SMELL FOR LIFE – THE MONELL ANOSMIA PROJECT

Smell can be afterthought in our audio-visual centric world, often omitted from medical textbooks, its diagnostic capabilities not taken advantage of, its contribution to our quality of life underappreciated. While smell is too often taken for granted, early in the pandemic, the world discovered that to the SARS-CoV-2 virus, our olfactory system is essential.

In March of 2020, the trickle of reports of sudden smell loss soon turned into a tsunami as Covid-19 rampaged. The virus caused smell loss and disorders in as many as 80% of infections. The scale of the crisis was unfathomable and the challenges formidable. With workplaces and labs closed, supply chains broken, and many of us shouldering extra caretaking burdens and health concerns, some projects needed to pause, while others were devised and implemented at warp-speed.

The Monell Center’s anosmia research was among the public health priorities immediately thrust into overdrive. With it was a newfound acknowledgement of just how critical our nonprofit mission is.

Thanks to the support of donors like you and Monell’s hard work to secure competitive grants, the Anosmia Project was firmly established when the pandemic hit. We were poised and able to quickly respond to the emerging public health crisis with expertise, leadership, and relevant research to help the millions of people worldwide newly afflicted by smell loss.

Monell’s response to the changing human sensory condition during the pandemic, as you will see in this impact report covering both 2020 and 2021, has been to re dedicate ourselves to our mission of understanding, treating, and preventing smell and taste loss, as well as to reorient our approaches to better include the health-related scope of a long pandemic and its impact on human lives.

And we couldn’t do it without you.
BY THE NUMBERS

Support for the Monell Anosmia Project is Growing

You are one of more than 550 individual donors to date

In total we’ve raised over $1,000,000 in private donations. And 34 of you have generously donated more than $1,000.

Your support helped to leverage an additional $1,652,266 in federal grants that directly relate to seeking causes and future treatments for smell disruptions and disorders.
COVID-19 and Smell Loss

Crisis Begets Opportunity

“The virus’s strangest symptom has opened new doors to understanding our most neglected sense,” proclaimed The New York Times Magazine in a cover story in January 2021, which featured the work of three Monell researchers. Indeed, what had sometimes been considered a niche science suddenly took center stage, as people worldwide sought to understand the smell loss and distortion that soon emerged as a critical public health issue.

If you have been a friend to the Monell Center for some time, you know of our 50+ year history as an independent nonprofit center dedicated to the study of smell and taste. For the rest of the world, the pandemic quickly made it clear that Monell was uniquely equipped to respond to the public health crisis, and that we were a vital source of information, research, leadership, and expertise. We appreciate equally the newfound global recognition of taste and smell as drivers of public health and the sustaining support and confidence of our long-time champions.

Leadership Through Research

Reports of smell loss associated with Covid-19 proliferated in the early days of the pandemic. In November of 2020, a global group of scientists, including lead author Dr. Danielle Reed (Citation #1 below) from Monell, published a report that quantified the impact: nearly 80% of those who contract Covid-19 report a sudden and significant loss of smell, making sudden-onset smell loss the best predictor of Covid-19 infection.

It was then determined that the virus had additional chemosensory impacts beyond sudden smell loss. Monell scientists were part of the consortium of researchers who (Citation #2 below) enumerated these impacts based on a multinational study. They found that not only is the sense of smell impacted, but there is also a loss of taste (e.g. sweet or salty) in a significant number of Covid-19 patients.

In addition to wide-ranging research on smell loss, our scientists are now working on Covid-19 specific studies to answer these questions:

- What percentage of patients fully recover their sense of smell? What is the timeline for recovery?
- What percentage of patients experience distortions of smell (parosmia)? How long do these distortions persist?
- What is the timeline of smell loss and recovery in “long hauler” Covid-19 patients? What changes occur in food preference and dietary intake in “long haulers”?
Leadership Through Collaboration

At the onset of the pandemic, the Monell Center significantly contributed to the formation of the Global Consortium of Chemosensory Researchers (GCCR), a worldwide group of more than 600 clinicians and scientists united to understand the chemosensory implications of Covid-19. While Dr. Danielle Reed took a leadership role with GCCR, numerous Monellians have contributed to the research and publications of the organization that has been at the forefront of Covid-19 sensory research. Valentia Parma, one of Monell’s newest faculty members, led GCCR throughout the pandemic.

A Vital Source of Information During the Pandemic

Monell has been an essential source of information on smell loss and anosmia throughout the pandemic. Our scientists provided critical insights to such major news outlets as The New York Times, Washington Post, CNN, NBC News, NPR, and The Atlantic, as well as consumer publications, including Huffington Post, Wired, Popular Science, Self, Food 52 and Readers Digest. We even helped debunk the TikTok “burnt orange” cure for an article in USA Today.

Among the notable media placements on Covid-19 informed by Monell scientists are:

- The Washington Post Scientists Begin to Unravel the Mysteries of the Coronavirus and Brains, June 07, 2021
- The Guardian Anosmia: How COVID Brought Loss of Smell Centre Stage, December 05, 2020
- NPR Will My Sense Of Smell Ever Return? Olfactory Insights From COVID And Beyond, May 08, 2021
- USA Today Millions of COVID-19 Survivors Have Lost the Sense of Smell and Taste. Will They Come Back? Not Even Researchers Know, January 31, 2021
- LA Times Months After Contracting COVID-19, Some Will Try Anything to Regain Their Sense of Smell, February 04, 2021
- NBC News A mouthful of nickels? Some say they taste metal after a Covid-19 vaccination, March 25, 2021
- Smithsonian Magazine Why Covid-19 Patients Are Suffering From Distorted and Phantom Smells, September 21, 2020
Monell scientists helped unravel the chemosensory aspects of Covid-19 for individuals hungry for information about their new affliction. On YouTube, our Smell Loss & Covid-19 (Citation #3 below) video, posted in May 2020, has been widely viewed. Global news outlet AJ+ spoke to Danielle Reed for a minidocumentary on parosmia, which aired in August 2021. “The Bizarre COVID Side Effect No One Is Talking About (Citation #4 below) had received over one million views by the end of 2021.

Kids and Covid-19

Because information on how Covid-19 impacts youth is scarce, Pamela Dalton, Valentina Parma, and colleagues held a Kids & Covid webinar aimed at families to talk about how Covid-19 manifests in children, particularly symptoms of sudden loss of smell and taste.

SERVING THE COMMUNITY WITH INFORMATION THEY NEED

In 2020-2021, the number of people joining our email list by finding our website skyrocketed compared to previous fiscal years.

During 2020-2021, 570 people joined the Monell mail list, representing a 70% increase over the previous year. Of that 570, 285 were people with smell disorders and disruptions. With this growth, we have increased our total community of individuals with smell loss to over 1,700 and our total community of individuals requesting information about smell loss to over 3400.

Monell’s prominence in The New York Times Magazine cover story on smell drove the biggest-ever spike in people joining our email list. Of the 570 people who joined our list through the website in 2020-2021, 256 of them (45%) joined in January, February, and March. Readers continue to be engaged by our newsletters, as evidenced by open rates well-exceeding the average for nonprofits.

The Monell website continues to be a trusted source of information. We updated and redesigned it in in October 2020 and in the year following, it attracted more than 74,626 users from 185 countries.
SCIENTIFIC LEADERSHIP AND GROUND-BREAKING RESEARCH

Improving Diagnostics: Sense of Smell Medical Screening

Smell loss has been implicated in increased mortality, Alzheimer’s, dementia, and Parkinson’s disease. Before Covid-19, it was rare for physicians to inquire about a patient’s sense of smell. Not only is our sense of smell undervalued, but smell tests have been expensive and time-consuming to administer. While there are tests that are suitable for research and in-depth clinical use, they do not meet the scientific and practical needs of speed, ease, and low cost for population surveillance. The Monell Center is actively addressing this gap and, in doing so, seeks to enable a fundamental change in healthcare.

The need for diagnostic smell testing was articulated in a study from the lab of Danielle Reed and published in *Chemical Senses* (Citation #5 below). It revealed that while about 75% of the people studied lost their sense of smell with Covid-19, not all of them were aware of their loss. Self-reporting of smell loss was an inferior measure compared to objective smell tests. In order to harness the diagnostic value of smell testing and make tests easier to administer and more readily available, Monell set out to develop a rapid smell test.

In September 2020 Co-Principal Investigators Dr. Pamela Dalton and Dr. Valentina Parma received a competitive NIH Award to develop the SCENTinel 1.0 rapid smell test. It is designed to be an effective, easy to use test for clinical situations to identify individuals with smell loss, including Covid-19 symptom screening. SCENTinel evaluates three olfactory functions: detection, intensity, and identification. This test not only has the potential to be groundbreaking for rapid identification of SARS-CoV-2 infection, but is a major step towards incorporating universal smell screening as a routine part of medical care.

The first paper on the SCENTinel rapid smell test developed at Monell was published in *Chemical Senses* (Citation #6 below) and authored by an all-Monell team: Pamela Dalton, Valentina Parma, Mackenzie Hannum, Maureen O’Leary, Robert Pellegrino, Nancy Rawson, and Danielle Reed. It assessed whether SCENTinel 1.0 could discriminate conditions of ongoing smell loss and normosmia and compared the performance of SCENTinel 1.0 to the NIH Toolbox Odor Identification Test, a validated and standardized smell test. The results demonstrated that SCENTinel 1.0 is a rapid, accurate, flexible, and cost-effective tool to use in large-scale population surveillance efforts.
While the immediate impetus for developing SCENTinel is for surveillance of Covid-19 and other respiratory diseases, it can also be adapted for different purposes. Other than the detection or validation of a smell disorder, it can be used repeatedly to monitor how someone’s sense of smell changes over time.

Moving forward, our strategy is threefold: to develop and validate an inexpensive rapid smell test as a disease diagnostic, to allow researchers to easily quantify smell in their studies, and to execute a concurrent public awareness campaign. Monell is collaborating with a commercialization partner to further develop this test.

Our long-term goal is that smell testing be used by doctors on a regular basis to screen for an array of diseases, including neurological disorders, many of which are associated with smell loss.

**UNCOVERING THE CAUSES OF SMELL LOSS**

**How Respiratory Viruses Cause Anosmia**

Well before Covid-19, we knew that respiratory viral infections were a leading cause of olfactory loss. Now that rapid onset smell loss has been firmly established as a cardinal symptom of Covid-19, and with up to 80% of patients experiencing chemosensory disturbances, viral-associated smell loss is not only prevalent, it has become an urgent public health issue. But, the mechanisms of viral-induced smell loss remain poorly understood.

Monell researchers are making great strides on the path to understanding viral-associated smell loss. In summer of 2020, Monell had raised private funds that allowed us to issue a request for proposals to our faculty seeking new research studies. Dr. Hong Wang leads the team awarded the funding, whose work addresses how to identify changes in olfactory tissue responsible for smell loss. Dr. Wang, an associate member of the Monell faculty, is a molecular biologist.
who has been investigating how inflammation alters or damages tissues involved in taste and smell.

Along with her Monell collaborators – Dr. Peihua Jiang, Dr. Akihito Kuboki and Dr. Johannes Reisert - Dr. Wang infected mice with the H1N1 flu virus as part of two-year study. They discovered that both the supporting cells and olfactory receptor neurons were damaged by the flu virus. These results align with other recent studies that show the SARS-CoV-2 virus significantly damages olfactory support cells, thereby causing changes to the olfactory tissue responsible for smell loss.

They also found that olfactory epithelial (OE) cells have built-in mechanisms for viral defense. Viral infection induces the expression of innate immune response genes in the OE. Their results showed that viral infection also induces the expression of the insulin receptor in the OE, a result consistent with the role of insulin for repairing olfactory sensory neurons.

In the first year of work, Dr. Wang’s team saw evidence that certain genetic mutations in viral defense mechanisms lead to more severe olfactory loss after viral infection. Inborn genetic errors in these genes have been reported in some human patients. Potentially, such genetic errors may also contribute to long-term olfactory loss associated with respiratory viral infection. Based on promising data, the team has been awarded additional philanthropic funds to continue to determine the underlying mechanisms of significant loss of olfactory sensory neurons and function. The team is readying to submit a proposal to the NIH to more fully investigate how olfactory tissues recover from respiratory viral infection and what factors control whether the sense of smell is fully restored or not.

Insights from these studies of the mechanisms for viral-associated smell loss will inform the development of treatments for smell loss.

**Influenza virus**

![Diagram of influenza virus infection](image)

**Identifying Genes that Cause Smell Loss**

Discovering which genes cause anosmia at birth could lead to gene therapies to restore the sense of smell not only for congenital anosmics, but also for others who suffer from full or partial loss...
of smell. The lab of Dr. Joel Mainland has been studying genetic inheritance patterns as part of a NIH grant to identify genes that cause congenital anosmia.

As of fall 2021, they have sequenced and identified more than 20,000 genes for each member in 10 families that include at least two congenital anosmics. They have now analyzed this large data set looking for patterns of gene variants that are more likely to occur in anosmic family members, both within and across different families. This research is especially challenging because researchers have identified only two genes associated with congenital smell loss, while more than 200 genes are implicated in patients born without sight and 100 altered genes have been discovered in patients born without hearing.

The team sequenced the genes of an additional 121 congenital anosmics to compare with the genes identified in the family groups. The analyses are nearly complete, and seven promising gene candidates have already been identified.

To determine whether one or more of these genes actually causes anosmia, the team will next need to modify or remove each of the candidate genes in animal models and observe whether smell loss occurs. Dr. Mainland will seek new NIH funding for this next critical stage of discovery.

The Mainland group uses whole-exome sequencing, which captures all of the genes involved in protein synthesis. More than 20,000 genes are analyzed for each individual in the study. The Mainland lab has generated a list of candidate anosmia genes, and as they sequence more samples, this list will be refined to prioritize gene variants found in multiple unrelated affected individuals.

Our lack of understanding of congenital anosmia prevents many anosmics from knowing if their condition is acquired or genetic, temporary or permanent, and provides them little hope for diagnosis and treatment. The work of the Mainland lab promises to provide critical knowledge about this condition.

MORE PROGRESS TOWARDS A CURE

Restoring the Sense of Smell with Adult Stem Cells

In one area of research, we seek to understand olfactory stem cells with an eye toward the ultimate goal of regenerative medicine — using the body’s own cells to restore functions that are otherwise lost. Taste and odor receptors normally regenerate. But disease, aging, trauma, and other factors can diminish or erase this capacity, which exacerbates smell dysfunction.
Dr. Peihua Jiang hopes to find a way to harness the regenerative ability of olfactory neurons and use it to restore the sense of smell in anosmics.

To do this, Dr. Jiang and his team are identifying physiological factors that cause olfactory stem cells to grow and differentiate into functional receptors for smell. Dr. Jiang’s group worked with different growth factors in cell culture media until they found a combination that allows mouse olfactory stem cells to replicate and differentiate into mature olfactory neurons within mini-organs (“organoids”).

Now Dr. Jiang is able to culture mouse nasal stem cells that grow into a three-dimensional olfactory organoids, which produce functional olfactory receptor neurons that respond to odors. This is a very promising finding, suggesting that growth factors used to culture olfactory stem cells in a dish might be able to stimulate stem cells in the nasal cavity of an individual to grow into functional olfactory receptors. He is currently testing whether these growth factors injected into anosmic mice produce new olfactory receptors and restore their sense of smell.

Dr. Jiang plans to culture adult human nasal stem cells and replicate his success with mice in growing functional olfactory receptor neurons in culture. The ultimate goal is to develop technology for use in regenerative medicine to restore olfactory function in anosmic individuals who have non-functional nasal olfactory cells.

**STEPS TOWARD TREATMENT: INSULIN AND SMELL LOSS**

**Insulin Spray**

One of the highlights of the summer of 2021 was a report from Dr. Akihito Kuboki on insulin and olfaction—a discovery that could be developed into an insulin spray to treat smell loss.
Dr. Akihito Kuboki, a postdoctoral fellow in Johannes Reisert’s lab, suspected that insulin might play a role in the maturation of olfactory sensory neurons (OSNs) after injury because insulin is part of the body’s repair pathway for visual neurons. But, relatively little was known about the role of insulin in the sense of smell.

The team found that insulin plays a critical role in the regeneration of OSNs after injury, particularly during their immature stage. The results were published in the journal *eNeuro* (Citation #7 below) in April 2021.

Not only do these findings suggest that applying insulin into the nasal passage could be developed as a therapy for smell dysfunction, their work identified a critical time window for treatment. OSNs are highly susceptible to insulin deprivation-induced cell death eight to 13 days after an injury. It is during that critical stage that newly generated OSNs are dependent on insulin. When they applied insulin to the regenerating OSNs at this critical time point, the mouse’s sense of smell was restored.

The research team induced diabetes type 1 in mice to reduce levels of circulating insulin reaching the OSNs. The reduced insulin interfered with the regeneration of OSNs, resulting in an impaired sense of smell. They analyzed how the structure of the olfactory tissue in the nasal cavity and the olfactory bulb is impaired by comparing the number of mature OSNs and how well the axons of OSNs reached the olfactory bulb.

The team also recorded odorant-induced responses in the OSNs in the nasal cavity. An odor-guided behavioral task, in which the mice needed to find a cookie reward depending on their ability to smell, measured olfactory function. This work shows that insulin plays a key role in preventing cell death, which can explain how diabetes contributes to smell loss.

Dr. Akhito is also a member of Dr. Hong Wang’s team looking at the role of inflammation in viral-induced smell loss, described above.

In addition to Kuboki, the team consists of Ichiro Matsumoto from Monell; Nobuyoshi Otori and Hiromi Kojima from Jikei University School of Medicine; and Shu Kikuta, and Tatsuya Yamasoba, from the University of Tokyo and Kuboki as lead author.
THE IMPACT OF SMELL LOSS

How Anosmia Alters Brain and Behavior

Smell loss has been shown to cause isolation, depression, and eating challenges. Dr. Johan Lundström wondered if acquired smell loss could also change our brains. Dr. Lundström is an Associate Member of Monell and a faculty member in Clinical Neuroscience at the Karolinska Institutet in Stockholm, Sweden. His team completed a study comparing a group with recent, adult-onset anosmia (those with 7 – 36 months of smell loss) and healthy controls and found that smell loss did indeed cause brain changes. This research was published in *Scientific Reports* in August 2021 (Citation #8 below).

The Lundström's lab compared the state of neural connections between the brains of people with acquired smell loss and others with a healthy sense of smell and found that acquired smell loss is associated with changes in the volume of grey matter (where nerve signals are processed) in multiple areas of the brain, including areas involved with the sense of smell. They also found that individuals with acquired anosmia show stronger neural connectivity involving parts of the brain responsible for visual processing.

Using magnetic resonance imaging (MRI), the team found that individuals with adult-onset anosmia showed a reduction in the size of the primary cortical area for smell (piriform cortex). In addition to evidence of shrinkage, the piriform cortex developed greater connectivity to areas of the brain that process and integrate information from multiple sensory systems. This research supports previous results that showed that individuals without a sense of smell are better at extracting information from other sensory systems, in other words, they are better at some tasks involving multisensory integration.

Previously, Dr. Lundström completed a research study investigating how cortical brain structures are altered in those with congenital anosmia. His team found that congenital anosmics did have a piriform cortex, but this brain area had been taken over by other sensory systems — rather than processing odors, it was processing visual and auditory information (Citation #9 below).

Dr. Lundström will next explore approaches to help restore the sense of smell in those with adult-onset anosmia. The pandemic delayed his plan to evaluate different smell training protocols for their efficacy and compare those approaches with non-invasive electrical stimulation of the brain. He hopes to resume those studies soon. The knowledge that recently acquired sensory loss is associated with changed brain morphology and connections gives scientists more clues to how the brain rewires itself to deal with smell loss.
RESPONDING TO THE CHANGING HUMAN SENSORY CONDITION

Patients at the Center of the Public Health Crisis

An estimated three million Americans will have sustained or long-term smell and/or taste loss from Covid-19. With so many people grappling with the consequences of smell disorders, it is more important than ever to focus on patient needs. Addressing the public health crisis of unprecedented numbers of people experiencing chemosensory loss will require a coordinated effort among researchers, patients, and clinicians. Monell is approaching the crisis through research, advocacy, and thought leadership.

In November 2018, we convened a first-of-its kind event, “Identifying Treatments for Taste and Smell Disorders.” It included multiple internationally recognized research groups and engaged patients and clinicians as active participants. Those conversations and the white paper that followed, along with the profound impact of Covid-19, spurred us to rededicate ourselves to addressing and advocating for the needs of people suffering from smell and taste disorders (Citation #10 below). While we have made great strides in addressing the gaps identified by the white paper, at this writing we at Monell are acutely aware that Covid-19 has dramatically changed the landscape. The initial white paper is now ready to be updated so that it can serve as a rising tide for all types of smell loss, including Covid-19-induced smell loss.

The Monell Anosmia Project Becomes Smell for Life

In February of 2021, we renamed the Monell Anosmia Project. It is now called the Monell Smell for Life Project. Since we first launched The Monell Anosmia Project in 2014, it has nurtured nine scientific studies, contributed to a conference and paper outlining recommended next steps in anosmia research, and held numerous smell training and outreach events. The new name reflects a fundamental shift in our approach to research, one that is more patient-centric and forward-looking.

Through Smell for Life, we seek to better understand the mechanisms of the sense of smell, elevate the role of smell in our lives and throughout our lifespan, and elucidate the pathway to treatments for smell loss. We recognize that individuals who suffer from smell loss or distortions experience social isolation, poor nutrition, depression, phantom odors, inability to sense danger such as natural gas, smoke or toxins, and the inability to experience the sensory joys of life.

Smell for Life is funded in part by federal grants but its founding and major support has been from individuals like you who are living with smell disorders and disruptions. As this support increases so does our investment in pilot studies and data collection.

SCENTinel at the Philadelphia Flower Show

On June 12, 2021, a crew of Monell staff and collaborators from Rowan University were on hand at the Philadelphia Flower Show to spread the word about the importance of our sense of smell. This was the first in-person outreach event since the start of the pandemic. They distributed SCENTinel cards, which attendees used to test their own senses of smell.
Our participation in the Flower show is just one of our communications efforts aimed at building public goodwill for this effort. Monell staff have also presented at a five-minute story slam about smell testing, demonstrated SCENTinel at events for the New York branch of the Wine & Food Society, the Philadelphia nonprofit, Friends in the City, and for the Campari Family of Beverages.

**Changing the Conversation**

**A Panel Discussion**

Monell hosted a virtual panel discussion on April 28, 2020, convening patients and scientists to discuss approaches to advancing smell loss research. This panel was originally scheduled as an in-person event, but because of the Covid-19 pandemic became a virtual meeting. More than 250 people signed on to hear from anosmia patient advocates and researchers, including a discussion on Covid-19 work. Fruitful conversations provided a roadmap for approaches to expand patient treatment and support, culminating in the formation of North America’s first taste and smell disorders patient advocacy group.

**Advocacy and Awareness**

In early 2020, Monell representatives began advising a group of emerging patient advocates in the United States. From our early convenings, we are proud to announce that these patients have now established the first 501c3 organization to serve North American patients with taste and smell disorders. Called the Smell and Taste Association of North America (STANA), the organization is partnering with others worldwide to build awareness while focusing on advocacy relevant to those living in North America.

STANA’s formation is quite important to Monell because patients can advocate for awareness and funding in a way that we, as researchers, cannot. By working together, over the long-term this relationship should help to increase federal, foundation, and individual support for taste and smell disorders.

**Patient-Centered Research**

Our most recent news is an award from the Patient-Centered Outcomes Research Institute (PCORI), an organization established to fund research that can help patients and those who care for them. The primary objective of our proposed project is to develop a shared patient-centered research agenda and learning community surrounding smell and taste loss.
The United States lags behind other countries in patient-centered outcomes research on taste and smell disorders, despite a wealth of outstanding researchers and clinicians. In May of 2021 we began discussions with the Otolaryngology Department at Thomas Jefferson University Hospital to co-create a shared research agenda as a means to rectify this gap. With STANA, the patient advocacy organization, we will develop a shared agreement about how to propel patient-centered clinical effectiveness research on taste and smell disorders. The grant will also help us update the 2020 Identifying Treatments for Taste and Smell Disorders white paper.

By building a sustainable learning community, we hope to better understand, diagnose, and potentially treat many types of smell and taste loss.

**World Taste & Smell Day**

In 2021, the Monell Center led the effort to establish the first-ever World Taste & Smell Day. The launch took place on September 14th, 2021 featuring an online world exploratorium of taste and smell, which crowdsourced taste and smell experiences from around the world. Funds were raised to support patient advocacy efforts. We expect this day dedicated to elevating taste and smell in our daily lives to grow and develop over the next three years.

**Anosmia Awareness Day**

Anosmia Awareness Day, which takes place each year on February 27th, continues to be an important gathering place for individuals with taste and smell disorders and disruptions. Monell used the 2021 effort to announce that it was renaming its smell loss research program from the Monell Anosmia Project to Smell for Life. The name change was meant to address our forward-looking ambitions to restore and deliver odors throughout life and to all. Monell also marked Anosmia Awareness Day by helping to introduce the Smell and Taste Association of North America, North America’s first patient advocacy group for smell and taste disorders, into the ecosystem of efforts to raise awareness and funds for smell loss research.

**Fragrance Day**

As part of Monell’s renewed and enhanced relationship with the Fragrance Foundation, the leading association for the fragrance industry, Dr. Pamela Dalton participated in their annual Fragrance Day celebration in March 2021 and contributed to their monthly newsletter with a Q&A on smell training.

**OTHER RELATED RESEARCH: SENSORY NUTRITION AT MONELL**

Monell is dedicated to the study of sensory nutrition, a unique and timely marriage of two disciplines: sensory science and nutrition. Building the knowledge base of this nascent but terribly important part of the human experience, sensory nutrition, is a part of Monell’s strategic aims. Because we can now predict that upwards of fifteen million worldwide will have new
sustained and/or long-term taste loss from Covid-19, this effort is even more relevant than when we first described it in our 2018 Strategic Plan. Studies planned include comparisons of post-acute Covid-19 patients who have recovered their taste loss and those who have not in order to determine the role of taste loss in body weight and obesity for both populations.

In other strides towards nutritional health, in August 2021, Dr. Stephanie Hunter was the first researcher to win a research grant from the patient advocacy organization AbScent for her project on food enjoyment among individuals with smell loss. This study will be of immediate help to patients grappling with nutritional health.

BUILDING THE FUTURE

Supporting Future Scientists
The Monell Science Apprenticeship Program is an eight-week paid experience pairing high school and college students, primarily from communities underrepresented in the sciences, with Monell mentors for a bench science experience. This year’s program provided a rich environment for young people to gain experience with smell and taste disorders and differences.

One of our high school apprentices, Norah Lee, conducted a project titled, “Can SCENTinel Screen for COVID-19?” with Pamela Dalton and postdoctoral fellow Stephanie Hunter. Another apprentice, Kathlyn Tu, was also introduced to a smell loss-related study, conducting her project, “How Does Respiratory Virus Affect Our Smell?” with mentor Hong Wang. High school student Jade Coleman worked with Drs. Danielle Reed and Mackenzie Hannum on a project, “Investigation of Question Structure on Overall Performance: A Study on SCENTinel.”

Another apprentice, Sarah Marks, has anosmia from birth and came to Monell to conduct a study in the Reed Lab on our ability to smell with our tongues. During her apprenticeship we encouraged Sarah to show her advocacy side. She “took over” Monell’s Instagram page to bring awareness to anosmia. She has since become a volunteer with STANA to help with science communications.

The Next Generation of Monell Faculty

As part of the rising tide of research on olfaction and what happens when it is altered, we hired two new faculty members in 2021: Dr. Kevin Bolding (currently a Postdoctoral Fellow,
Olfaction, Boston University) and Dr. Valentina Parma (formerly Research Assistant Professor, Smell and Human Health, Temple University), who recently accepted faculty positions at the Center. Dr. Parma studies how the sense of smell impacts human health and well-being, with particular emphasis on smell to diagnose Covid-19 and odor-based treatments for autistic children. Dr. Bolding’s research is focused on learning and memory in the olfactory center of the human brain.

BUILDING THE FUTURE, WITH YOUR HELP

Expertise When It’s Most Needed

Monell is bringing its 50-plus years of scientific leadership to create a multidisciplinary research program to discover why smell loss occurs – and to prevent or cure it. When fully funded, Monell’s anosmia research will have the potential to impact millions of individuals worldwide who are so desperately seeking answers for an underappreciated condition. Our discoveries will inform consumer goods companies in their effort to improve the aroma and taste experience of products, supporting healthy aging, and improving the quality of life for all.

Get Involved

- Sign up for our newsletter: https://monell.org/get-updates/
- Follow Monell on Social Media
  - Instagram: monell center
  - Twitter: @MonellSC
  - Facebook: Monell Center
  - YouTube.com: MonellCenter
- Participate or spread the word about studies on taste, smell, and sensory perception
- Support our scientists: http://monell.org/support/

THANK YOU

Thank you for all you have done to contribute to our impact. Your continued support for Smell for Life will be invested in a multi-disciplinary team of investigators who are tackling smell loss from multiple angles and perspectives – from regenerative approaches to smell loss, the role of inflammation in viral-induced smell loss, brain training as a technique to treat smell loss, to genetic components of congenital smell loss.

STRUGGLING TO EXPLAIN YOUR SMELL DISORDER TO OTHERS?

www.smellforlife.monell.org
GLOSSARY OF TERMS

Throughout the text, we have used the term *taste and smell disorders* to describe the following range of clinical conditions:

**Anosmia**: the loss of the sense of smell, either total or partial.
**Ageusia**: the loss of taste functions of the tongue, particularly the inability to detect sweetness, sourness, bitterness, saltiness, and umami.
**Parosmia**: an abnormality in the sense of smell.
**Dysosmia**: the distortion in the perceived quality of an odor or as the presence of a strange odor in the absence of actual odor stimulation.
**Dysguesia**: an impairment of the sense of taste.
**Hyposmia**: a reduced ability to smell and to detect odors.
**Hypogeusia**: a reduced ability to taste things

CITATIONS

3. https://www.youtube.com/watch?v=y5nnLlspY3g&t=39s
4. https://www.youtube.com/watch?v=GjfR44szh4o
**RELATED LINKS**

2. The Monell Anosmia project/Smell for Life Project: [https://monell.org/anosmia/](https://monell.org/anosmia/)
3. GCCR Website: [https://gcchemosensr.org/](https://gcchemosensr.org/)
4. Monell Media Mentions: [https://monell.org/media-mentions/](https://monell.org/media-mentions/)
5. Kids and Covid Video: [https://www.youtube.com/watch?v=ov3_tfPH9iQ](https://www.youtube.com/watch?v=ov3_tfPH9iQ)
7. Anosmia Panel Discussion Recording: [https://www.youtube.com/watch?v=8TV-MYOJfmM](https://www.youtube.com/watch?v=8TV-MYOJfmM)
10. AbScent: [https://abscent.org/](https://abscent.org/)
11. Share this page to explain anosmia to others: [www.smellforlife.monell.org](http://www.smellforlife.monell.org)
Formerly the Anosmia Project, our hub of research and resources related to smell loss.

**Awareness**
Monell is a vital source of information on smell and taste for the press and the public.

**Advocacy**
We strive to support patient needs through our work with STANA, World Taste and Smell Day and Anosmia Awareness Day.

**Collaboration**
We’re advancing science through collaboration with worldwide affiliations.

**Improving Diagnostics**
Monell’s SCENTinel smell test is effective, inexpensive and easy to use.

**Causes of Smell Loss**
We’ve expanded knowledge through research on both viral-induced and congenital anosmia.

**Progress Towards Treatments and Cure**
Monell scientists’ work on stem cells and on the role of insulin in olfactory regeneration are paving the way to treatments and cures for smell loss.

**Impact of Smell Loss**
Our latest research charts impact of smell loss on the human brain.

**COVID-19 and Smell Loss**
Our scientists are now working on Covid-19-specific studies.

**Sensory Nutrition**
The marriage of sensory and nutrition sciences to address diet-related health challenges of both anosmics and normosmics.