental agencies and Wisconsin residents, but also conducting research to help us better understand the sources, fluxes, transformations and fate of PFAS compounds in the environment. At the same time, WSLH research scientists are developing new methods and applying new analytical tools to provide a more comprehensive assessment of PFAS contamination of atmospheric, terrestrial and aquatic environments.

AND

The WSLH PFAS Research Center (PRC) is currently addressing four primary questions:

1. What is the significance of air pathways to PFAS dissemination and transformation?

2. Can specific sources of PFAS be identified from their chemical "fingerprints" (i.e. unique suites of PFAS compounds)?

3. What is the TOTAL burden of PFAS in environmental matrices and what is the fractional contribution and nature of the PFAS compounds that we are "missing" (i.e. the difference between the TOTAL and the typical targeted analysis of just 30+ PFAS compounds)?

4. What are the atmospheric and tributary loadings of PFAS to the upper Great Lakes?

With support from the US EPA Office of Research & Development (EPA-ORD) WSLH initiated a pilot program for long-term monitoring of PFAS concentrations and deposition in precipitation. This effort evolved from pioneering work WSLH scientists performed back in 2019-2020 to document how National Atmospheric Deposition Program (NADP) infrastructure and operations could be adapted for PFAS assessments. The role of atmospheric cycling and deposition of PFAS is poorly characterized and its significance previously under recognized. Recent work documents that PFAS deposition in precipitation can represent a major fraction of the PFAS loading to many terrestrial and aquatic ecosystems.

Before PFAS can be "rained-out" of the atmosphere, it must first be emitted into the atmosphere as vapor or aerosol species. Field and laboratory methods to make these "air-phase" PFAS measurements at pg/m^3 ambient levels are challenging and need further development and validation. To address these questions, the WSLH PRC secured another large grant from EPA-ORD and in spring 2022 initiated a major air monitoring and method validation program for PFAS at two sites in Wisconsin (Madison-Eagle Heights and Baraboo-Devils Lake).

WSLH Senior Scientist and PFAS Research Center Principal Investigator Martin Shafer along with co-principal investigator UW-Madison Civil and Environmental Engineering Professor Christy Remucal secured a 3-year grant from the US Geological Survey (USGS) Water Resources Research Program to quantify multi-media loadings of PFAS to Lake Superior

RESEARCH EXPLORES SOURCES TRANSFORMATIONS OF PFAS

Photo by Jan Klawitter | WSLH

using targeted (LC/MS/MS) and non-targeted (TOF-CIC and qTOF-MS) analyses.

Initiated in early 2022, Shafer and Remucal have quantified PFAS levels and fluxes in 28 Lake Superior Tributaries during snow melt and two baseflow periods in 2022. Stream-bed sediments have also been collected. Weekly precipitation fluxes of PFAS are being quantified at eight NADP/NTN sites located around Lake Superior in Minnesota, Wisconsin and Upper Michigan. They have also obtained sediment cores from the main depositional basins of Lake Superior.

In another collaborative research project focused on atmospheric processing of PFAS, Shafer and co-principal investigator Alex Frie with University of Minnesota-Sea Grant will be applying new analytical tools, including Combustion Ion Chromatography (CIC), high-resolution time-of-flight mass-spectrometry (qTOF-MS) and Total Oxidizable Precursor Assays (TOP), to more comprehensively characterize the PFAS in precipitation collected from additional NADP/NTN sites in Minnesota and Lower Michigan. Sediment receptors will also be characterized.

Remucal and Shafer are also working together on a new grant funded by the Wisconsin Ground Water Coordinating Council. In this study, initiated in fall 2022, they will be applying a suite of advanced analytical techniques to provide a novel characterization of PFAS in disperse sources likely to impact groundwaters. These sources/materials will include wastewater-derived biosolids, landfill leachates, and unique to this study, septage from on-site (home) sewage systems. Also unique to this study is an effort to characterize for the first time, PFAS in well drilling aids (including foams and drilling fluid additives).

In addition to leading the WSLH PFAS Research Lab, Shafer also works closely with officials responsible for PFAS research and policy at EPA-ORD, EPA-OAR, EPA region 5, and WDNR and leads PFAS initiatives with the NADP. Research initiatives and findings have been presented at numerous scientific meetings.

DRUG CRISIS CAUSES DRAMATIC INCREASE IN TOXICOLOGY TESTING

Photo by Ed Oliver | WSLH

The opioid and other drugs of abuse crisis in Wisconsin has taken its toll in many ways. Forensic Toxicologists at the Wisconsin State Laboratory of Hygiene have seen the impact through the dramatic increase in drug testing for Operating While Intoxicated (OWI) and Coroner/Medical Examiner (C/ME) cases.

The Forensic Toxicology Section of the Wisconsin State Laboratory of Hygiene (WSLH) is responsible for nearly 90% of blood alcohol and drug testing for Wisconsin OWI cases. WSLH blood alcohol testing accounts for more than half of all OWI tests in Wisconsin.

Drug testing is far more complicated than alcohol testing, requiring multiple analysts and instruments. OWI drug testing cases at the WSLH have more than doubled since 2014. The increase is due to an overall rise in sample submissions from law enforcement agencies from around the state, coupled with the increase in demand for drug testing due to the opioid crisis.

Although opioids grab the headlines, THC continues to be the most common drug detected in impaired drivers. The next most common drug reported was methamphetamine. Additionally, most drug cases reported by the WSLH contain more than one drug.

WSLH forensic toxicologists also testify in nearly 300 court cases annually. In 2022, they testified in 59 Wisconsin counties (in-person or virtually).

In addition to OWI testing, the WSLH provides testing for Wisconsin's Coroners and Medical Examiners (C/ME) in non-felony crime death investigations. Since 2014, the C/ME drug testing caseload has more than quadrupled. The opioid crisis in Wisconsin has created a greater need for more testing of C/ME samples, which includes both alcohol and drug testing in death investigations.

In addition to their work for Wisconsin's law enforcement agencies and C/ME's, WSLH forensic toxicologists have been collaborating with epidemiologists at the Wisconsin Department of Health Services and with national partners like the Association of Public Health Laboratories (APHL) and other state public health labs on drugs of abuse biosurveillance to understand drug usage trends.

"The WSLH provides a unique opportunity for a forensic laboratory to reside within a major public health laboratory in a Big 10 university," explains WSLH Forensic Toxicology Director Amy Miles. "The WSLH has provided this perspective to national partners such as the Centers for Disease Control and Prevention (CDC) and the Association of Public Health Laboratories (APHL)."

APHL's Overdose Biosurveillance Task Force, which is co-chaired by Miles, has allowed for a cross-discipline collaboration regarding drug trends within impaired driving, post-mortem and hospital emergency departments.

"The taskforce is exploring polysubstance testing using the confluence of forensic and public health lab testing," said Miles.

Barkholtz Links UW School of Pharmacy and WSLH Forensic Toxicology

Heather Barkholtz joined UW-Madison in 2021 in a joint faculty position with the UW School of Pharmacy and the Wisconsin State Laboratory of Hygiene Forensic Toxicology section with a goal to enhance collaboration between the WSLH and the School of Pharmacy to advance innovation in opioid and drug abuse surveillance and foster translational research, teaching, and outreach to support public health surveillance and testing. In just a few years she is well on her way to meeting and exceeding her initial plans.

Barkholtz, an assistant professor in the UW School of Pharmacy's Pharmaceutical Sciences Division, has brought in nearly $750,000 in federal research funding from the U.S. Department of Justice through two grants to address novel psychoactive substances (NPS) trends in combination with the evolving opioid epidemic.

The first grant funds the purchase of state-of-the-art instrumentation to allow WSLH forensic toxicologists to implement more selective, sensitive, and efficient methodology for the identification and quantification of emerging NPS, including synthetic opioids and synthetic cannabinoids.

The second research project funded by a grant from the National Institute of Justice (NIJ), the research, development and evaluation agency of the U.S. Department of Justice is entitled *Illuminating the Dark: Molecular Networking as a Novel Psychoactive Substance Identification Strategy*.

According to Barkholtz, illicit use of novel psychoactive substances (NPS) such as "spice" and "bath salts" have become increasingly popular among drug users. When a NPS emerges, its chemical structure is not known to forensic toxicologists seeking to detect them in impaired drivers, drug-facilitated crimes, overdose incidents, etc. When these NPS go undetected in forensic laboratories, public health, law enforcement, and medical professionals do not have complete information from which to make decisions.

Barkholtz, along with co-collaborators at the WSLH and in the UW School of Pharmacy, School of Medicine and Public Health and College of Engineering, also received a UW Institute for Clinical and Translational Research (ICTR) pilot award to look at the impact of cannabis isolates on driving. The goal of the project is to establish an independently-funded cannabis pharmacology laboratory whose aim is to understand and quantify the impacts of intra- and inter-personal variability on cannabis impairment, the occurrence and severity of adverse events, and therapeutic applications.

"Working alongside Hygiene Lab personnel gives me a unique insight into pain points or areas in need of research," Barkholtz said. "I can then dive in to these research questions, with the help of UW-Madison's high-performing students. This unique position facilitates additions to the body of knowledge, aiding the Hygiene Lab and the UW School of Pharmacy through curation of scholarly products that are directly applicable to real-world problems."

Barkholtz credits her dual appointment with allowing her to mentor undergraduate and graduate students.

"Currently, three undergraduate students from the School of Pharmacy and one graduate student from the Chemistry Department are working in the lab. These students have an interest in forensic science or public health, and get the opportunity to work alongside Wisconsin's experts in these fields," Barkholtz explains.

According to WSLH Forensic Toxicology Director Amy Miles, Barkholtz has provided the WSLH Forensic Toxicology Section with a unique opportunity that does not exist in any other forensic laboratory.

"The section has a direct connection to filling research gaps in forensic toxicology, "Miles said. "When the section identifies an area that needs research or assistance in finding literature and other resources, Dr. Barkholtz immediately responds. [...] With states progressing toward decriminalizing marijuana, Dr. Barkholtz will be able to provide much-needed information in this area. Dr. Barkholtz's connection with the WSLH and the School of Pharmacy will foster collaborations and further research in drugs and human performance. Something that has been lacking in forensic toxicology, until now."

FINDING ANSWERS FOR WISCONSIN FAMILIES

WSLH's Cytogenetics & Molecular Genetics Program Detects Rare Diseases with Post-Mortem Genetic Testing Partnership

The situation is terrifying. A seemingly healthy person suddenly collapses – unconscious – and tragically dies from cardiac arrest. Oftentimes sudden, unexplained cardiac death can also happen during sleep. Family members in their grief ask "Why?" and maybe even "Can it happen to us too?

For the past 6 years, our Cytogenetics and Molecular Genetics program has helped families in Wisconsin find answers. Having an answer to a loved one's cause of death provides an opportunity for closure. Once identified, healthcare providers can test blood relatives for the often-treatable genetic conditions. Between 2016 and 2021 we tested 18 deceased patients, 7 of whom had rare genetic conditions that led to sudden cardiac death. Surviving family members are now getting the treatment they need.

"This program aims to make post-mortem genetic testing more accessible for Wisconsin residents," said Vanessa Horner, director of the Cytogenetics and Molecular Genetics program and UW associate professor of pathology and laboratory medicine. "Insurance will often not cover the cost, and lack of awareness can mean that an appropriate specimen is not available for testing." She adds that the program aims to remove barriers to access by building awareness about post-mortem testing.

Publishing papers, creating partnerships, and giving talks are ways Horner and her team have built awareness. As a result of their efforts, UW Health now has a protocol for post-mortem genetic testing in cases of sudden unexplained infant death. This protocol now provides information to families in a time-sensitive manner. The program is now working to increase awareness of the program with coroners and medical examiners across the state.

In a recent survey, 60% of Wisconsin coroners and medical examiners said that they were not aware of post-mortem genetic testing. Of the remaining 40% who were, many indicated that they did not know when or how to order the test. Horner and her team are talking with many coroners and medical examiners about the program. They hope coroners and medical examiners feel more informed in providing this service to eligible families in Wisconsin.

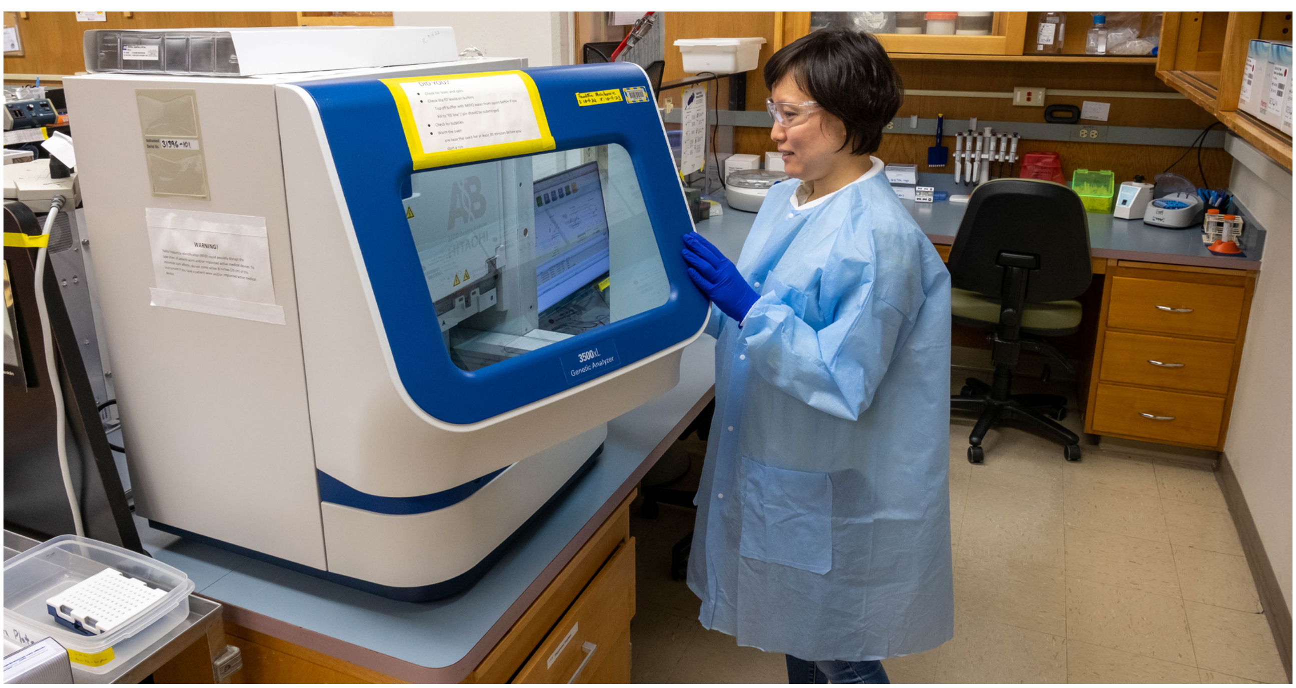


Photo by Jan Klawitter | WSLH

AIR, WATER, NOW SOIL AND FORAGE TESTING AT WSLH

Photos by Michael P. King/UW–Madison CALS

Farmers, crop consultants, gardeners, researchers, and others rely on soil analysis services to help them grow. People look to the Soil and Forage Analysis Lab at UW-Madison for the information they need to make important decisions. As of late 2021, the Soil and Forage Analysis Lab moved their lab location from Marshfield, Wisconsin to the State Lab of Hygiene in Madison. Now the lab is getting the boost they need to grow their efforts throughout the state.

At WSLH, the Soil and Forage Analysis Lab will have the capacity to expand their reach and deepen their impact in Wisconsin. The lab processes thousands of samples every week. With updated facilities, the Soils and Forage Analysis Lab has reviewed their processes to continue to provide high-quality and timely services. This means that the lab will be able to provide more soil testing services to more people.

"We are poised to begin an exciting period in the lab's history, exploring new methods of soil analysis and how they can benefit our agricultural systems and environment," said Andrew Stammer, director of the Soil and Forage Analysis Lab. Since 2018, Stammer has served as the lab's director, serving Wisconsin agriculture by providing farms, agribusinesses, and homeowners with high-quality soil, forage, manure, and plant analyses, as well as working with clients on soil fertility and nutrient management issues.

The people of Wisconsin will continue to benefit from the lab's services by gaining access to updated testing methods that develop from these research activities. Now at WSLH, the Soil and Forage Analysis Lab will have more time and resources to build partnerships with researchers and others on the UW-Madison campus. Innovative testing methods result from these collaborations between the lab and researchers conducting agricultural or sustainability projects.

For more than 100 years, the Soil and Forage Analysis Lab has provided valuable services to Wisconsin. At WSLH, the lab will be able to provide the same high-quality service and aid the WSLH Environmental Health Division in deepening our impact. In regard to sustainability, the Environmental Health Division will be able to more cohesively test and analyze the quality of our environments in Wisconsin. We will have a fuller picture of how to improve and maintain healthy environments, testing the quality of air, water, and now land.

WSLH CYTOLOGY PROGRAM

The Cytology laboratory at the Wisconsin State Laboratory of Hygiene (WSLH) was created in 1947 by then director Dr. William D. Stovall at the inception of nationwide cervical cancer screening. At that time, cervical cancer was one of the most common causes of cancer related death for American women.

Due to the success of the Pap test in screening for the early precursors of cervical cancer and identifying patients for early treatment, cervical cancer rates dropped drastically over the ensuing decades. Despite this success, there has recently been a plateau in cervical cancer mortality, predominantly due to a persistent gap in access to appropriate cervical cancer screening.

In 1947 Dr. Stovall sent WSLH Medical Technologist Norma Arvold to train with Dr. George Papanicolaou, the founder of clinical cytology and inventor of the Pap smear. Upon her return Arvold established the cytology unit within the pathology section of the WSLH and began to train additional personnel in this new discipline.

“While the profession of cytotechnology initially grew out of need to expand the workforce for reviewing Pap tests beyond the available pathologists, cytotechnologists have become indispensable in a team approach to cytology, with unique skills and expertise that complement the work of pathologists,” said WSLH Cytology director and UW assistant professor of pathology and laboratory medicine Kaitlin Sundling. “Cytotechnologists at the WSLH hold leadership positions in our state cytology professional organization and are active members of our national organizations.”

“Local and national advocacy are the key factors in ensuring that the profession continues to serve public health interests,” notes Joshua Faulkes, Cytotechnology Program director at UW-Madison.

WSLH Cytology works with a diverse group of clients (reproductive health clinics, county clinics and local health departments, prisons, universities, and Tribal health centers) mostly through the Wisconsin Department of Health Services (DHS) to provide cytology and molecular testing to populations in need. The DHS contract allows WSLH cytotechnologists to test samples from more than 10,000 patients annually and provide histological follow up for patients who have abnormal results.

More Than 70 Years of Cancer Screening and Training Healthcare Professionals

Cytology Training Program Provides Critical Hands-On Learning Experience

In addition to clinical testing, the WSLH Cytology Section houses the University of Wisconsin – Madison Cytotechnology Program. This accredited one-year certificate training program was established at the WSLH in 1957 and has been training classes of up to 12 students a year for decades.

The program is 39 credits and is completed following a bachelor's degree, or, for 3+1 students, as a final year in which the credits transfer back to the student's home institution toward completion of their bachelor's degree.

"Throughout their year with us, students master the screening skills, diagnostic skills, and medical knowledge they will need to guide collection and evaluation of minimally invasive samples from any part of the human body," Sundling explains.

"In preparing our students for an ever-evolving field, we also include instruction in laboratory operations, molecular biomarker testing, and a dedicated 2-week cytogenetics course led by Kimberly Anderson and her colleagues in the WSLH Cytogenetics Laboratory."

Cytotechnology students also complete clinical rotations at UW Health and SSM Health, as well as participating actively in clinical work at the WSLH. These hands-on experiences capstone students' training before they sit for their Board of Certification exam and become certified Cytotechnologists.

> "Our program is paramount to the effectiveness of Wisconsin's public health workforce for cancer screening and diagnosis."
>
> Kaitlin Sundling
> Director of Cytology

Over the past three years, 22 students have completed the program. All have moved on to positions in cytotechnology or related fields, and many have chosen from multiple job offers prior to program completion.

Despite a nationwide shortage of cytotechnologists due to growing needs within the field and an aging workforce, only 18 cytotechnology programs remain nationally.

"Our program is the only program remaining within the state of Wisconsin. Regionally, the nearest programs are at Mayo Clinic, University of Nebraska, Cleveland Clinic, and Indiana University, leaving nearby states Illinois, Michigan, and Iowa without cytotechnology programs," Sundling said. "Most of our graduates find employment in the Midwest with over 30% remaining in Wisconsin."

"Our program is paramount to the effectiveness of Wisconsin's public health workforce for cancer screening and diagnosis. We are working on plans for a more flexible certificate option that will make our program more appealing to working students as well as meeting the needs of employers ranging from commercial laboratories to healthcare settings to public health laboratories like ours."

JOINT WSLH-UW ACADEMIC APPOINTMENTS

Many WSLH senior scientists have joint appointments in academic departments at UW-Madison, as well as other UW System schools

UNIVERSITY OF WISCONSIN-MADISON

School of Medicine and Public Health

Kimberly Anderson
Adjunct Assistant Professor
Academic Affairs

Mei Baker,
Professor (CHS), Pediatrics;
Affiliate Faculty
Population Health Sciences, Pathology and Laboratory Medicine

Allen Bateman
Public Health Program Faculty
Master of Public Health (MPH) Program

Vanessa Horner
Associate Professor (CHS)
Pathology and Laboratory Medicine

Roberto Mendez
Assistant Professor (CHS)
Pediatrics

James Schauer
Affiliate Faculty
Population Health Sciences

Xiangqiang Shao
Assistant Professor (CHS)
Pediatrics

Kaitlin Sundling
Assistant Professor (CHS)
Pathology and Laboratory Medicine

Alana Sterkel
Assistant Professor (CHS)
Pathology and Laboratory Medicine

School of Pharmacy

Heather Barkholtz
Assistant Professor
Pharmaceutical Sciences Division;
Affiliate Faculty
Molecular and Environmental Toxicology

College of Engineering

Ross Edwards
Affiliate Faculty
Civil and Environmental Engineering

James Schauer
Peterson-Rader-Hawn Professor
William C. Boyle Professor of Environmental Engineering
Civil and Environmental Engineering;
Affiliate Faculty
Chemical and Biological Engineering
Mechanical Engineering;
Program Faculty
Environmental Chemistry and Technology

Martin Shafer
Associate Scientist
Environmental Chemistry and Technology

UNIVERSITY OF WISCONSIN WHITEWATER

College of Business and Economics Department of Occupational and Environmental Safety and Health

George Gruetzmacher
Adjunct Faculty

UNIVERSITY OF WISCONSIN LA CROSSE

Alana Sterkel
Adjunct Faculty

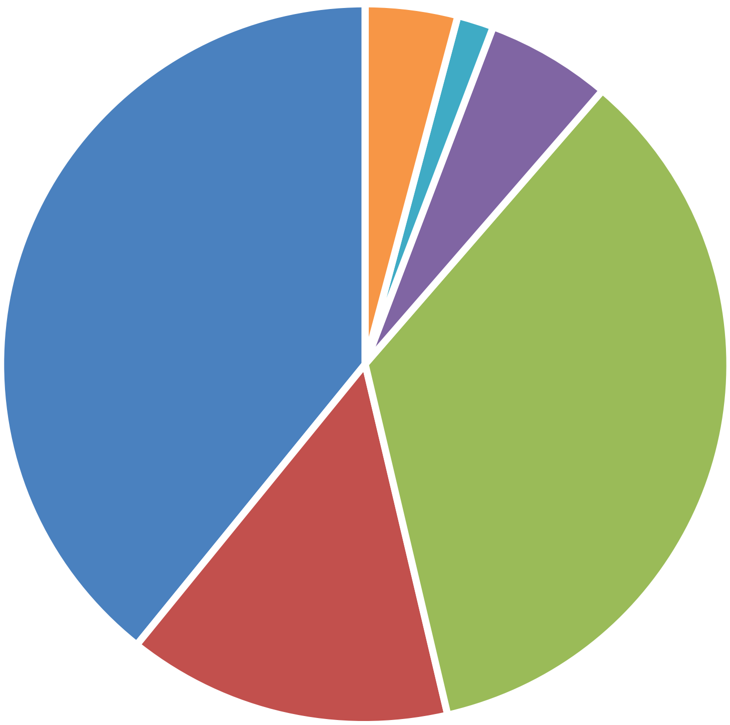
FISCAL YEAR 2022 FINANCIALS

REVENUES

Clinical Testing	$18,904,219	32%
State General Program Revenue	$12,030,200	21%
Research Grants	$7,013,174	12%
Environmental Testing	$6,380,267	11%
Newborn Screening	$4,396,974	8%
Proficiency Testing	$3,467,620	6%
Occupational Health	$1,893,044	3%
National Atmospheric Deposition Program	$1,632,233	3%
OWI Driver Improvement Surcharge	$1,619,200	3%
WI DHS Supplemental Contracts	$893,675	2%
Investment Income	$4,595	0%
TOTAL REVENUES	**$58,235,201**	**100%**

HOW WE USE OUR FUNDS

Salaries	39%
Fringe Benefits	14%
Supplies and Services	35%
Building Rent	6%
Overhead Transfers to UW	2%
Depreciation	4%
Other	0%



THE LEADERSHIP AT WSLH

BOARD OF DIRECTORS

Appointed by Governor of Wisconsin

Member	Representing
Robert Corliss, MD	Clinical Laboratories
Jessica Blahnik	Coroners and Medical Examiners
Jennifer Buchholz	Environmental Laboratories
Jeffrey Kindrai	Local Health Departments
Christopher Strang, PhD, MPH, CIH, CSP	Occupational Health
Gina Green-Harris, MBA	Public Member

University of Wisconsin-Madison and Wisconsin State Agencies

Member	Representing
Anjon (Jon) Audhya, PhD	Chancellor, UW-Madison and Dean, School of Medicine and Public Health
Mark Werner, PhD	Secretary, Department of Health Services
Greg Pils	Secretary, Department of Natural Resources
Gil Kelley	Secretary, Department of Agriculture, Trade and Consumer Protection

WSLH KEY STAFF CONTACTS

James J. Schauer, PhD, PE, MBA - WSLH Director
wslhdirector@slh.wisc.edu | 608-890-1569

Errin Rider, PhD, D(ABMM) – WSLH Associate Director, and Director, Clinical Laboratory Services
errin.rider@slh.wisc.edu | 608-890-1093

Steve Strebel, WSLH Interim Associate Director for Non-Clinical Testing & Director, Wisconsin Occupational Health Laboratory - WOHL
steve.strebel@slh.wisc.edu | 608-224-6216

Allen Benson - Chief Information Officer
allen.benson@slh.wisc.edu | 608-221-6269

Kevin Karbowski, MHSA, CPA, Chief Financial Officer
kevin.karbowski@slh.wisc.edu | 608-265-4511

Nancy McLean - Human Resources Director
nancy.mclean@slh.wisc.edu | 608-890-3008

Jan Klawitter, MA - Communications Manager
jan.klawitter@slh.wisc.edu | 608-265-2529

Background Photo by Michael P. King/UW–Madison CALS
Cover Page Foreground Photo by Bryce Richter/UW-Madison
Back Page Foreground Photo by Jan Klawitter/WSLH
Annual Report Stories: Jan Klawitter and Megan Flowers/WSLH
Annual Report Design: Megan Flowers/WSLH

Wisconsin State
Laboratory of Hygiene
UNIVERSITY OF WISCONSIN–MADISON

www.slh.wisc.edu