Every day, Monell scientists make discoveries about how our bodies detect and respond to chemical molecules in the worlds within and around us.

As a nonprofit research institution we have an unrivaled approach to understanding taste and smell. Our work guides policies and inspires products that enable healthier diets, safer environments, and more powerful ways to meet pressing world health challenges — from obesity to infectious diseases to Alzheimer’s dementia.

Bruce Kimball, PhD, and Stephanie Gervasi, PhD
It has been a remarkable 50-year journey, full of exciting discovery and new perspectives. This year was no exception.

Morley Kare founded Monell in 1968 as an experiment. We began by looking beyond the traditional academic structure of the time to collaborate freely and richly across disciplines. We went on to break barriers by recognizing the broad value of forming productive partnerships in both the public and private sectors.

The result of this bold experiment is a legacy of fundamental knowledge that now is guiding us to a healthier future.

Today, we continue to grow partnerships with research and academic institutions, industry associations, and organizations within the US and abroad to support data-based decisions and policies with the ultimate goal of assuring healthy living for all.

Our newest academic partner, Thomas Jefferson University, shares our mission of improving human health. Together we have the great opportunity to translate Monell’s basic science to advance clinical practice on numerous fronts. As just one example, a new collaborative research venture focused on taste carries high potential to increase the likelihood that children in Third World countries will take their life-saving medicines. This important work, funded by the Bill & Melinda Gates Foundation, could not have been conceptualized or carried out by either partner alone.

You — our donors and our industry sponsors — set the springboard for studies like these. Your support enables us to train our young scientists to become tomorrow’s leaders. It drives us as we explore and innovate to advance global well-being. And you help us launch vital research initiatives such as our new sensory nutrition program, which addresses critical problems in nutritional health by combining our expertise in the sensory drivers of food intake with innovative research in nutrient detection, metabolism, appetite, and food choice.

Thank you for joining us on this remarkable journey. Together with you, we built our legacy of discovery. Together with you, we now are transforming tomorrow.
Sensing Taste: On the Tongue and Beyond

The sense of taste serves as a nutrient detector in our mouths, allowing us to evaluate the nutritional value of foods and avoid toxins. Taste recognition begins with the coupling of a molecule to a receptor protein embedded in a cell membrane.

LEGACY OF DISCOVERY

• In the 1970s, Monell investigators were the first to identify a vertebrate taste receptor, an amino acid receptor in fish. Several decades later, Monell scientists contributed to the identification of human sweet and bitter receptors.

• Monell scientists pioneered techniques to biopsy and culture living human taste cells. Today, these techniques are being used to discover novel flavor-active compounds and to reduce bitterness of medicines in pediatric pharmacologic formulations.

• Monell scientists identified “taste” receptors in the nose, gut, and sperm, extra-oral receptors with therapeutic potential for treating diseases and disorders such as chronic rhinosinusitis, diabetes, obesity, and intestinal parasites. In the airways, these chemical sensors act as sentinels to protect the body against invading bacteria, while bitter receptors in the gut trigger immune responses against parasites. Other studies revealed that sweet receptors in the gut recognize sugars and other nutrients to help modulate insulin release and coordinate metabolism.

IN 1967, The Ambrose Monell Foundation made an initial $1 million investment to create the Monell Chemical Senses Center, with Dr. Morley Kare as its director.

“Monell itself is a scientific experiment.”

Morley Kare, PhD
Over the past year, the team of physician-scientist Noam Cohen, MD, PhD, behavioral geneticist Danielle Reed, PhD, and colleagues continued their seminal work detailing how bitter and sweet taste receptors in the airways activate immune responses to protect against bacterial infections.

One study explored the function of nasal sweet receptors, which monitor nasal glucose to track whether bacteria are using sugar to fuel their growth. High levels of nasal glucose minimize immune responses, so the bacteria mask their presence by secreting ‘fake glucose’ in the form of d-amino acids to trick the sweet receptor into thinking that glucose levels are high.

Other work from the same team showed that simple taste tests for sensitivity to bitter substances such as quinine may serve as a non-invasive marker to indicate an individual’s susceptibility to infection and severity of chronic sinus disease.

What if succinate, a metabolite found in all cells of the body and used as a food and dietary supplement, could be used to control or even prevent the devastating parasitic worm infections that plague the developing world? Molecular biologist Peihua Jiang, PhD, showed that taste-like cells in the intestines sense succinate secreted by parasites, and that dietary succinate activates these cells and initiates immune responses against parasitic invasion.
Throughout the 1970s and 80s, Monell scientists conducted studies that revealed the remarkable plasticity of the olfactory system. This research demonstrated that sensitivity to individual odors can be induced through repeated exposure to those odors, leading the way to today’s research on the effectiveness of ‘smell training’ to help restore olfactory function in individuals suffering from smell loss.

And while anosmia is under-recognized and receives little attention from the medical profession, the landmark 1986 scratch and sniff National Geographic Smell Survey enabled Monell scientists to document the extent of this sensory disorder, revealing that:

- almost two-thirds of us have suffered a temporary loss of smell
  (as the authors noted, consider a world where two-thirds of the inhabitants had experienced temporary blindness) and that
- 1.2 percent of individuals worldwide – currently over nine million people – suffer from permanent smell loss and cannot smell at all.
Monell’s Anosmia Project, launched in 2014, builds on our decades of foundational work as the Center takes a leadership role in efforts to identify treatments for the millions who suffer from anosmia and also to raise awareness about this devastating disability. This year brought significant advancements that together bring hope for a future where smell loss can be cured.

- Neuroscientist Joel Mainland, PhD, received a new grant from the National Institutes of Health to continue his work to identify the causal genes underlying congenital anosmia, a condition where people are born without a sense of smell. This grant places Monell in an elite group of leaders in anosmia research. Candidate genes that contribute to congenital anosmia could have the added benefit of helping us determine the underlying physiology involved in acquired anosmia.

- Monell, in partnership with two university-based chemosensory research centers, obtained funding from the National Institute on Deafness and Other Communication Disorders (NIDCD) and Kerry to host a groundbreaking two-day conference in November 2018 that will identify the most promising treatment-focused research directions for smell and taste disorders. The “Identifying Treatments for Taste and Smell Disorders” meeting brings together researchers and clinicians in taste, smell, and the other senses to share approaches for research to restore sensory loss. Patients will educate scientists and clinicians by describing their experiences with smell and taste loss and the related impact on their quality of life.
Liking for sweet and salty foods is part of being human, but too much increases our risk for disease. Fifty years of Monell research shows that this liking can be modified, paving the way to sensory strategies to improve global nutritional health.

Some examples from over 140 Monell publications on sweet taste, 121 papers on salty taste, and 88 related to nutrition:

- Approaching sweetness from multiple perspectives extending from sensory to molecular to receptor kinetics, Monell research identified differences between sugar and non-nutritive sweeteners to highlight the critical importance of sucrose and other caloric sugars to the rewarding pleasurable sensations associated with sweet taste.

- Monell studies revealed that early introduction to salty foods increases children’s preferences for the taste of salt.

- Two seminal Monell studies form the basis for current FDA guidelines to reduce dietary sodium by gradually lowering the amount of salt in manufactured and restaurant food.
  - Research from Monell established that most of the salt we eat in our society is from commercially-prepared foods.
  - Monell scientists showed that people prefer lower levels of saltiness following several weeks on a low-sodium diet.

“In simplest terms, the fundamental purpose of understanding the chemical senses is to assist in solving the problems of population and nutrition.”

The global obesity epidemic continues to increase, in part because of our inborn love of sugary foods. With excess weight comes rising rates of obesity-associated chronic disease, including diabetes, heart disease, and metabolic syndrome.

Does a reduction in the sensory exposure to sugar change sweet taste perception and make reduced sugar foods taste better? Over the next five years, funds from a new NIDCD grant will allow Monell scientists Gary Beauchamp, PhD, and Paul Wise, PhD, to conduct a randomized clinical trial to address that question.

In partnership with a US Department of Agriculture nutrition laboratory, the ground-breaking study will provide participants with all foods for four months to ask if reducing dietary sugar by about one-third leads people to prefer lower levels of sugar in food and beverages.

If so, these sensory findings would provide strong support for recommendations to improve public health by reducing the amount of added sugars in commercially-prepared foods and beverages.
The Taste of Gut Inflammation

Gustducin, a critical taste cell molecule involved in sensing sweet, bitter, and umami on the tongue, has also been found in intestinal immune cells. Using an animal model of inflammatory bowel disease (IBD), Monell researchers found that mice lacking gustducin developed more gut inflammation, tissue lesions, and white blood cells in the colon. “Taste signaling pathways may play a role in regulating gut inflammation and perhaps susceptibility to IBD, a debilitating condition that affects over 1.4 million Americans,” said Hong Wang, PhD.

Mama, What’s a Smell?

Unlike vision or hearing, there is no standardized test to assess the sense of smell in young children. To fill that void, one current Monell scientist and three alumni contributed to an international study to create an odor identification test that can diagnose a reduced sense of smell in children as young as five. Scientists from 19 countries tested 1,760 children to select odors for testing and validate the Universal Sniff (U-Sniff) test. The study provides data to develop a test that can be used internationally to document if a child has a reduced sense of smell.

Tweaking Taste

Monell investigators identified a new role for the Gli3 gene that helps control regeneration of taste stem cells, the parental cells that produce the different types of taste receptor cells. Gli3 also selectively regulates growth of the sweet/umami taste cell. “Ultimately, understanding the genes that regulate taste regeneration may give us tools to improve nutritional health in at-risk populations, including diabetics, cancer patients and the elderly, by manipulating taste function,” said Sunil Sukumaran, PhD.

Kickstarting Immunity

Someday a taste cell protein called Pou2f3 might be used as a therapeutic agent to boost certain immune responses. Molecular biologist Ichiro Matsumoto, PhD, working with collaborators at the Tokyo Institute of Technology, provided evidence that Pou2f3 is needed to generate sentinel “taste cells” throughout the body. These cells function as gatekeepers to protect against potentially harmful substances – from poisonous compounds to invading bacteria to parasites – and initiate immune responses.

Peeking Inside Taste Cells

A significant technological advance from Monell now enables scientists to identify the complete set of genes in any type of taste receptor cell. The technology provides a treasure trove of information that will help researchers identify precisely how each type of taste cell carries out its specific function, both when healthy and when affected by damage or disease.
The work of the Monell Center is supported through three principal sources. One source is government funding, consisting chiefly of competitive federal grants. Additional funds come from corporate sponsorship fees and industry-sponsored basic or translational research. Finally, the Center receives significant support from generous gifts and grants from private individuals and philanthropic foundations. While all three are critical to the Center’s income, government funding traditionally has been the largest source of support. In 2017-2018, however, the Center received a substantial increase in philanthropic support, largely associated with its 50th Anniversary. Total revenues for the year increased by eight percent, which when combined with a reduction in expenses by six percent resulted in a small surplus – a positive turnaround from the deficits of the previous two years. Indications for 2018-19 suggest a substantial increase in federal funding and a corresponding increase in our research work. The Center is most grateful for the continued generosity of the Monell Foundation, the Center’s founding funder and largest private donor.
Corporate Sponsorship Program

Working successfully with companies since our founding, Monell has defined the gold standard for transparent and productive academic-industry partnerships.

Diverse Business Sectors

Companies from a wide range of business sectors and trade associations gain broad value from Monell science. Current sponsor categories range from foods and beverages to fragrances to personal care products, pharmaceuticals, technology, and more.

**MONELL SPONSOR INDUSTRY SECTORS | 2017-18**

- **32%** Food & Beverage Manufacturers
- **19%** Consumer Product (non-food)
- **15%** Food Ingredient
- **10%** Flavor & Fragrance
- **7%** Beauty
- **5%** Trade Associations
- **5%** Health & Pharmaceutical
- **5%** Technology

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**BENEFITS**

Monell sponsors benefit from close interactions with the Center’s scientists in multiple ways. These opportunities provide early access to emerging science and technical advances through:

- exclusive attendance at educational conferences and research symposia
- consultation opportunities
- training of visiting scientists
- opportunity for research collaborations
- special access to intellectual property

**SPONSOR CONTACT HOURS | 2017-18**

- **1,500** AT CONFERENCES (sponsor’s meeting, symposium, seminars)
- **250** ONE-ONE MEETINGS, VISITS, CONSULTATIONS
- **250** VISITING SCIENTISTS/TRAINING/ON-SITE PROJECT WORK

Monell’s industry partners benefited from approximately 2,000 hours of interactions with Center scientists this past year. These focused connections help to advance and translate sponsors’ technical know-how and identify solutions that enhance their marketplace innovation.
**Sponsor Spotlights:** Monell deeply appreciates our many longstanding relationships with corporate partners around the world. Among our longest-term relationships, we are proud to recognize inaugural sponsors Campbell’s Soup Company and Unilever for 50 years of support! Firmenich, Givaudan, and Mars have been part of the Monell family for more than 45 years. Our current sponsors have partnered with us on average more than 26 years.

**AJINOMOTO**

The motto “Eat Well, Live Well” aptly characterizes Ajinomoto, a global leader in research, development, and sales of amino acid products in the food and many other industries. Ajinomoto joined Monell’s sponsor program in 1975 as our first Japanese corporate sponsor and since then has helped us build relationships with many Japanese companies. Over the years Monell and Ajinomoto have co-organized many international conferences on taste and nutrition and worked together on multiple research projects to advance understanding of how sensory mechanisms impact human nutrition.

Ajinomoto has maximally leveraged the ability to enhance their technical capabilities and productivity through multiple visiting scientist placements at Monell. Among the first Ajinomoto scientists to visit Monell was Dr. Kunio Torii, who arrived in 1977 to work with Dr. Robert Cagan on the biochemical mechanisms underlying the umami amino acid taste stimulus glutamate. Their groundbreaking research helped establish the fields of taste molecular and cellular biology.

Ajinomoto scientists return to Japan imbued with the Monell ethos of collaborative, interdisciplinary work. Numerous close scientific collaborations have led to many deep personal friendships between Monell scientists and our industry colleagues, establishing lasting international ties.

**SENSONICS**

Our newest sponsor, Sensonics International, joined Monell in 2017. Sensonics manufactures and distributes smell and taste tests and instrumentation for assessing chemosensory dysfunction to academic, medical, and industrial researchers throughout the world. Their premier product is the Smell Identification Test™ [UPSIT], a comprehensive 40-item test that is the worldwide standard for olfactory testing.

Sensonics founder Dr. Richard L. Doty began his career in the 1970s as a Monell scientist, then went on to direct the Smell and Taste Center at the University of Pennsylvania. He values Monell sponsorship for its ability to enhance Sensonics’ research potential in basic and clinical chemosensory science. Sensonics and Monell share a vision to advance recognition of the importance of taste and smell, with an emphasis on the potential of these senses to aid in diagnosis and mechanistic understanding of neurocognitive disorders such as Alzheimer’s, Parkinson’s, depression, and schizophrenia.

Visit [www.monell.org/sponsors](http://www.monell.org/sponsors) for a list of current corporate sponsors and to learn more
Many Thanks to Monell Center Donors 2017-2018

One of our greatest pleasures is to thank you – the friends, alumni, employees, foundations and businesses – who support Monell’s research mission through philanthropic gifts and grants. Below, we gratefully recognize your donations received between July 1, 2017 and June 30, 2018.

Christina Kind, Kenneth Kind, Andrew Kindfuller, Valerie Kind-Rubin, and Laura Kind McKenna: A Family Affair
Our mother, Patricia van Ameringen Kind, was a long-time supporter and board member of the Monell Center. One of her many contributions to the Center was choosing Arlene Love’s iconic public sculpture, Face Fragment. Supporting the 2017 restoration of the sculpture was an important way to give back in our mother’s memory.

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To discuss a gift to Monell, please contact Jenifer Trachtman, Director of Development, at 267-519-4715 or jtrachtman@monell.org.

Visit www.monell.org/giving to make a secure online contribution.

Every effort has been made to ensure the accuracy of these lists. If we have inadvertently misspelled or omitted your name, please accept our apologies and notify Jenifer Trachtman.
The Ambrose Monell Foundation: A Half-Century and Counting

One of the Monell Foundation’s boldest decisions was to award a grant back in 1967 to establish the Monell Center. It was a gamble, we literally were underwriting something that had never been done before. Fifty years later, the gamble has paid off. Monell’s basic discoveries in taste and smell are enriching health outcomes in ways we could not have imagined. The Foundation is proud of its longtime and ongoing support of the Center. — Ambrose K. Monell, Foundation President, pictured far right with Foundation Directors Maurizio Morello (left) and Gary Beauchamp (center).
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MONELL CENTER
3500 MARKET STREET
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