University of Wisconsin–Madison Researchers on the Forefront of COVID-19 Research

The Wisconsin Idea in Action

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Photos by UW Communications

Office of the Vice Chancellor for
Research and Graduate Education
UNIVERSITY OF WISCONSIN–MADISON

Steve Ackerman

Dear Reader,

Last year, as a result of the COVID-19 global pandemic, research on the University of Wisconsin-Madison campus was mostly halted with the exception of COVID-19 response research, therapeutics and a few other exceptions. Most research moved from campus, to kitchen tables, basements and the living rooms of our homes. I think all research was impacted by the pandemic response in some way. It might have been access to labs, but also libraries, field stations and human subjects. We faced travel restrictions and remote meeting challenges.

But while some research was slowed and even halted, many researchers on campus found themselves busier than ever as they pivoted to COVID-19 response. In fact, in record time, we put together public-private partnerships of scientists, engineers, public health experts, manufacturers and many others to address the pandemic. Our research support teams stepped in and we quickly pooled our expertise and resources to become a national leader in responding to and studying impacts of COVID-19.

In this report, we highlight areas of the campus research response to COVID-19 in 2020. More stories can be found online at https://covid19.impact.wisc.edu/ and https://covid19.impact.wisc.edu/stories/. We've learned a lot about COVID-19 since it emerged, but recognize that there is still much we do not yet know.

UW–Madison is a top 10 public research university and a resource that can help light the way to finding a vaccine for COVID-19, but also much more. It's been inspiring to see how our world class researchers at the UW–Madison have hit the ground running and are on the forefront of fighting COVID-19, by studying the virus from different angles and disciplines. We know this research is vital to our country's health and our ability to recover and rebuild after this crisis and to prevent future ones. In some cases, time is critical to discovery.

The pandemic has demonstrated that the UW–Madison research enterprise is resilient. It also exemplifies how a diversified, low-density, and network-based research enterprise might be structured. In the coming year, we will find ways to enhance our resilience and better understand our inevitable new research environment.

First and foremost, we want to make sure that research is conducted safely and practices minimize the risk of transmission. Working within those essential parameters, our COVID-19 research response is robust and epitomizes the Wisconsin Idea in action.

Steven A. Ackerman
Vice Chancellor for Research and Graduate Education
University of Wisconsin-Madison

Virus Response Drives Innovation

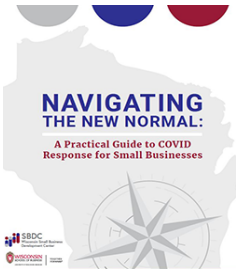
Photos courtesy UW–Madison Engineering

Badger Shield: The engineers whose Badger Shield design drew worldwide demand are back with a pandemic-inspired design that increases face mask effectiveness. The innovation came after a study by UW–Madison professors of mechanical engineering **Scott Sanders** and **David Rothamer**, that revealed that various masks and face shields allow tiny particles to escape through the material and at the edges. Sanders created a demonstration of how coughs spread viruses with wearing a mask. Sanders and Rothamer usually study combustion engines and use laser illumination to find the leaks. In April 2020, though, they turned their expertise and tools toward solutions to the growing pandemic. The result is the Badger Seal, the mask fitter is a soft, adjustable "frame" with elastic worn either as ear loops or the head. With readily available materials, the fitter is easy to make at home. They also leaned on **Lennon Rodgers**, who specializes in engineering design and directs the Grainger Engineering Design Innovation Laboratory, the engineering makerspace at UW–Madison, which pioneered several personal protective equipment (PPE) solutions now in wide use. Rodgersled the iterative engineering design and prototyping process.

Biobanking plasma: In the spring of 2020, when most research became remote, efforts picked up at the UW Carbone Cancer Center Translational Science Biocore BioBank as researchers across campus began pivoting their studies to address the SARS-CoV-2 virus (COVID-19). To do their research, they needed blood product samples from patients. They could find those samples at the TSB BioBank. UW School of Medicine and Public Health immunologist **Miriam Shele**f, who focuses on understanding rheumatoid arthritis to inform clinical care and treatments, was one of those researchers. She sent emails to see if anyone at UW–Madison was banking plasma or other blood products from patients recovering from the virus. Her group had previously established a biobank, or biological repository, of serum, plasma and other blood products from rheumatoid arthritis patients. "No one knew of anyone doing that and so I got started," says Shelef professor in the Department of Medicine.

Shelef applied for and received a research grant from the Wisconsin Partnership Program's COVID-19 Response Grant Program. With the grant, she established the COVID-19 Convalescent Biobank, a biorepository for blood samples from individuals who have recovered from COVID-19. Shelef also reached out to **Kristina Matkowskyj**, associate professor in the Department of Pathology and Laboratory Medicine, for help storing and distributing collections. Matkowskyj, who is director of the UW Carbone Cancer Center TSB BioBank, led the collection of samples from hospitalized patients acutely ill with COVID-19.

COVID Crush game: UW–Madison social epidemiologist **Malia Jones** and her colleague **Caitlin Bourbeau** created **COVID Crush**, a game meant to help simulate the transmission of a disease like COVID-19. It allows players to experiment with physical distancing scenarios, watching how it leads to or limits the spread of COVID-19 in a population of 1,000 dots, which represent individual people. **Watch the video and learn how to play COVID Crush.**



SBDC Publishes COVID-19 Workbook for Small Business: Staff at the UW–Madison Small Business Development Center created a workbook to help entrepreneurs navigate their COVID-19 response. *Navigating the New Normal: A Practical Guide to COVID Response for Small Businesses* uses business fundamentals and best practices to help entrepreneurs assess their situations and plan for a future, which may include COVID-19. The free guide was designed with funds from the CARES Act. "In *Navigating the New Normal,* we use a checklist format to help small business owners reflect on their experiences, realize how much they've already accomplished, and think through their next steps in a structured way," says **SBDC Director Michelle Somes-Booher**. "Our goal is to bring them back to their business planning basics and help them evaluate."

Covid-19 Economic Impacts, Consumer Behavior and Work

Buying habits: COVID-19 research at UW–Madison is tracking how the pandemic has altered not just what consumers are buying, but *how* they are buying it. Wisconsin School of Business faculty have been following the pandemic-influenced consumer marketplace. **Joann Peck,** professor of business and associate professor of marketing, studies how people are trying to exert some control in some domain of their lives as well as social distancing as the norm and changes in shopping routines, especially grocery shopping, and have discovered the ease and convenience of online shopping.

Digital adaptation: Kevin Chung, assistant professor of marketing, is looking at the incredible pace of digital adoption by industry and consumers during the pandemic and how it looks like it is here to stay because people are realizing that these food delivery apps, curbside pickups, etc. work well and make people's lives more convenient.

Shift to online shopping: Hart Posen, professor in business and management and human resources, is studying the shift to online shopping, and most notably in grocery, in which online shopping has traditionally lagged. Ordering groceries online may be a lasting trend post-pandemic. But, Posen also notes that COVID has proven that brick-

and-mortar retail is very far from dead. “We very much want to shop in person—for clothes, food, and many other types of household products—because we enjoy doing so,” he says. Posen notes that retailers have been affected differently by the pandemic. Some companies are well-positioned to survive. Others will likely disappear from the retail landscape. For many firms, the pandemic has forced creativity, flexibility and innovation. Posen also says that companies are showing that they can develop products remarkably fast when called upon to do so. “One thing this crisis has shown is the payoff to being flexible,” he says. “It takes being able to respond quickly.”

Remote work: Jirs Meuris, assistant professor of management and human resources and faculty affiliate with UW–Madison’s Institute for Research on Poverty and the Center for Financial Security, describes how boundaries between work and home are now particularly fraught with so many employees working remotely. “One word that stands out to me in thinking about how this pandemic is affecting employees is ‘uncertainty.’ Normally when people experience uncertainty in their work—such as pay or hours—they tend to remove themselves from that situation. Now people can’t get away from this kind of risk and uncertainty, so they have to find some way to cope with it.” He is also studying the boundaries of work and identity. “Normally, people can go from about 9 to 5, and they leave at five and they can physically get away from work. Whereas now, with everyone being at home, let’s say it’s 5:30 and your boss says, ‘Hey, can you do this,’ then that boundary has loosened. These boundaries are going to be an issue and they’re going to differentiate between people who can do work anytime from people who have to set those boundaries even though they’re at home.”

Audit training: Physical distancing has affected not only how audit firms do business, but how younger audit professionals learn, says **Emily Griffith**, professor for Inspired Learning in Business and an assistant professor of accounting and information systems. She shares how the pandemic has disrupted the model: “It’s a team-based approach, and the audit team is such a fundamental way that people get trained and learn how to do the job. That’s completely different now because everyone is working remotely via Zoom, so they’re having to totally change the way they do their work. It’s like anything, you establish a rapport with auditors, but no one loves when the auditor comes, right? You work really hard as an auditor to establish positive relationships, make things go smoothly, and help your clients not dread your arrival every year. Now that’s kind of all out the window.”

Female leaders: Alex Stajkovic, associate professor of management and human resources, and **Kayla Sergent,** assistant professor of management at Edgewood College, found that U.S. states with women governors at the helm had fewer COVID-19 deaths. There were several reasons for this, including the ability to bring in other voices and viewpoints.

Consumer behavior: Evan Polman, associate professor of marketing, is an expert in consumer behavior and decision-making, but even he has seen unprecedented shifts brought on by the coronavirus pandemic. Polman says the uncertainty of our lives now

links what he calls the “three Cs: Consumer Behavior, COVID, and Curiosity,” making us wonder how others are doing and how they are impacted.

Nancy Wong, professor and chair of the Consumer Science Department at UW–Madison’s School of Human Ecology, is researching consumer behavior in relation to health care, personal finance and sustainability.

Real estate: Mark Eppli, director of the James A. Graaskamp Center for Real Estate and a faculty associate in real estate and urban land economics, notes that while the U.S. residential and commercial real estate markets are prone to fluctuation during a crisis, impacts imposed by COVID-19 have differed from those in previous economic downturns. Pre-coronavirus, the U.S residential housing market was strong. The COVID-19 crisis has forced a significant shift—and it’s going to look bleak, at least for a while, Eppli says. He expects we will see a decrease in new sales for two main reasons. First, real estate is an “in-person transaction.” Second, uncertainty is a huge factor. Roughly 10.7 million households also are severely rent burdened in the U.S., Eppli says, and that means struggling to survive, much less save. Lodging and retail are “really challenged.” With the onset of COVID-19, many hotels completely shut down while others struggled to stay open with minimum occupancy. Construction, considered an essential business in Wisconsin as in many states, continues, but Eppli predicts future slowdowns.

How firms handle upheaval: Dan Wangerin, associate professor of accounting and information systems, shares his insights on what he’s observing with tax practices, financial reporting, and how firms are responding to the coronavirus pandemic and five things to know about how firms are handling the upheaval, including asset valuation: asset write-downs and impairments are a big focus; different sectors of the economy are affected in different ways; we’re seeing more tax credit carryforwards but more uncertainty; uncertainty makes asset valuation an even trickier task; and the economic downturn is impacting loan loss reserves.

Supply chains: Supply chains are an area of expertise for **Greg DeCroix**, professor in supply chain management and academic director of the Grainger Center for Supply Chain Management, and **Pete Lukszys**, Wisconsin School of Business senior lecturer. “Whether it’s personal protective equipment, testing supplies, or food, a lot of our supply chains have really been struggling over the last couple of months,” DeCroix says. Lukszys is part of a core campus team, including the UW–Madison’s School of Human Ecology and the UW College of Engineering, that worked to design, prototype and locally contract a manufacturer for a procedure mask. DeCroix and Lukszys were asked to evaluate the university’s PPE supply and demand, tasked with understanding how much PPE campus has, where it is stored and at what rate it is being used. UW Health reached out to DeCroix and Lukszys on forecasting demand for hospital masks and gowns.

Entrepreneurship: Jon Eckhardt, associate professor, faculty affiliate with the Weinert Center for Entrepreneurship, Discovery Fellow at the Wisconsin Institute for Discovery, and professor in business leadership, has been studying how the current economic

crisis impacts entrepreneurship and the entrepreneurial workforce. He has found that many existing startup companies with high quality products are struggling to land customers and this will impact their ability to raise capital. Second, he is concerned about how the crisis may be affecting the pipeline of future entrepreneurs.

Human capital: Russ Coff, professor and department chair, academic director of the Bolz Center for Arts Administration, and distinguished chair in business, studies human capital as a source of competitive advantage. One project that he is leading looks at how businesses can restart given that many contract agreements and understandings have now been broken as a result of COVID-19.

Labor force: Sarada, assistant professor of management and economics, is studying what's going to happen with the labor force and what's going to happen with entrepreneurship. The first is really this unequal effect of the crisis on low wage workers. The second is, in a very short time, we'll have this capital crunch for entrepreneurship. She notes that communication is really important. "Now companies are going to have to think about, how are we going to restructure meeting rooms? How do we make remote workers feel valuable? How do we deal with workers who have to care for children when schools are closed? I think companies are going to have to battle that because when the economy comes back, and it will, and always does—I say this with good confidence, I hope so—they're going to have to deal with attracting those workers back.

Testing

Due to the increasing number of COVID-19 cases, several labs in Wisconsin – Promega, Exact Sciences, UW Health and the Marshfield Health Clinic System – have been cooperating to research and share the knowledge of COVID-19. These organizations join the Wisconsin State Lab of Hygiene and the Milwaukee Public Health Lab, inleading testing of COVID-19 in Wisconsin.

Thomas Friedrich, professor in the UW School of Veterinary Medicine, has been working on multiple projects, collaborating with **David O'Connor**, professor at the UW School of Medicine and Public Health, and **Shelby O'Connor**, associate professor in the Department of Pathology and Laboratory Medicine. One project uses animal models of COVID-19 pathogenesis to gain insight of animal infection of COVID-19.

The second project focuses on developing more efficient methods for rapid SARS-CoV-2 genetic testing using a process to find evidence of the novel coronavirus in saliva. “Recent studies show that frequent, repeated testing is key to detecting infected people quickly,” says Friedrich. “Because people can be contagious before they show symptoms of COVID-19, rapid testing can allow them to isolate and protect others before they even realize they are infected.”

The third project involves genetic sequencing of SARS-CoV-2 and reveals that the virus, which was once distinct between Dane and Milwaukee Counties, now reflects patterns of geographic mixing across the state. The study was published Nov. 3, 2020 in Nature Journal and showed that the two counties had largely distinct epidemics through April 2020 with limited genetic mixing, and that both saw lower rates of spread after Wisconsin’s Safer at Home executive order in March 2020. The virus mutates about once every two weeks, or every second transmission between people, like a game of telephone, although these genetic changes have minimal effects on the virus’ behavior or threat. Instead, studying viral samples for these “fingerprints” or “signatures” at a specific point in time or location allows researchers to trace patterns of spread.

Data Science

The Survey of the Health of Wisconsin (SHOW): The SHOW has been estimating how COVID-19 influences health. The SHOW has created an online survey to trace economic impacts, detections, information about the virus, behavior changes and mental health coping stages.

Health Innovation Program: A report from researchers at the School of Medicine and Public Health identifies which Wisconsin zip codes are most at risk of COVID-19 complications, helping health systems across the state prepare for hospitalizations and distribute protective equipment. The Health Innovation Program, a health systems research program within the SMPH, has prepared the susceptibility reports based on anonymized health data provided by the Wisconsin Collaborative for Healthcare Quality, a network of Wisconsin’s primary care physicians. The reports estimate the number of individuals in a zip code that could develop severe complications from COVID-19, based on risk factors identified by the Centers for Disease Control and Prevention. These risk factors include being over the age of 65 or having underlying conditions such as diabetes, lung disease, severe obesity or conditions that compromise the immune system. **Jessica Bonham-Werling** is director of the Neighborhood Health Partnerships program, which prepared the reports.

Computing resources: The IceCube Neutrino Observatory, located at the South Pole, it is made up of over 5,000 basketball-sized light sensors embedded in a cubic kilometer of ice. Thousands of computers back at the UW–Madison, IceCube’s lead institution, scour data from those sensors for evidence of elusive subatomic particles that originate in outer space: astrophysical neutrinos. Now, some of these computing resources are being used to simulate protein folding of COVID-19. How proteins fold into three-dimensional shapes is difficult to predict but has big effects on biological interactions, like those between a virus and its host. These simulations will help researchers

understand how the virus compromises human immune systems and reproduces. While IceCube remains operational, its home research center at UW–Madison, the Wisconsin IceCube Particle Astrophysics Center, WIPAC, is temporarily providing some of its available computing resources to Folding@home. This citizen-science distributed-computing project crowdsources computationally intensive tasks like simulating protein dynamics. Distributed computing projects like Folding@home combine the power of thousands of individual computers contributed by their owners to process different portions of data simultaneously, significantly speeding up their results.

Air quality during COVID-19: For **Brad Pierce,** professor in UW-Madison's Atmospheric and Oceanic Sciences Department and director of the Space Science and Engineering Center, the world under COVID-19 restrictions is a vast laboratory. What happens to the air when people quit driving to work and industries scale back production? Pierce wants to know what kinds of reductions are happening here. So he and an UW AOS graduate student, **Jerrold Acdan**, are combing through satellite data to determine what the shutdown is doing to the air.

Pneumonia: Using artificial intelligence technology, UW–Madison investigators have developed a far more precise way to identify cases of COVID-19-induced pneumonia. Using a custom artificial intelligence algorithm called CV19-Net, the UW research team dug into a vast resource database of tens of thousands of COVID-19 chest X-rays to show its method could identify pneumonia caused by COVID-19 at a sensitivity of 88 percent, according to **Guang-Hong Chen**, professor of medical physics and radiology at the School of Medicine and Public Health. Chen's research team includes **Ran Zhang**, assistant scientist in medical physics, and **Scott Reeder**, professor of radiology and medical physics and UW Health radiologist, and other researchers and clinicians at both SMPH and the Henry Ford Health System in Detroit.

Vaccine, Mutation, Transmission and Trials

Vaccine development: Yoshi Kawaoka, globally recognized influenza expert and professor in the School of Veterinary Medicine, is developing and testing a COVID-19 vaccine, the only vaccine that could protect against both flu and novel coronavirus.

William Murphy, a professor of biomedical engineering and orthopedics, has been working to develop better several types of vaccine for humans, including for treatment COVID-19. One project is to mimic particles to make stable gene therapy in the human body to develop a vaccine.

Adel Talaat, professor of pathobiological sciences in the School of Veterinary Medicine, and his lab are working on a potential vaccine, based on technology previously developed to combat another kind of coronavirus that causes disease in poultry. Talaat is an expert on nanotechnology-based vaccines for human and animal diseases.

Virus mutation: Kawaoka also has been conducting animal modeling research to study mutations of the virus. "Several papers had already described that this mutation makes the protein more functional and more efficient at getting into cells," Kawaoka says. "We

saw that the mutant virus transmits better airborne than the (original) virus, which may explain why this virus dominated in humans. A study published in Science by a team of researchers in the United States and Japan shows that the mutant virus, called D614G, is more easily transmitted and grows better within hosts, likely aiding its dominance. It differs from the original virus by just one amino acid, or short string of genetic code, in the spike protein that helps the viruses enter cells to cause infection. The mutation, researchers say, should not interfere with COVID-19 vaccine effectiveness.

Viral spread: As a new, apparently more transmissible version of the virus that causes COVID-19 has appeared in several countries, new research finds that the transmissibility of viral strains and the population density of a region will play big roles in how vaccination campaigns can help towns and cities return to more normal activities. The findings suggest that directing vaccines toward densely populated counties would help to interrupt transmission of the disease. Current vaccination distribution plans don't take density into account. **Tony Ives**, professor of integrative biology, and Claudio Bozzuto of the independent data research company Wildlife Analysis GmbH studied the spread of COVID-19 in the U.S. at the start of the pandemic, before people changed their behavior to avoid the disease. This let them uncover factors that may affect the transmission of COVID-19 when masking and physical distancing start to wane and behavior once again resembles the pre-pandemic normal.

Transmission to cats and hamsters: Kawaoka and his team also confirmed that cats could become infected by COVID-19 and transmit to other cats**. Peter Halfman**, associate scientist in the School of Veterinary Medicine, lead the study. Even though cats are no clear evidence, it has already been identified that cats are infected because of close contact with humans. The study results were published May 13, 2020 in the New England Journal of Medicine.

Animal model: Syrian hamsters have served critical roles in understanding human infectious diseases for decades. A new study, led by Kawaoka and clinical assistant professor **Samantha Loeber**, was published June 22, 2020 in the Proceedings of the National Academy of Sciences, and demonstrates they are also a useful small animal model for researchers trying to understand SARS-CoV-2 and in evaluating vaccines, treatments and drugs against the disease it causes.

Clinical trials for vaccine: UW Health and the School of Medicine and Public Health were among the first sites in the country to study whether a vaccine developed by the pharmaceutical company AstraZeneca can prevent COVID-19. The UW Health arm of the study was led by **William Hartman**, assistant professor of anesthesiology. The study was a phase 3 randomized, double-blinded, placebo-controlled clinical trial — the gold standard for measuring the efficacy of investigatory drugs. UW is one of 100 clinical sites around the country to participate in the trial.

Waisman Biomanufacturing at UW–Madison is helping produce a COVID-19 vaccine for phase 1 and phase 2 clinical trials, partnering with Heat Biologic. UW–Madison also may be a trial site. The vaccine will target those most vulnerable to COVID-19 — namely, the elderly and those with health conditions that weaken their

immune system. “Waisman Biomanufacturing’s mission is to advance novel vaccines and therapeutics into early human clinical trials,” says **Carl Ross**, managing director of Waisman Biomanufacturing, part of the Waisman Center.

Treatment and Risk Factors

Experimental drug: William Hartman, UW Health anesthesiologist, has been the principal investigator for the Regeneron clinical trial. The U.S. Food and Drug Administration recently gave emergency authorization for Regeneron’s experimental drug cocktail, which is meant to help high-risk patients with mild symptoms. The goal is to treat patients early on, to stop the disease before it turns severe. UW Health is a part of the clinical trial for the drug. Hartman’s study has already confirmed that some patients have significant recoveries from the COVID-19 infection by plasma treatment.

Antibodies: Waisman Biomanufacturing will manufacture a new drug to treat and prevent COVID-19, developed by biotech company GigaGen. The drug, called GIGA-2050, uses an approach similar to treating COVID-19 patients with convalescent plasma, or blood products from people recovering (convalescing) from an infection. GigaGen, which creates antibody drugs for infectious diseases, transplant rejection and some cancers, screened blood donated by people recovering from bouts with COVID-19, and found large patient-to-patient differences in the amounts of different types of coronavirus antibodies. GIGA-2050 replicates and recombines thousands of the donor antibodies most effective at binding to variants of SARS CoV-2, and manufactures them so they may be delivered in a uniform, high-potency dose. GigaGen reports that in lab tests, GIGA-2050 has been more protective against the virus than convalescent plasma.

Molecular Clues: Ariel Jaitovich, a pulmonary and critical care physician at the Albany Medical Center in New York — sought out a collaboration with investigators at the Morgridge Institute for Research, the Department of Biomolecular Chemistry and the School of Medicine and Public Health to better understand the molecular profile of COVID-19 and provide insights that may improve treatment. One example is the immunological concept of a cytokine storm — where the inflammatory response of the immune system goes into overdrive. Jaitovich reached out to Morgridge investigator, SMPH professor and mass spectrometry expert **Josh Coon**. Coon leads the Laboratory for Biomolecular Mass Spectrometry at UW–Madison and had been looking for a way to leverage his lab’s

technology to help with the pandemic. The lab's efforts will be managed by LBMS associate director **Katie Overmyer** and assistant staff scientist **Evgenia Shishkova**. While the Coon laboratory works on characterizing the molecular signatures, Jaitovich's team will also work to identify the genetic influences on the disease. To analyze this data, which involves RNA sequencing, Jaitovich is collaborating with Morgridge bioinformatics experts **Ron Stewart** and **Scott Swanson**. Swanson will lead the analysis to determine if there are unique gene expression profiles that might differ between the mild and severe cases.

Treating Cytokine Storm: David Andes, professor of medicine in the infectious disease division at School of Medicine and Public Health, has been collaborating with pharmaceutical company Novartis examining the potential for an existing drug called Ruxolitinib to treat a serious and often deadly complication of a COVID-19 infection called cytokine storm that can occur when an immune system in the human body exaggerates.

COVID toes: During the COVID-19 global pandemic, pediatric dermatologists at UW Health and elsewhere saw a surge of red to purple bruise-like blisters and bumps on otherwise healthy children. Doctors soon hypothesized there could be a link between the painful purple blistered toes and COVID-19, so the term "COVID toes" was coined and began making headlines. **Lisa Arkin**, assistant professor and director of pediatric dermatology, researches how the immune system responds to "COVID toes," "Our team hypothesizes that COVID toes represent a visible manifestation of robust interferon response to initial SARS-CoV-2 exposure, which rapidly eradicates the virus, preventing typical symptoms of COVID-19," Arkin says.

Respiratory allergy and asthma: Respiratory allergy, asthma and controlled allergen exposure were associated with significantly reduced gene expression in a protein that the coronavirus uses to infect cells with COVID-19, according to a study by the School of Medicine and Public Health. Unexpectedly, reports out of China found that asthma and respiratory allergies were not significant risk factors for severe COVID-19 illness in that country. As a result, UW researchers hypothesized that reduced *ACE2* gene expression might be one of the contributing reasons why. "We were surprised to learn that the COVID-19 pandemic in China did not seem to impact people with asthma as severely as we would've expected it to," says **Dr. Daniel Jackson**, lead investigator and associate professor of pediatrics and medicine. "Knowing that other risk factors for severe COVID-19 illness like hypertension and obesity lead to increased *ACE2* expression, we wanted to determine if patients with allergies and asthma could have reduced *ACE2* gene expression as a potential explanation for this unexpected early finding from the outbreak." Using an animalmodel, scientists at the UW–Madison, the University of Tokyo and the Icahn School of Medicine at Mount Sinai show that prior infection with the SARS-CoV-2 virus provides protection against reinfection, and treatment with convalescent serum limits virus replication in their lungs.

Surveillance

Wastewater: Scientists at the Wisconsin State Laboratory of Hygiene, with collaborators at the UW–Milwaukee's School of Freshwater Sciences, are sifting through raw sewage from nearly 100 wastewater treatment facilities statewide and at the UW–Madison, in search of the genetic fingerprint of the virus that causes COVID-19. **Martin Shafer**, scientist at the Wisconsin State Lab of Hygiene and associate scientist at the School of Engineering, and his team have monitored wastewater to estimate COVID-19 dynamics at the UW community. Detecting and measuring how much virus there is may provide an early warning signal that cases of COVID-19 may soon rise and provide a readout of how levels of virus change in a population over time. It could give hospitals time to prepare for an increase in patients.

Spread: John Yin, professor of chemical and biochemical engineering, has studied how the virus spreads by using several methods. One long term project that he has been doing is that beneficial defective interfering particles, which is related to COVID-19 viruses.

Song Gao, assistant professor of geography, has been using cellular phone data to track COVID-19 spread geographically, and interpreting human mobility and social media data for his COVID-19 study. "We developed a travel-network-based susceptible-exposed-infectious-removed (SEIR) mathematical compartmental model system that characterizes infections by state and incorporates inflows and outflows of interstate travelers," Gao says.

Kerry (Kaiping) Chen, assistant professor in computational communication, received an NSF Rapid Response Research Funding Award to research the spread of COVID-19 and methods for mitigating future outbreaks. Chen will collaborate with UW–Madison colleagues in geography, math and population health sciences.

Communications

The UW–Madison Division of Extension is supporting Wisconsin's farmers with online tools offering guidance on everything from sick leave for employees and routine cleaning, to resources about farm management during COVID-19.

The Division of Extension's COVID-19 financial guide highlights resources available to residents across Wisconsin. As of mid-July, half of American adults reported they had lost employment income because of the pandemic. About one-in-four adults reported that they either missed last month's rent or mortgage payment, or had slight to no confidence that their household could make the next payment on time. The FAQs highlight some common financial challenges as a result of the COVID-19 pandemic.

The Division of Extension offers food safety tips to assist with buying and preparing food during the COVID-19 pandemic. There is no evidence that COVID-19 is a foodborne illness.

Telehealth infrastructure in nursing homes: A research study at the School of Medicine and Public Health seeks to reduce COVID-19 spread in Wisconsin nursing homes by collaborating with community and academic partners to expand telehealth infrastructure. **Dr. Christopher Crnich,** associate professor of infectious disease, is the lead. The goal is to gather data that will allow his team to design and implement a new telehealth model in nursing homes. Researchers are conducting a workflow analysis, interviewing staff, and observing telehealth encounters between providers and residents at four nursing homes in Dane County. Preliminary data shows the complexity of implementing telehealth in nursing homes. Organizing telehealth meetings is just one of the tasks staff is responsible for within nursing homes. **Dr. Elizabeth Chapman** and **Dr. Ann Braus**, clinical assistant professors, geriatrics and gerontology; and **James H. Ford II**, assistant professor in the School of Pharmacy, are collaborators on the study.

Communications guidelines: A trio of communication experts including **Dominique Brossard**, professor and chair of Life Sciences Communication, developed recommendations on how to effectively communicate about COVID-19. The guidelines encourage campuses to emphasize social solidarity, work with students to craft and share messages, to avoid amplifying misinformation – even to debunk myths about the disease – among several other recommendations. The recommendations are based on the science of communicating about risks to young adults and experiences of universities during the fall. The researchers also worked with students at multiple universities to review the findings and ground them in real-life student experiences.

More productive screen time: Educational engineering games take stay-at-home kids to the next level. UW–Madison engineers have developed a few more options for productive screen time.

Wisconsin Connect app: Developed by a collaboration of campus groups, COVID-19 Wisconsin Connect is a free desktop and mobile app that provides accurate information, social support and helpful resources to Wisconsinites. One key feature is the COVID-19 Fact Checker, a digest of information that separates COVID facts from fiction. The information in the fact checker is provided by the Center for Communication and Civic Renewal (CCCR) within the UW-Madison School of Journalism and Mass Communication. Communication experts from CCCR find questions and misinformation related to COVID-19 on social media, and conduct fact-checks using vetted content from experts at leading health and government sources to correct the misinformation.

Communications advice for separated families: Because of the COVID-19 pandemic, critically ill patients have been hospitalized and isolated from their families and loved ones. In many hospitals, the palliative care team has been charged with maintaining communication between the critical care team and their patients' families. **Dr. Gretchen Schwarze**, associate professor of surgery, and her team along **with Dr. Toby Campbell**, thoracic medical oncologist and UW Health Chief of Palliative Care, created the Best Case/Worst Case: ICU (COVID-19) communication toolkit to assist separated families; to help them develop an understanding of their loved one's illness, prognostic awareness and the range of possible outcomes. The toolkit can help critical care providers understand the patient's overall trajectory when there is a high rate of care-team member transition. https://www.hipxchange.org/BCWC_COVID-19

Communications for patients on ventilators: For a patient suffering from COVID-19, communication means everything. If that person is on a ventilator and no visitors are allowed in the room, doctors and nurses must rely on tools and technology to communicate. **Sarah Marshall**, speech-language pathologist (SLP) in the Waisman Center Communication Aids and Systems Clinic (CASC), has been working with an international task force of SLPs, researchers and engineers to develop communication tools and trainings for patients with COVID-19 who are unable to communicate secondary to intubation. CASC is one of 10 specialty clinics at the Waisman Center and specializes in augmentative and alternative communication (AAC). The Patient Provider Communication Task Force, in conjunction with the United States Society of AAC, has developed a series of free communication supports for patients on ventilators due to COVID19. Learn more about the task force and view other resources here: https://www.patientprovidercommunication.org/supporting-communication-covid-19.htm

Covering faces around kids won't mask emotions: The proliferation of face coverings to keep COVID-19 in check isn't keeping kids from understanding facial expressions, according to a new study by UW–Madison psychologists. Results of the study, co-authored by **Seth Pollak**, professor of psychology, and **Ashley Ruba**, postdoctoral research in UW–Madison's Child Emotion Lab, were recently published in the journal PLOS ONE.

Creative Scholarship and the Coronavirus

Coloring book: Artists are tackling COVID-19 with coloring pages and a booklet for children, and drawings to help adults through every day. One of those artists is cartoonist and UW–Madison alumnus **Will Santino**. Santino's coloring pages are one of three art projects—supported by the UW–Madison "Do Your Part" Communication Collaborative for COVID-19 Response, the Global Health Institute and the School of Human Ecology—to help children and adults navigate a COVID-19 world. The projects include drawings for adults by UW alumna and artist **Mary Michaud** and a coloring book for children based on 10 ways to limit coronavirus spread (by UW-Madison seniors **Carissa Waldo, Caitlin Marks and Paige Broustis**).

Music references: Dipo Oyeleye, UW–Madison graduate student in English, has studied music and mentions of COVID-19. In his research, he noticed that European and American music are largely been devoid of COVID-19 topics. But Oyeleye, who is from Nigeria, was fascinated by the array of musicians in Africa who were responding to the global health crisis by composing songs to warn and educate the public—and how effective that music was at conveying key messages In a time of crisis. As part of his latest research project, Oyeleye is compiling and analyzing a list of more than 50 songs about COVID-19 by musicians across the continent, in genres from traditional to hip-hop and EDM.

Promoting Native American mask wearing: Native Americans have a higher percentage of their people contracting COVID-19 because of preexisting conditions and the fact that many generations may live in the same household. The Ho-Chunk Nation decided to promote the wearing of face masks through billboards, newspaper spreads and posters in each of their communities**. Tom Jones,** professor of art and photography, conducted photo shoots in the Wisconsin Dells, Wittenberg, Tomah, Wisconsin Rapids and Black River Falls. He photographed nearly 60 people.



Photos by Tom Jones

Photographic documentation of COVID-19 experiences: Darcy Padilla, associate professor of art, has launched a project, Aftermath, that creates a series of original photographic essays documenting the experiences of American s in the COVID-19 pandemic and aftermath. Photographing the challenges facing Americans, the work will tell the stories of people around the country who are coping with profound social and economic disparity. The inspiration for the project is the work done by iconic photographers who were employed by the Farm Security Administration to document the experiences of Americans during the Great Depression and World War II. The goal is a visual resource that draws attention to a critical aspect of American society and leaves a historic record. He work is also included in a recent book, Picturing Resistance: Moments and Movements of Social Change from the 1950s to Today.

Online and physical exhibit: Curated by **Jessica A. Cooley**, a current art history dissertator, and featuring **Jill Casid**, professor of art history and gender and women's studies, **Sami Schalk,** associate professor of gender and women's studies, and **Ellen Samuels,** professor of English and gender and women's studies, Indisposable: Structures of Support After the Americans with Disabilities Act is a multi-module exhibition that will roll out as a series of online events and will culminate in a physical exhibition at the Ford Foundation Gallery in the summer of 2021. The exhibit addresses urgent questions of where pandemic and demands for racial justice intersect. COVID-19 and the continuing effects of white supremacy expose an ideological landscape where some lives, particularly those lived at the intersection of disability, queer and BIPOC communities, are deemed disposable. However, precarious support structures are neither a new revelation nor a new crisis, but rather a continuation of a past which both predates the ADA and has not yet passed. And yet, these ongoing crises also highlight the generative humanity of people who create support structures. With disability as the binding thread throughout, this exhibition is most importantly about how we raise each other up collectively, interdependently, materially, and with joy.

Photo by Sami Schalk

#QuarantineLooks: Embracing the Fabulously Mundane, is an online and physical exhibition at the Ford Foundation Gallery by **Sami Schalk**, associate professor of gender and women's studies, and is part of the Indisposable: Structures of Support After the Americans with Disabilities Act exhibition. How does disability create knowledge essential to surviving a global pandemic? One answer: joy. As an act of pleasure activism and self-care during the pandemic lockdown, Schalk began posting images of herself on social media with new hairstyles, outfits and facemasks. Dressing up to handle ordinary tasks such as walking the dog or taking out the trash sparked delight and connection with strangers and friends.

Connecting COVID to struggles with racial violence: Amaud Johnson, professor of English and creative writing, has written a series of personal essays on COVID-19 as well as struggles with racial violence. Johnson argues that they are connected. Two

examples are "And God Laughs" Emergence Magazine, June 2020, and "The Fault Lines of Midwestern Racism Run Deep" Lit Hub, September 2020. Johnson is working on an essay collection, entitled “A Stoned Soul Picnic.” COVID-19 isn't the main theme, but as this pandemic evolves, Johnson is responding to how this crisis exposes old and sad truths about our struggles with race in America.

Pandemic-inspired essays: Jesse Lee Kercheval, professor of English and creative writing, has published a series of essays about the pandemic: “Half a Loaf,” The Sewanee Review https://thesewaneereview.com/articles/corona-correspondences-45, “The New Troy,” Guernica https://www.guernicamag.com/the-new-troy/, “I Am Going to Eat the World,” Food and Covid-19, Entropy, https://entropymag.org/food-and-covid-19-i-am-going-to-eat-the-world/, and “Art + Me,” On the Seawall https://www.ronslate.com/art-me/. Kercheval is also working on a book of essays about the pandemic.

Dance research project: Peggy Choy, professor of dance, has a new project, Dreams of the Abandoned Daughter: Dance About Climate Change. This dance research project has an allegorical parallel with the COVID pandemic and racial injustice. The dance-theater story (to be in video format) is about an imagined region hit by a deadly, new unknown virus. The virus' emergence is linked to climate change, and in this region, it is increased, severe flooding. The dance-theater video gives options to consider in the context of climate change education. There are plans for an online streamed premiere in 2022 if funding comes through to support this project.

Online mask exhibit: Since March of 2020 face masks have become a central tool in the fight against COVID-19. The Center for Design and Material Culture has initiated a “Rapid Response Collecting Project,” inspired by the model developed by the Victoria & Albert Museum in London, to document the new role masks play in American life, particularly in our region. Curated by Design History graduate student **Natalie Wright**, this online exhibition features 22 masks that will be acquired by the Helen Louise Allen Textile Collection. Whether selected because of their symbolic value, unique technological aspects, or aesthetic qualities, masks are fascinating signifiers of social distinction, political thought and cultural identity, even as they serve a vital public health need. In the spirit of the Wisconsin Idea, Wright hopes that this growing collection of masks will help us both preserve and interpret the cultural legacy of the COVID-19 pandemic.

“International Virtual Altar Project”/“Bi-lingual, International Community Art Project”: Over the past seven years, School of Human Ecology Professors **Carolyn Kallenborn** and **Jane Rafferty** have created community installations in Madison to remember and honor those who are gone. The altar project has its roots in Day of the Dead. In 2020, an in-person community celebration was not possible due to COVID-19. The challenge was to create a community celebration that was virtual and/or socially distant. Kallenborn worked with an interdisciplinary team of faculty and graduate

students from UW–Madison and master artisans from Oaxaca, Mexico. Together, they developed a series of bilingual, international collaborative virtual projects and socially distant community exhibitions. The Covid-19 crisis emphasized the need for, and the opportunities presented by, online collaboration and compelling virtual storytelling. Fifty-three individuals from four countries sent in materials. Their videos, photographs and artworks were edited together, set to music and presented as a socially distant event at a large-scale outdoor projection. They also built a website to host a bilingual online exhibition of the altars as well as the final 30-minute video. The socially distant artworks and virtual events have provoked conversations about crossing worlds: life and death, art and craft, and the borders between countries, languages, cultures, classes, and with Covid-19, issues of being physically distant and staying connected.

Living Room Music (in the times of Covid): For the Contemporary Percussion Ensemble concert, **Anthony (Tony) Di Sanza,** professor of percussion/music, usually performs in a staged living room with performers sitting together on couches and chairs, creating a piece that is intended to feel spontaneous. But for, Living Room Music (in the times of COVID) in 2020, each player performed in their own apartment separated by large sheets of plexiglass representing the walls (both real and metaphorical) between them. Each performer existed in their own apartment and eventually became aware of each other, resulting in the third movement being played on piano in one apartment with the others playing on the walls (plexiglass) of their own apartments. The students faced each other playing on either side of the wall, masked and with the 8'x4' sheet of plexiglass between them. Failing to break through the walls, the final movement placed the students back in their living room chairs. "However, this music is simpler and more rhythmically consonant than the previous movements, attempting to reflect a glimmer of hope that we will one day live as we once had," Di Sanza says.

Recordings to address COVID: Brass lecturer **Tom Caw's** musical group, Nominal Duo, was invited to perform at the New Music Gathering in Portland, Oregon last June. When the conference went online, they were asked to submit a recording, preferably one that tackled COVID circumstances in some way. As brass players, they were unable to play together and also lacked safe access to spaces suitable for recording. In addition, they wanted to maintain their ensemble's dedication to improvisation and electro-acoustic techniques as central performance practices. So, Caw and his euphonium colleague at Carroll University, Brett Keating, both recorded an improvised layer of direct input electronics and sent them to each other to complete with a second improvised layer. They presented the results at the New Music Gathering's virtual conference and released them as a two-part EP. During this pandemic, there has been a trend of multi-track recordings created by individuals as well as chamber ensembles that are unable to safely rehearse together. Mead Witter School of Music alumnus **Ben Davis** composed a seven-part multi-track piece for Caw that turns this concept on its head. It is a technically challenging and rhythmically complex piece.

Impacts of online and cell phone communication: Siena Laws, an undergraduate student resident of The Studio Creative Arts Residential Learning Community 2019-2020, has launched a research project to explore impacts of online and cell phone

communication on people's daily lives during the pandemic. Laws hopes that studying this landmark time can shed some light on both the positive and negative impacts of online communication on our lives, how different people approach it and its impacts on how people work and maintain relationships. She will conduct interviews with people in her community with a variety of experiences with online communication and COVID-19. She will then document these conversations through illustrations, interview excerpts and comics which will be assembled into a short book. This project is intended to examine this reality of technology use and its implications for individual's mental health and wellness but not to ignore the significance of modern technology on people's ability to work and carry on with their lives in a safe manner.

Snapshot of COVID-19 Research Grants

UW–Madison COVID-19 Research Project Awards (2020): 72 approved projects totaling more than $53 M in extramural funding.

The Wisconsin Partnership Program at the UW School of Medicine and Public Health announced 21 new awards totaling $2.2 million to researchers and community organizations across Wisconsin for their efforts to lessen the impact of COVID-19.

Cap Times' Evjue Foundation announced $635,000 in special COVID-19 grants. UW–Madison received two awards.

University of Wisconsin-Madison 2020 COVID-19 Research Response Report

Report produced by Yui Kasahara, Office of the Vice Chancellor for Research and Graduate Education student intern Fall 2020

Photos by University Communications

Graphic elements by University Marketing

See https://www.research.wisc.edu for additional information on research at UW–Madison.

UW–Madison COVID-19 Impacts stories: How UW–Madison is supporting public health and the people of Wisconsin (https://covid19.impact.wisc.edu/)