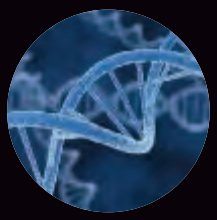
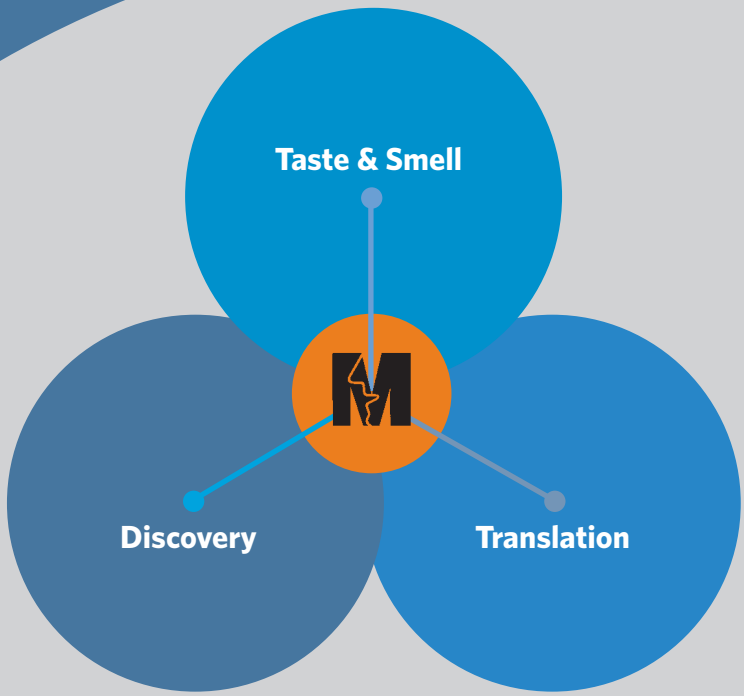
# MONELL CENTER

## 2014-2015

## Annual Report






**Monell's mission** is to advance scientific understanding of the mechanisms and functions of the chemical senses to benefit human health and well-being.

# Letter from the Director

Robert F. Margolskee

**Thank you** for making my first year as Director of Monell so rewarding. This annual report is an opportunity both to look back at the remarkable breakthroughs we achieved with your support over the past year and also to look forward to the extraordinary potential of taste and smell science.

As you read our report, I hope you will find topics and themes of keen personal interest. As someone trained in medicine and molecular genetics, I personally feel that some of our most exciting advances involve the strong potential to translate Monell's genomic research into the opportunity to improve human health.

Another fascinating area of research at Monell focuses on learning more about internal chemosensory cells, known as interoceptors. Just as 'traditional' taste and smell receptors in the mouth and nose sense chemical information about the world around us, interoceptors are inner chemosensory cells that help regulate the internal chemical milieu to control many of the body's essential functions.

We are discovering that many interoceptors have much in common with the taste and smell receptors in our mouths and noses. For example, the same protein that serves as a bitter taste receptor in oral taste cells also has been found in lung and airway cells, where it guards against respiratory diseases by protecting us from inhaled bacteria and other pathogens. Also, when we eat a food containing carbohydrates, chemosensory cells in our intestines use sweet receptor proteins to monitor the amount of sugar digested and help regulate blood glucose levels by signaling the pancreas to release the appropriate amount of insulin.

Monell's pioneering work on interoceptors builds potential to identify novel therapeutic targets for metabolic diseases. To provide just one example, in type 2 or adult onset diabetes, a decreased effectiveness of insulin eventually results in the dangerous metabolic state of hyperglycemia (high blood sugar). Therapies that stimulate the intestinal interoceptors described above could help regulate blood glucose levels more effectively both by stimulating more insulin release and by making the insulin more effective at transporting glucose from the bloodstream into cells.

Yet another highly promising avenue of research involves the emerging field of regenerative medicine, wherein stem cells are used to restore function to tissues and organs damaged by injury or aging. Already, Monell researchers are leveraging the unique regenerative properties of taste and smell stem cells in studies to understand how they differentiate and grow into different mature cell types. The potential applications for this research are numerous, including the identification of therapies to combat loss of taste and smell, debilitating conditions with serious adverse consequences on health and well-being.

Monell's science relies on people. You will see in our financials that the greatest part of our budget is used for research. This includes salaries for laboratory heads, postdoctoral fellows, and research assistants, together with costs for research supplies and equipment. I owe a great deal of gratitude to everyone who helps to make Monell the hallmark institution that it is.

Moving forward, we will build on what we have learned thus far to further uncover the potential of the fascinating and primal chemical senses. To help achieve our mission, in the coming year we will focus on recruiting outstanding new faculty and on expanding our collaborative ventures. We also will begin to unveil plans for our 50th anniversary, which we will celebrate in 2018. This milestone anniversary will provide a special opportunity for you to get to know our work and our scientists even better.

Enjoy our report! Your interest and support are critical to our success. If you want to know more about Monell – please reach out to anyone at the Center, including myself.

**Robert F. Margolskee, MD, PhD**
Director & President

# **Research at Monell:** Building on Basic

Simultaneously broad, deep, fundamental, and targeted, Monell's research focuses on the mechanisms and functions of taste and smell to expand knowledge of how we relate to our internal and external worlds. The resulting discoveries enhance our lives through the potential of translation and application.

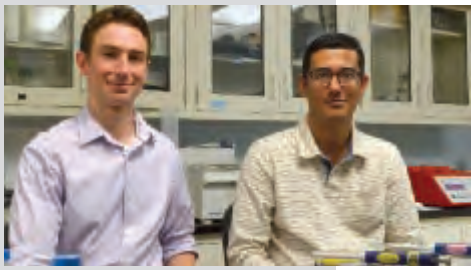
**Nutritional translation**

- Identifies tenable solutions to pressing diet-related public health problems, including obesity and hypertension
- Assists industry's need to develop healthful and well-accepted foods and beverages

**Clinical translation**

- Harnesses knowledge of internal chemoreceptors and of cellular regeneration to identify innovative therapies
- Develops new approaches to diagnose and treat disease

Interdisciplinary collaborations within the Center and with a wide-ranging international network of colleagues from academic and corporate research facilities bring fresh perspectives and extraordinary depth to Monell's science.



Complementing Monell's research mission, the Center's commitment to training builds potential through preparation of the next generation of scientists. Their contributions will insure continued discovery and innovation to solve the problems and challenges yet to come.

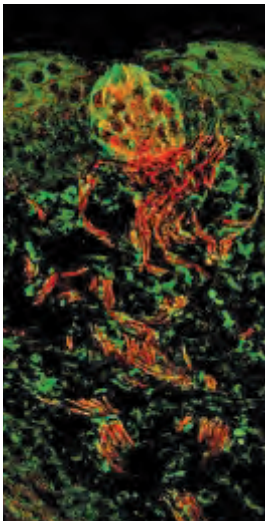
# Publications

**The following selected review of recent publications exemplifies how the themes of health, nutrition, communication, training (* indicates a Monell postdoctoral fellow) and interdisciplinary research resonate through Monell's chemosensory science. The collective findings reaffirm the critical value and potential of advancing discovery in taste and smell.**

## Neuroscience

The brain integrates signals from taste and smell pathways to form the sensory experience of flavor. This study used sophisticated fMRI technology to map brain regions activated by taste alone, smell alone and the combined sensory inputs from a real world beverage – orange juice. The findings pinpointed a brain region where sensory inputs converge and may transition into a holistic flavor percept. A sub-region of this area has connections to memory centers, a link that may be relevant to the formation and persistence of flavor preferences. Increased understanding of this process could provide insight into reshaping unhealthy eating habits. Seubert, J*, Ohla, K*, Yokomukai, Y, Kellermann, T, & Lundström, JN. (2015). Superadditive opercular activation to food flavor is mediated by enhanced temporal and limbic coupling. Human Brain Mapping, 36, 1662-1676.

Two taste cell types transmit information from sweet, salty, sour, bitter, and umami receptors to the taste nerves that send information to the brain. A fundamental problem in taste neuroscience is how the cells signal the specificity of the taste quality to the nerve. This study evaluated the role of glucagon-like peptide-1 (GLP-1), a gut hormone involved in blood glucose regulation that also is found in taste cells of the tongue. The findings revealed that sweet compounds – but not other taste qualities – stimulate taste cells to release GLP-1. Further, mice engineered to be missing the GLP-1 receptor were less responsive to sweet compounds, but not to other tastes. Together, the findings suggest that GLP-1 has both metabolic and taste functions, increasing evidence for a strong interaction between two physiological systems involved in detection of sugars. This interplay may have implications for the development and progression of obesity and metabolic disease. Takai, S*, Yasumatsu, K, Inoue, M, Iwata, S, Yoshida, R, Shigemura, N, Yanagawa, Y, Drucker, DJ, Margolskee, RF, & Ninomiya, Y. (2015). Glucagon-like peptide-1 is specifically involved in sweet taste transmission. FASEB Journal, 29, 2268-2280.



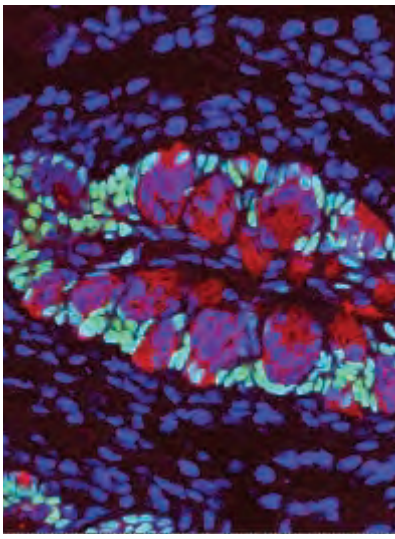
## Sensation & Perception

Children consume far more sugar and salt than recommended, increasing lifelong risk for poor health outcomes. Understanding the biology behind children's taste preferences is a crucial first step to reducing their excess salt and sugar intake. This study revealed that, in general, children prefer sweeter and saltier tastes than do adults. Further, children who most prefer high levels of sweet taste also prefer high levels of salty taste. These preferences relate not only to real-world food intake but also to physiological measures of growth. The findings may help develop informed strategies to promote healthy eating in growing children. Mennella, JA, Finkbeiner, S, Lipchock, S*, Liang-Dar, H, & Reed, DR. (2014). Preferences for salty and sweet tastes are elevated and related to each other during childhood. PLoS ONE, 9, e92201.

Individuals with asthma need to understand how to manage their symptoms to prevent severe attacks. In this study of people with moderate asthma, Monell researchers demonstrated that the participants' beliefs about a benign rose-smelling odor – specifically whether it was potentially harmful (asthma-triggering) or therapeutic – influenced both psychological and physiological responses to a 15-minute odor exposure. In particular, airway inflammation increased for at least 24 hours when participants believed the odor might be harmful. The findings highlight the role that expectations can play in health-related outcomes. Jaén, C & Dalton, P. (2014). Asthma and odors: The role of risk perception in asthma exacerbation. Journal of Psychosomatic Research, 77, 302-308.

The refreshing 'bite' of carbonation is an integral part of beverages consumed around the globe. The mild irritation occurs when enzymes in the mouth convert carbon dioxide into carbonic acid, which then activates sensory nerve endings. These same nerve endings also detect sensations of warming and cooling. This study revealed that while cooling enhances carbonation's bite, warming has no effect. The combined results lend insight into identifying the receptors that mediate carbonation sensation. Understanding how bite is transmitted and modulated may have implications for understanding how to control other types of pain related to tissue acidification, including pain from certain cancers. Wise, PM & Bryant, BP. (2014). The effect of temperature and menthol on carbonation bite. Chemical Senses, 39, 571-582.

## Health & Disease



Bitter receptor proteins on the tongue detect potential toxins, including bacteria in spoiled foods. Bitter receptors in the nose and upper respiratory tract also detect bacteria and activate immune responses. This study used cultured human respiratory epithelial cells to identify exactly how upper airway bitter receptors trigger an anti-bacterial defense. The research further revealed that this defense is inhibited by sweet taste receptors also located in respiratory cells. Clinical studies showed that patients with chronic rhinosinusitis have elevated glucose levels in their nasal secretions, suggesting that chronic activation of airway sweet receptors may inhibit the ability of bitter receptors to defend against infection. The findings that bitter and sweet receptors in the airway contribute to human respiratory immunity and disease susceptibility reveal a potential novel therapeutic target for chronic rhinosinusitis, which affects 35 million Americans with a cost of $6 billion each year. Lee, RJ, Kofonow, JM, Rosen, PL, Siebert, AP, Chen, B, Doghramji, L, Xiong, G, Adappa, ND, Palmer, JN, Kennedy, DW, Kreindler, JL, Margolskee, RF, & Cohen, NA. (2014). Bitter and sweet taste receptors regulate human upper respiratory innate immunity. Journal of Clinical Investigation, 124, 1393-1405.

Reduced food intake and associated malnutrition can negatively affect the long-term prognosis of individuals with cancer, autoimmune disorders, and chronic inflammatory diseases. Following up on previous findings that localized the immune system protein tumor necrosis factor (TNF) in taste buds, this study asked whether TNF directly affects taste. Mice engineered to be lacking the TNF gene (TNF knockout mice) had a deficit in their ability to sense bitter taste. This suggests that TNF regulates bitter taste in normal mice and that elevated TNF levels associated with infection or inflammation may cause foods to taste more bitter. Specifically, TNF may act directly on the taste system to make sick people more sensitive to bitterness so that foods taste less appetizing. Feng, P, Jotaki, M*, Kim, A, Chai, J, Simon, N, Zhou, M, Bachmanov, AA, Huang, L, and Wang, H. (2015). Regulation of taste responses by tumor necrosis factor. Brain, Behavior, and Immunity, doi:10.1016/j.bbi.2015.04.001.

## Nutrition & Metabolism

Fat has been a desired energy source for much of human evolution, making the ability to detect fat via sensory cues a potentially beneficial one. This study revealed that small changes in the fat content of milk can be identified using the sense of smell. As food smell almost always is detected before taste, the findings identify one of the initial sensory qualities that signal whether a food contains fat. Innovative methods using odor to make low-fat foods more palatable could someday aid public health efforts to reduce dietary fat intake. Boesveldt, S* & Lundström, JN. (2014). Detecting fat content of food from a distance: Olfactory-based fat discrimination in humans. PLoS ONE, 9, e85977.

Oral sensations, including taste, guide food selection and also play a role in determining how ingested food is digested and metabolized. To better understand how taste influences dietary fat digestion, this rodent study asked whether the pleasantness of a taste influences how quickly fat empties from the stomach into the intestines. The findings revealed that unpleasant tastes (such as bitter) slow gastric emptying of fat, thereby decreasing the amount of fat in the intestines. A presumed consequence would be less intestinal absorption of triglycerides – a type of fat associated with increased risk for stroke and heart disease – into the blood. These results suggest that it may be possible to control blood triglyceride levels using the taste of food. Saitou, K., Lees, JN, & Tordoff, MG. (2014). Taste hedonics influence the disposition of fat by modulating gastric emptying in rats. PLoS ONE, 9, e90717.

Healthy diets depend on a balanced intake of carbohydrates, fat, and protein, known collectively as macronutrients. When given a choice, mice select appropriate quantities of each, but it is not known how taste genes contribute to this ability. This survey of seven genetically distinct mouse strains allowed mice to self-select their diets and revealed marked differences in preferences: some strains were strong fat-likers, others were strong carbohydrate-likers and others ate equal amounts of the two. Additional experiments used molecular genetic techniques to examine the contribution of three taste genes to macronutrient preference. Surprisingly, the sweet taste receptor does not appear to be involved in the preference for carbohydrates (which include sugars). Two other genes, known as ITPR3 and CALHM1, play a role in fat preference and are the first single genes shown to contribute to preference of fat over carbohydrates. Tordoff, MG, Downing, A, & Voznesenskaya, A.* (2014). Macronutrient selection by seven inbred mouse strains and three taste-related knockout strains. Physiology & Behavior, 135, 49-54.

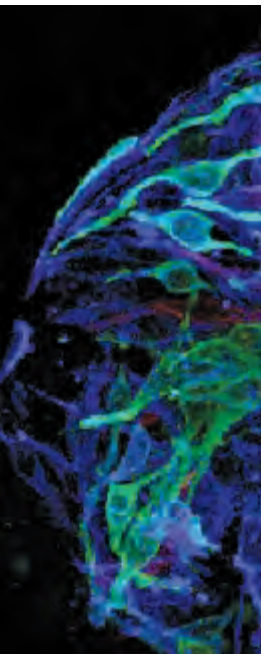
## Chemical Communication & Ecology

Monell research has increased understanding of how chemical signals conveyed through body odors provide an important source of information about individual identity and status for many species. To better understand the mechanisms underlying disease-related changes in body odor, this study used trained biosensor mice to differentiate the odor of animals vaccinated against either rabies or West Nile virus from non-vaccinated animals. Since vaccination activates the immune system, the findings suggest that it is possible to use odors to detect immune system status. This could permit non-invasive disease detection before the onset of observable symptoms. The findings also have implications for wildlife management practices, as odor-based signals of vaccination efforts and immune activation could impact subsequent social and reproductive behavior in target species. This study is part of Monell's long-standing partnership with the USDA's National Wildlife Research Center, which has maintained a field station at Monell for over 40 years. Over 200 studies have increased knowledge about the biology and behavior of many animal and avian species to aid in effective management of wildlife resources. Kimball, BA, Opiekun, M, Yamazaki, K, & Beauchamp, GK. (2014). Immunization alters body odor. Physiology & Behavior, 128, 80-85.

Monell research recently identified earwax odors as a source of information about an individual's ethnic origin. This study used analytical chemistry techniques to examine the composition of volatile organic compounds – odor chemicals – in earwax of male donors of African, Caucasian, and Asian descent. The findings revealed that earwax contains a complex mix of odor chemicals and that differences in their relative amounts define the earwax 'odorprint' of each ethnic group. A gene known to influence the quality of human underarm odor did not influence the earwax odor chemical profile, suggesting that different biochemical pathways must be involved generating in the two odor sources. Studies will continue to explore the potential of human earwax as a source of personal information. Prokop-Prigge, KA*, Mansfield, CJ, Parker, MR*, Thaler, E, Grice, EA, Wysocki, CJ, and Preti, G. (2015) Ethnic/racial and genetic influences on cerumen odorant profiles. Journal of Chemical Ecology, 41, 67-74.

## Development, Regeneration & Aging

Taste (and olfactory) cells regenerate across the lifetime and thus provide a valuable model for understanding stem cell biology and the mechanisms of cellular regeneration. Monell scientists identified the taste stem cell in 2013. The current study established that when grown in a culture dish, this stem cell (identified by a marker known as Lgr5) can generate all three types of functional taste cells, thus mimicking the process of taste cell development that occurs naturally in taste buds. This paves the way for future studies to better understand taste cell regeneration and how this process is regulated in health and disease. Ren, W*, Lewandowski, BC*, Watson, J, Aihara, E, Iwatsuki, K, Bachmanov, AA, Margolskee, RF, & Jiang, P. (2014). Single Lgr5- or Lgr6-expressing taste stem/progenitor cells generate taste bud cells ex vivo. Proceedings of the Academy of Sciences USA, 111, 16401-16406.



The bitter taste of medicines presents a significant obstacle to ensuring that young children, who are unable to swallow encapsulated formulations, take the medicines they need. Building on foundational Monell research describing the unique sensory taste biology of children, this study evaluated the effectiveness of two reported bitter-blocking compounds in children and adults. Both bitter blockers were less effective in children than in adults. The findings highlight the important role of biological development in understanding individual taste experiences and provide initial steps to designing evidence-based strategies to promote increased adherence to medication regimens in children. Mennella, JA, Reed, DR, Roberts, KM, Matthew, PS, & Mansfield, CJ. (2014). Age-related differences in bitter taste and efficacy of bitter blockers. PLoS ONE, 9, e103107.

## Molecular Biology & Genomics

In humans, approximately 400 functional genes code for different types of specialized odor sensors, known as olfactory receptor proteins. The receptors combine to detect both quality and intensity of a large variety of odors, but exactly how they work together is not well understood. Increasing the complexity of the problem, each underlying gene can vary slightly, resulting in one or more variants for each of the receptors, and each variant responds to odors in a slightly different way. The variants are distributed across individuals such that nearly everyone has a unique combination of olfactory receptors. To gain a better understanding of the extent of olfactory receptor variation and how this impacts human odor perception, this study combined molecular genetics, sensory testing, and mathematical modeling to predict that the olfactory receptor tuning of any two individuals differs by over 30 percent. The findings provide a critical step towards understanding how olfactory receptors encode odor molecules and verify that we all do indeed live in unique sensory worlds. Mainland, JD, Keller, A, Li, Y, Zhou, T, Trimmer, C*, & Snyder, LL. (2014). The missense of smell: functional variability in the human odorant receptor repertoire. Nature Neuroscience, 17, 114-1120.

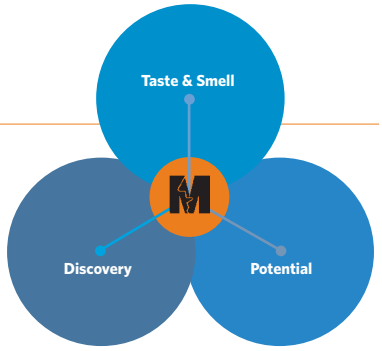
Beginning with the 2005 study that revealed a defective sweet taste receptor gene in domestic and wild cats, Monell scientists have related taste function of different species to their dietary niche. The overall goal is to increase understanding of the oral and extra-oral functions of the varied taste receptors. This study examined sweet taste function in the giant panda, which differs from its relative the carnivorous cat in that it feeds almost exclusively on (non-sweet) bamboo. Behavioral experiments revealed that the giant panda can taste sugar solutions but do not respond to most non-caloric sweeteners. Parallel approaches using panda DNA inserted into cultured host cells showed a similar response: the cells responded to sugars but not to most non-caloric sweeteners, confirming that the giant panda has a functional sweet taste receptor. The giant panda's ability to detect sugars could reflect an extra-oral function of the sweet taste receptor related to digestion of plants. Jiang, P, Josue-Almqvist, J, Jin, X, Li, X, Brand, JG, Margolskee, RF, Reed, DR, & Beauchamp, GK. (2014). The bamboo-eating giant panda (Ailuropoda melanoleuca) has a sweet tooth: behavioral and molecular responses to compounds that taste sweet to humans. PLoS ONE, 9, e93043.

Overconsumption of sugar is associated with obesity and related health problems, leading global public health organizations to recommend that adults and children reduce their daily intake of sugar. However, there currently is little understanding of why people differ in their perception of sweet taste, making it difficult to develop successful evidence-based strategies to reduce sugar consumption. This study asked 754 sets of twins to rate the intensity of two natural sugars and two non-caloric sweeteners. Mathematical modeling reveled that genetic factors account for approximately 30 percent of person-to-person variability in sweet taste perception. Understanding the relative contributions of genetic and environmental factors that influence our perception of sweetness should inform efforts to reduce the amount of sugars and sweeteners we consume. Hwang, L-D, Zhu, G, Breslin, PAS, Reed, DR, Martin, NG, and Wright, MJ. (2015). A common genetic influence on human intensity ratings of sugars and high-potency sweeteners. Twin Research and Human Genetics, 18, 361-367.

# **Building on Basic:** Transformative Opportunity

Continuing Monell's emphasis on strong scientific leadership, Robert F. Margolskee, MD, PhD, assumed the position of Director on October 1, 2014. Dr. Margolskee succeeded Gary K. Beauchamp, PhD, who had led Monell with great aplomb since 1990.

An internationally-recognized pioneer in the use of molecular biology to study cellular mechanisms of taste, Dr. Margolskee has been responsible for several major advances in the field of taste biology, as well as for newer discoveries in the area of how the gut senses nutrients. He joined Monell's faculty in 2009 and was appointed Associate Director in 2010. Prior appointments include positions at the Mount Sinai School of Medicine, the Howard Hughes Medical Institute and the Roche Institute of Molecular Biology.




As Monell prepares to mark its 50th anniversary in 2018, Dr. Margolskee's vision integrates the Center's unparalleled strength in basic scientific discovery with the development of critical translational bridges to improve human health. One key priority is to leverage Monell's capabilities in multiple emerging scientific technologies and innovative expertise. A parallel goal focuses on further expanding Monell's proficiency through recruitment of the best and the brightest scientists in the chemical senses and strategic development of global academic affiliations.

## Global Academic Partnerships

Monell continues to enlarge its circle of formal partnerships with academic institutions around the world. These key partnerships bring valuable breadth and depth to the Center's research by expanding its intellectual and technological resources and extending its geographic range.

This past year brought additional strength to Monell through the formalization of two new important affiliations:


• Building on Monell's strategy of developing a strong institutional presence in Asia, the Center entered into a cooperative agreement with the Dental School of Sichuan University, a top-ranked Chinese academic institution. This fall, a PhD candidate from Sichuan University will begin predoctoral chemical senses research and training at Monell.

• Much closer to home, Monell formalized an affiliation with Drexel University's Department of Culinary Arts & Food Science. Food science and the chemical senses are closely intertwined and this partnership brings the science of taste and smell into food applications that affect appetite, health and nutrition.

## Current Academic Affiliations

**Beijing Institutes of Life Science, Chinese Academy of Sciences**
Beijing, CHINA

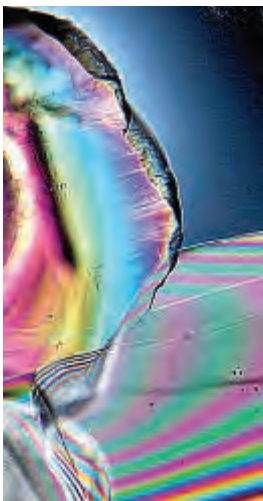
**Department of Culinary Arts & Food Science, Drexel University**
Philadelphia, USA

**Pavlov Institute of Physiology of the Russian Academy of Sciences**
St. Petersburg, RUSSIA

**Singapore Institute for Clinical Sciences, Biomedical Sciences Institute**
SINGAPORE

**State Key Laboratory of Oral Diseases, Sichuan University**
Sichuan, CHINA

**Zhejiang Gongshang University**
**Monell-Zhejiang Gongshang Joint Sensory Science Laboratory**
Hangzhou, CHINA



## New Faculty

### Noam Cohen, MD, PhD
Adjunct Associate Member

As a physician-scientist, Cohen intermingles clinical and research perspectives to better understand the pathophysiology of chronic rhinosinusitis, leading to more effective treatments. A major focus of his research is the role that taste receptors located in the lining of the upper respiratory tract play in defense against bacterial infection.

**"Monell's fundamental strength and interdisciplinary mentality augment my goal to advance patient care by combining clinical expertise and biological investigation."**

### Marco Tizzano, PhD
Assistant Member

Monell's newest faculty member studies taste receptors located in the cells lining our airways and what happens when those specialized cells are exposed to noxious chemicals and molecules from pathogenic bacteria. As Tizzano unravels the resulting pathophysiological processes, the resulting knowledge may lead to drug targets for treating inflammatory conditions associated with respiratory diseases.

**"Monell is the best place to do research on the chemical senses, period. Monell's faculty is comprised of the top scientists in the field; I couldn't have chosen better colleagues."**

### Darren Logan, PhD
Assistant Member

Bringing a strong technological background in genetics and genomics, Logan's broad research goal is to fully understand the hundreds of interacting genes that enable olfactory sensory neurons to sense odorants. Other studies search for genes that underlie smell disorders such as anosmia, as well as those that are affected at the onset of diseases with a strong olfactory component, including Parkinson's and Alzheimer's diseases.

**"At Monell, the combined technical expertise and resources across every aspect of the chemical senses is phenomenal. Its sum truly is greater than the sum of its parts."**

### Yuzo Ninomiya, PhD
Adjunct Member

The preeminent taste neurophysiologist in Japan, Ninomiya uses electrophysiological and molecular biology techniques to understand the cellular coding mechanisms that underlie salty, umami (savory), and sweet taste qualities. Other studies explore hormonal modulation of sweet taste, research with implications for food intake regulation, diabetes, and other metabolic diseases.

**"Monell is the world's only institute where we can study all aspects of chemoreception, using interdisciplinary basic research to link genetic and molecular discoveries to human sensory perception and clinical translation."**

# Building the Future

## Growing Scientific Leaders

### The Rising Generation

### Postdoctoral & Visiting Scientists

**Postdoctoral Fellows**

- 2.5 Average years at Monell
- 2 mos-5 yrs Time at Monell
- 50+ Applications
- 5 Supported by Monell's NIH training grant
- 2 Accepted
- 18 Post-doctoral fellows
- 15 Papers published
- 8 Countries represented
- 2 Supported by their own NIH grants
- 17 Presentations at scientific meetings
- 11 Faculty mentors

Training

**Visiting Scientists**

- 28 Visiting scientists
- 110 Average days at Monell
- 15 Different labs

### The Coming Generation

### Monell Science Apprenticeship Program

- 6,499 Visits to the MSAP application webpage
- 19 Students accepted
- 89% From groups underrepresented in the sciences
- 240+ Applications received
- 7 Students supported by federal grants
- 1,050 Estimated mentorship hours

MSAP

## Growing Public Knowledge

### Anosmia Awareness

**>700%**
Increase in anosmic individuals contacting Monell

43
Tweets about anosmia

**9,352**
Visits to anosmia pages on Monell's website

**23**
Facebook posts about anosmia

14
Monell webpages dedicated to anosmia

**2,565**
Video views

3
Monell videos produced about anosmia

**5**
News stories written about Monell and anosmia

**1**
CME seminar on anosmia

Anosmia

### Education & Outreach

**30**
Monellians

4 Philadelphia Science Festival events

14 Community events

165 Hours

**9**
School- focused events

Outreach

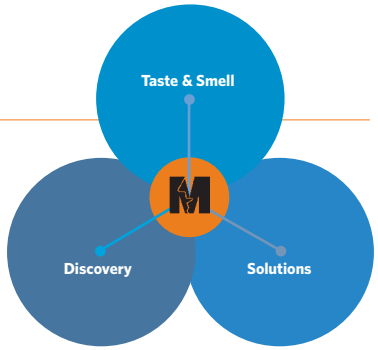
# Corporate Sponsorship

**Monell** has been at the vanguard of successful academic-industry partnerships for almost 50 years. Annual support from corporate memberships provides the Center with unrestricted funds to support young investigators, explore new research ideas and maintain ongoing scientific programs. Corporate sponsors stimulate Monell scientists to imagine their basic research as it relates to real-world problems, which in turn fertilizes new basic research ideas and directions. At the same time, the close partnership and dialog with Monell scientists helps corporate sponsors bridge the large chasm between fundamental research and successful biomedical and marketplace innovation.

Corporate sponsors enjoy exclusive access to Monell research expertise and unbiased cutting-edge scientific information via educational and consulting opportunities. This past year, Monell hosted two educational meetings for sponsor companies. The annual **Review for Sponsors** showcased new research findings from across the Center. The **Spring Colloquium** offered an in-depth exploration of *Chemosensing Good and Evil*, which focused on the science behind the attraction to chemonsensory stimuli like sugars and the avoidance of odors that communicate disease.

Ajinomoto scientist Yusuke Ihara discusses research findings related to the genetics of individual differences with Monell neuroscientist Joel Mainland. This past year, three research scientists from sponsor companies visited the Center for research training in chemosensory science.

Sponsors have the opportunity to fund collaborative research projects involving basic research questions of mutual interest. In addition to individual research projects, Monell has two ongoing research consortia supported by multiple sponsors. One project investigates the molecular basis of salt taste and the other explores the nature of adaptation of classes of sweeteners.




# Monell Center Corporate Sponsors

2014-15

AB InBev
AFB International Inc.
Ajinomoto Co., Inc.
Altria Group
Asahi Group Holdings Ltd.
Campbell Soup Company
The Coca-Cola Company
Colgate-Palmolive Company
Coty Inc.
Diageo, plc
Diana Ingredients
Estée Lauder Companies, Inc.
Firmenich Incorporated
General Mills
Givaudan SA
Heng Yuan Xiang China (Group) Co., Ltd.
Ingredion Inc.
International Flavors & Fragrances Inc.
Japan Tobacco Inc.
Johnson & Johnson
Kao Corporation
Kellogg Company
Kerry Ingredients and Flavours
Keurig Green Mountain Inc.
Kirin Holdings Company, Ltd.
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Mars
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Mead Johnson Nutritionals
Megmilk Snow Brand Co. Ltd.
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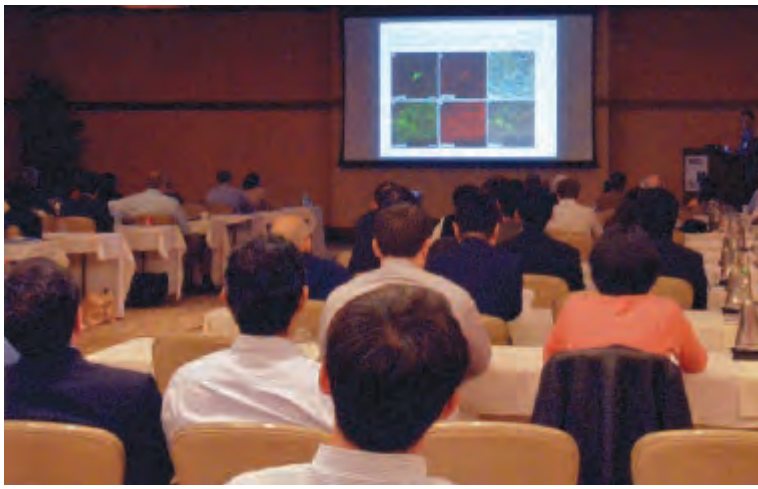

# Thank You

**James Albrecht,** long-time member of Monell's International Advisory Committee and retired executive from McCormick, has a passionate interest in mentoring young people. After meeting several of Monell's outstanding postdoctoral fellows last spring, he asked if he could earmark a gift to support a new fellow. The answer was a resounding yes and as a result, Monell now welcomes Patrick Millet, a new postdoctoral fellow working under the direction of Gary Beauchamp and Bruce Kimball to investigate the use of body odor changes in disease detection. In recruiting Patrick, Beauchamp also interviewed another excellent postdoctoral candidate, Stephanie Gervasi, whose skills and strengths are complimentary to Patrick's. She also will be joining Monell's postdoctoral program and will be funded through the Center's NIH training grant. In effect, Jim's original generous support has thus been doubled. Many thanks to Jim Albrecht for his partnership in Monell's goal to recruit and train a new generation of scientists.

As a young attorney at Dechert in the 1970s, **Richard Berkman** was introduced to Monell by his colleague F. Hastings Griffin, Jr. Over the years, Berkman has advised Monell on the Center's legal issues and in 2008, he became a member of Monell's Board of Directors. Deeply interested in how Monell's research translates to improve health and quality of life, Berkman and his wife Toni Seidl recently made a leadership gift to support new faculty, with the goal of cultivating tomorrow's scientific leaders at Monell. As a direct outcome of their support and generosity, rising scientists Marco Tizzano and Darren Logan were successfully recruited to the Center this past year.

## Monell Center Donors 2014-2015

**We gratefully recognize donations received between July 1, 2014 and July 15, 2015.**

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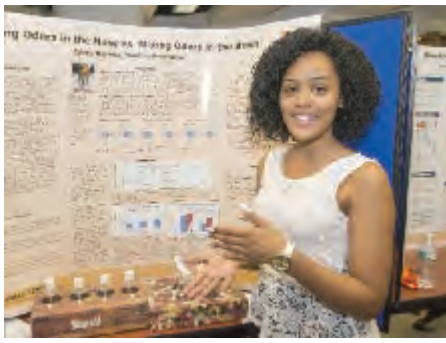
Monell Board Chair **Dwight Riskey** and his wife Cynthia recently reaffirmed their commitment to Monell through a new leadership gift. Riskey began his career at Monell as a postdoctoral fellow before moving on to become a highly successful marketing executive in the food and beverage industry. Over the years, Monell has been enriched by Riskey's insightful understanding of science and industry trends, as well as by his generosity. The Riskeys' gift supports Monell's vision of adding one new faculty member each year to our roster of principal investigators. Service to a nonprofit organization takes many forms and is often referred to as "time, treasure, and talent" or "wealth, wisdom and work." Dwight Riskey is one of the unique leaders at Monell who gives all three with great humor, enthusiasm, and generosity of spirit.



Three students from Camden NJ, including Idalis Herrera (pictured here presenting her research findings), attended the Monell Science Apprenticeship Program thanks to a grant from the **Subaru of America Foundation**. Many thanks also to first-time MSAP supporters **The Charter Foundation** and **Eugene Garfield**, and to **Robert Bedoukian, The Charles E. Ellis Trust, John Labows,** the **Christopher Ludwick Foundation**, and the **National Institutes of Health** for their continuing support.

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## Monell Events

### Life of Spice

Culinary historian Cynthia Clampitt, Monell scientist Gary Beauchamp, and McCormick & Company retired executive Marianne Gillette brought spices to life at Monell's April event with the Geographical Society of Philadelphia. Short talks by the three experts introduced the history of spices, explored how they excite our senses, and revealed how their use in the kitchen can turn ordinary food into exotic cuisine. Afterwards, Monell scientists engaged guests in interactive demonstrations during a special catered reception that explored the unique sensory science behind spices.

### Monell Leadership Transition

As Robert Margolskee assumed the title of Director and President in October 2014, Monell celebrated the leadership transition with a festive dinner for scientists, supporters and friends. Making the occasion even more special was the announcement of $1 million in challenge gifts from board members Richard L. Berkman and Dwight Riskey. The gifts, made in honor of Director Emeritus Gary Beauchamp, support new faculty recruitment in the areas of nutrition, taste, and olfaction. Pictured left to right: Richard Berkman, Robert Margolskee, Gary Beauchamp and Dwight Riskey.

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### Consistent long-term support of the Monell Center

Below we recognize individuals who have given $25,000 or more over their lifetime and individuals who have given at least once a year for three or more consecutive fiscal years.

#### $25,000 - $99,999

Todd Abraham
Arthur and Carolyn Asbury
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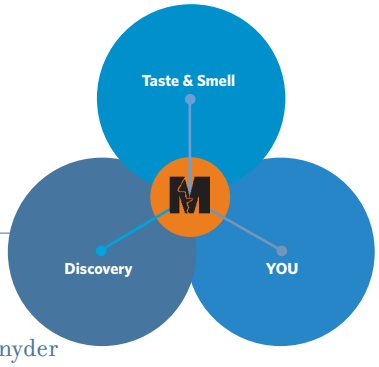
James J. Albrecht
Gary and Fay Beauchamp
John and Teresa Hickey
Bonnie Lou Hunt
Philip S. Johnson
Shaun F. O'Malley*
Ghislaine H. Polak
Dwight R. Riskey

## George Rowe Memorial

On May 18th, Monell hosted a memorial service for long-time board member George Rowe, Jr., who passed away on August 14, 2014. Rowe was deeply involved in Monell activities from the time of its inception in 1968 and for the following 36 years. Enthusiastically providing advice and guidance on all issues – fiscal, administrative and scientific – Rowe had a lively and insightful interest in the Center's research and scientists. Monell was pleased to welcome three of George's children – John, Julia, and Katharine – and their extended families for the service. Also attending were Rowe's nephews Benjamin and Stephen Warnke, members of Monell's Board and International Advisory Council, and colleagues and co-workers. Many in attendance offered affectionate remembrances. Others who were unable to attend – including Gene Grisanti, Ambrose Monell, and Richard Menschel – sent tributes that were read at the service by Gary Beauchamp. It was a lovely tribute to a true Monell friend, colleague, and advisor. Pictured are John Rowe and Katharine Rowe.

## Meyerson Lecture

Monell hosted the 4th Martin Meyerson Lecture on September 30, 2014. Named in memory of Monell Board Chair Martin Meyerson and made possible through a gift from Margy Ellin Meyerson, the lecture brings preeminent speakers to Monell to present cutting edge scientific insights. The 2014 speaker, Richard Wrangham, PhD, is Ruth B. Moore Professor of Biological Anthropology at Harvard University.




**$500,000 +**

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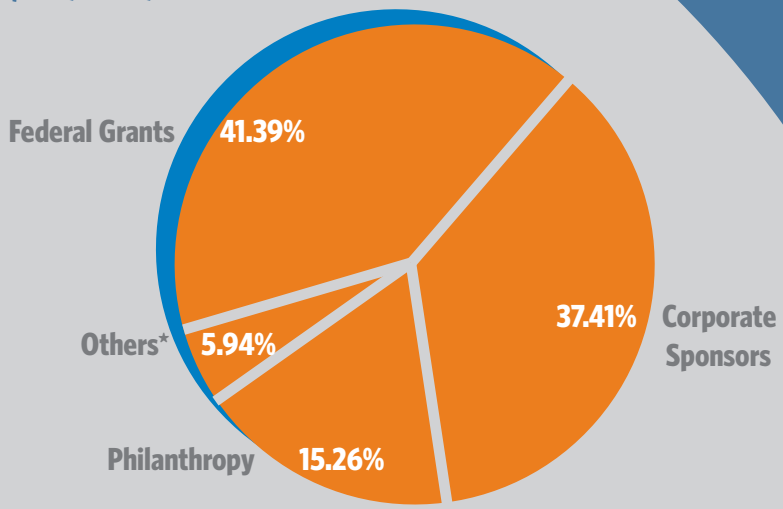
# Financials

The Monell Chemical Senses Center was founded in 1968 through the generosity of the Ambrose Monell Foundation, which invested $1 million in "a great experiment." As the Center built its reputation as the only independent institute devoted to fundamental research in the chemical senses, the National Institutes of Health (NIH) quickly became Monell's principal source of funding.

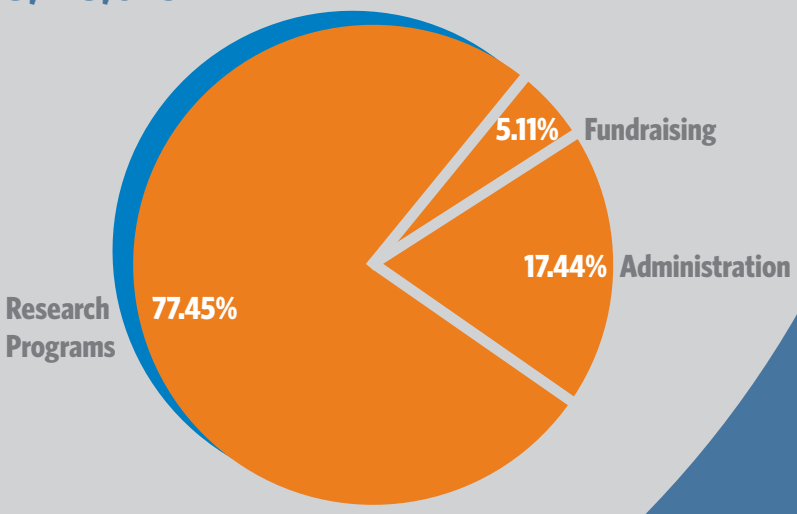
Over the last twelve years, NIH funding has declined by more than 18 percent in constant dollars, impacting the entire US scientific community. During this time, Monell maintained a balanced portfolio of revenue through two additional critical pillars of support: unrestricted funds from corporate sponsors and donations from individuals and foundations. The Monell Foundation remains the Center's largest private donor. As federal funding continues to shrink, philanthropic gifts from individuals are increasingly important to maintain Monell's mission to advance discovery in taste and smell and their impact on human health, nutrition and well-being.

## Total Revenues
## $15,224,955




* Others include: PA State grant, contributed services, honoraria, interest income, patent income and rent income.

## Total Expenses
## $15,218,623

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ADVANCING DISCOVERY
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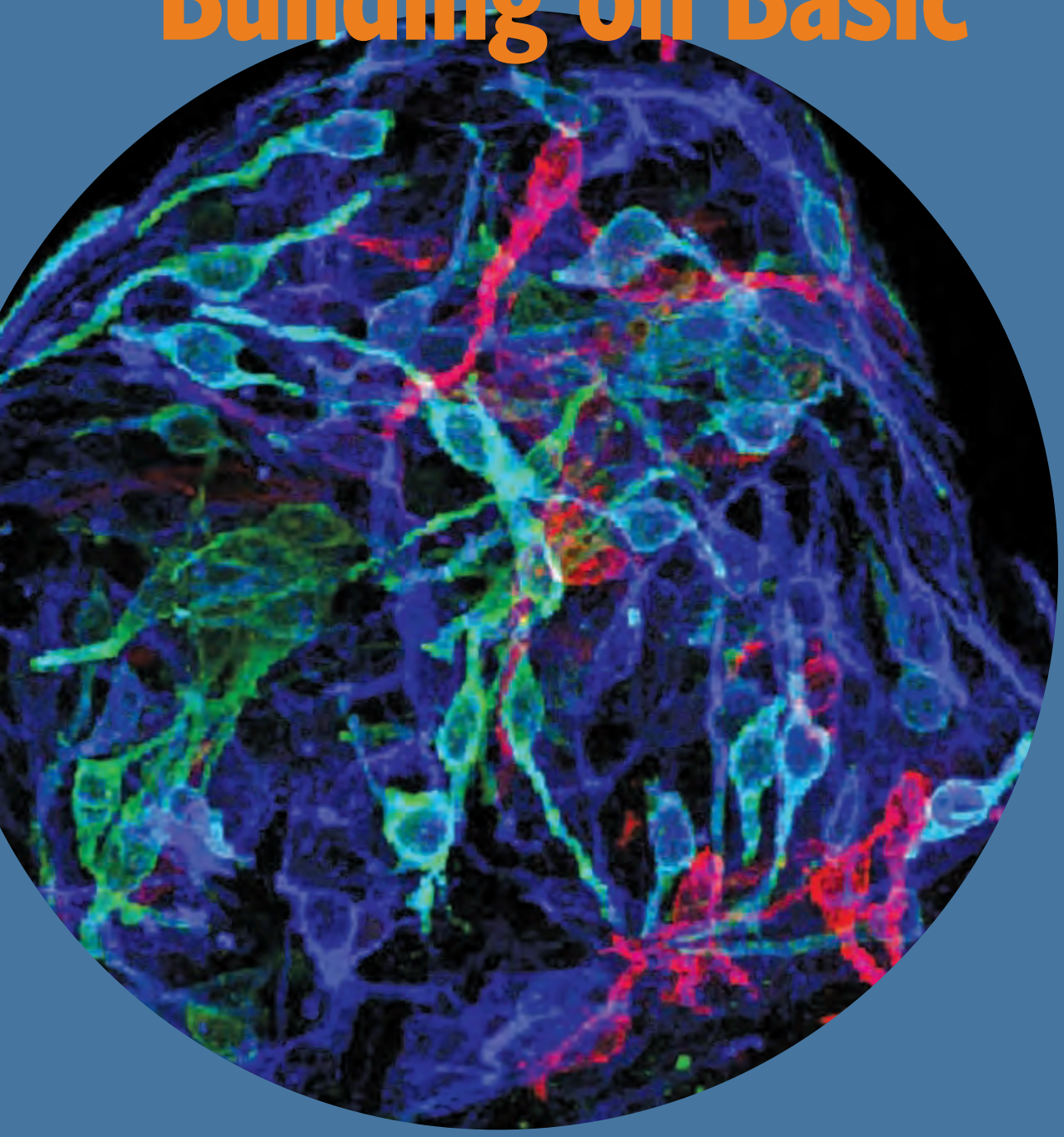
# Building on Basic



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