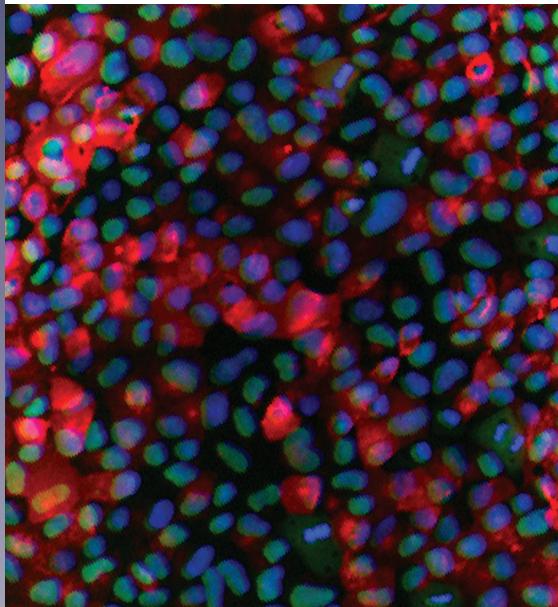




# CORIELL INSTITUTE

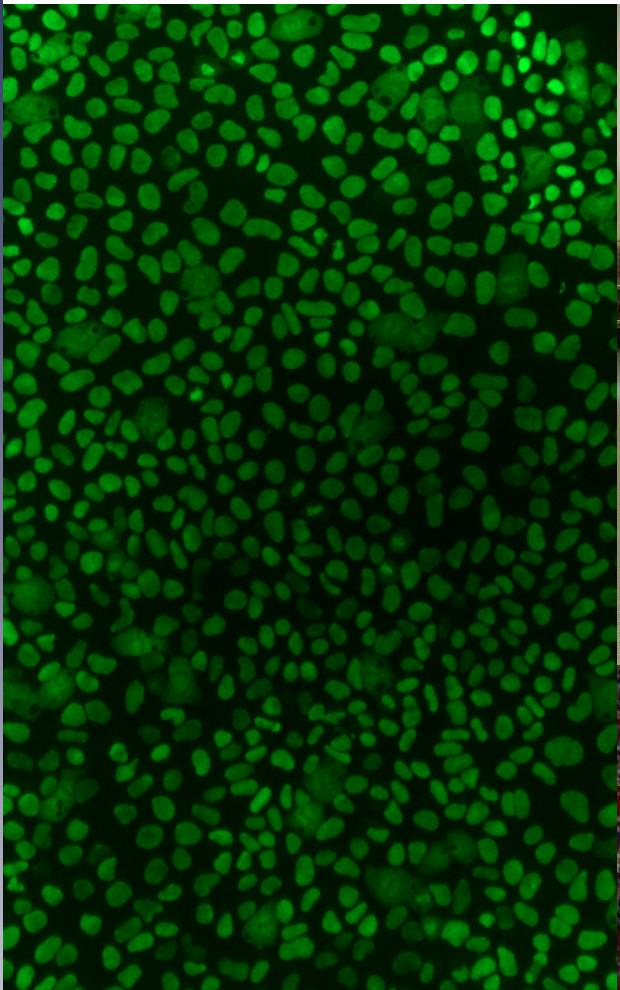
## FOR MEDICAL RESEARCH



# 2019

ANNUAL REPORT

*Biobanking  
Research  
Community Engagement*



*Above left: Induced pluripotent stem cells stained with a cell surface protein antibody to confirm expression of key pluripotent stem cell marker – SOX2 – as a part of the quality control process.*



*Above right: Coriell's William G. Rohrer Cryogenic Storage Facility.*

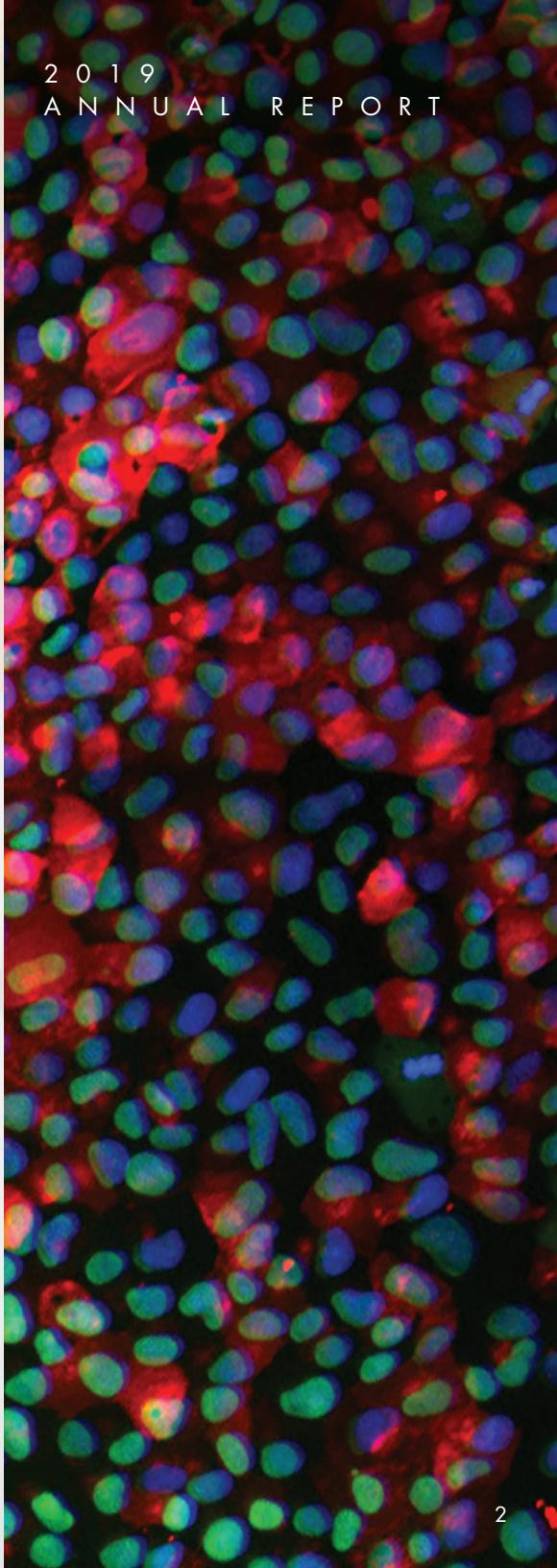


*Right: Coriell President and CEO Dr. Jean-Pierre Issa assists student during educational DNA Day activity.*

# CONTENTS

- 3 *Letter from Jean-Pierre Issa, MD, President & Chief Executive Officer*
- 4 *Coriell Board of Trustees*
- 5 *Biobanking*
- 9 *Research*
- 13 *Community Engagement*
- 16 *Facts & Figures*

Induced pluripotent stem cells created in Coriell's Stem Cell Lab stained with multiple cell surface protein antibodies to confirm expression of four key stem cell markers – OCT4, SSEA4, SOX2 and TRA160 as a part of the quality control process.





Jean-Pierre Issa, MD  
President &  
Chief Executive Officer

# LETTER FROM DR. ISSA

PRESIDENT  
& CEO

**E**arlier this year, I stepped into the corner office at the Coriell Institute for Medical Research as its new President and Chief Executive Officer. It's an honor to be chosen by such a prestigious organization to be its leader and now, after nearly a year, I'm sure we're a good fit.

I knew of Coriell before I was interested in the top job, of course. My career has been in the world of epigenetics research and Coriell's importance to the research community is known worldwide. But it wasn't until I visited, interviewed, and met the people – the insightful researchers, the skilled lab technicians, the dedicated support staff – that I really appreciated its strengths and potential.

Now at the helm, I am working to tap and maximize that potential each and every day.

Prior to Coriell, I led the Fels Institute for Cancer Research and Molecular Biology at Temple University. There, my lab and I investigated the many ways one's epigenome plays a role in their health, from cancer development to understanding aging. Our work was funded by grants from many sources such as the National Institutes of Health and private foundations, and I'm excited to announce that this research and much of my valuable staff came with me to Coriell.

These new members of the Coriell team deepen the Institute's already strong research capability in several ways. Jaroslav Jelinek, MD, PhD, joined as the new chief research officer, a new executive level role tasked with overseeing all of the research efforts at the Institute. And in Jozef Madzo, PhD, Coriell gained an expert in bioinformatics, a field that continues to boom as scientists rely more and more on algorithms to analyze complex genomic and epigenomic data.

Dr. Jelinek and Dr. Madzo, and the rest of the new team, not only add to Coriell's research capabilities, they also enhance the Institute's ability to offer a broader range of in demand services to clients than ever before.

With the leadership transition mostly complete, we now look to the horizon and plan for the future of Coriell. The Institute's biobanking operation is as strong as ever and the Camden Opioid Research Initiative – our collaborative research program investigating risk factors for opioid use disorder – started recruiting full time this year.

I am filled with gratitude to be trusted with Coriell's history and legacy, and I'm excited for the possibilities I see in its future.

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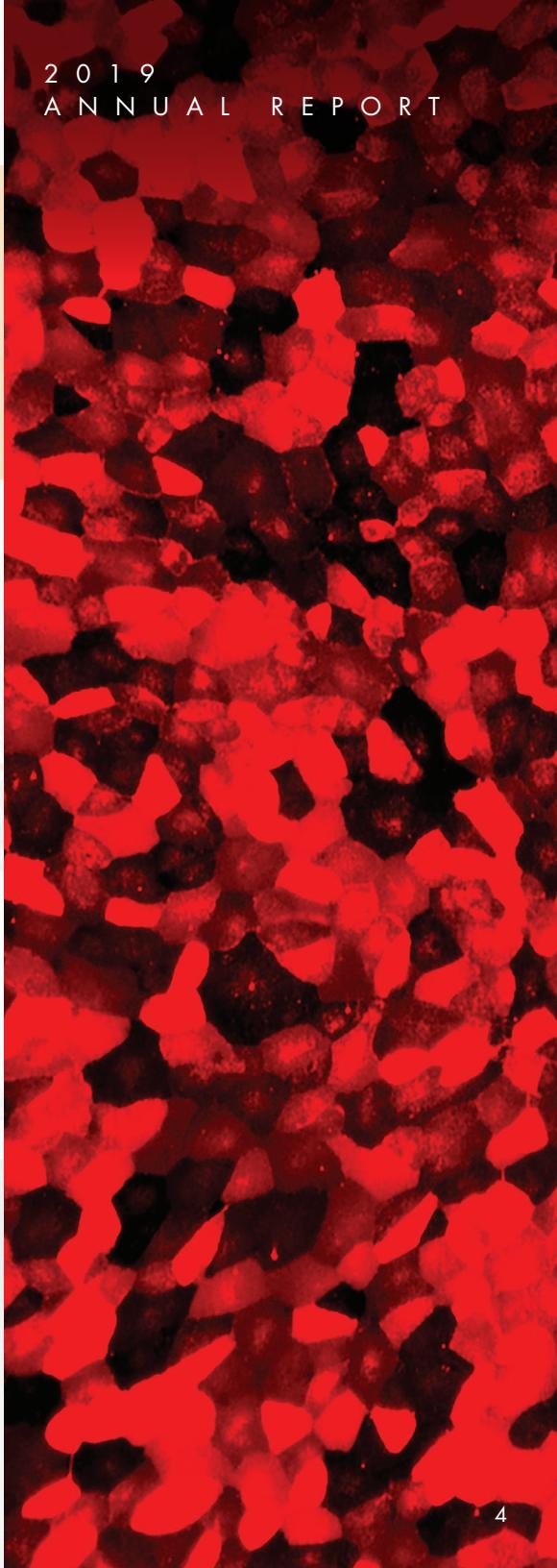
*John Piccone*

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Induced pluripotent stem cells stained with a cell surface protein antibody to confirm expression of key pluripotent stem cell marker – TRA160 – as a part of the quality control process.



# BIOBANKING

*Coriell's biobank teams added new samples, generated new scientific knowledge, created new induced pluripotent stem cells, and introduced broader diversity to the samples available to researchers worldwide.*

Last year was one of continued growth for the Coriell biobank – the keystone of the Institute. Over the course of the year, Coriell's biobank teams added new samples, generated new scientific knowledge, created new induced pluripotent stem cells, and introduced broader diversity to the samples available to researchers worldwide.

Coriell remains the proud steward of the National Institute of General Medical Sciences (NIGMS) Human Genetic Cell Repository. This repository represents one of the longest standing collaborations between an institution and the NIH. This collection is noteworthy because it offers the global scientific community biological samples representing more than 1,000 rare human genetic diseases. The NIGMS repository collection contains more than 11,700 unique cell lines, over 6,300 DNA samples, and more than 50 human induced pluripotent stem cell (iPSC) lines.

Over the last year, NIGMS repository staff continued to engage with the rare disease and broader scientific community by attending conferences and disease advocacy group meetings, organizing blood collections, and

adding new cell lines and DNA to the repository. For example, blood samples were collected from affected individuals and their family members at the Turner Syndrome Foundation and the CHAMP1 Research Foundation family meetings. Dozens of unique, de-identified cell and DNA samples were added to the growing collection of samples from rare diseases and chromosomal abnormalities.

Coriell has overseen the operations of the National Institute on Aging (NIA) Aging Cell Repository since its establishment in 1974. This collection offers cell lines and DNA collected from human donors of advanced age and donors diagnosed with age related disorders and complex diseases, such as progeria and Alzheimer's disease. This repository distributes a diverse collection of more than 3,500 biospecimens from humans and over 25 animal species, including animal models of aging, to researchers around the world. This year, the NIA repository added new marmoset tissue biopsy samples that will be used to create fibroblast cell lines.

*Last year was one of continued growth for the Coriell biobank – the keystone of the Institute.*

The National Human Genome Research Institute (NHGRI) Sample Repository for Human Genetic Research remains in Coriell's care as well. A crown jewel of Coriell's collection, this biobank offers cell and DNA samples from 27 distinct human populations used for the International HapMap and 1000 Genomes projects. This collection provides scientists with a standardized set of samples of known origin, which supports the discovery of human genetic variation and disease research.

More than 1,500 samples from African Americans were added to the National Institute of Neurological Disorders and Stroke (NINDS) Human Genetics Resource Center, greatly increasing the diversity of the cell lines and DNA samples available to researchers. This collection contains thousands of cell lines and DNA from subjects with cerebrovascular disease and neurological disorders, including epilepsy, parkinsonism, dystonia, amyotrophic lateral sclerosis (ALS) and Tourette syndrome as well as at-risk family members and population controls.



*Above:* Coriell's William G. Rohrer Cryogenic Storage Facility houses millions of samples from over 257,000 unique patient donors.

*Left:* Coriell staff participate in a bike ride to raise money for research for amyotrophic lateral sclerosis.

Coriell's biobank is the centerpiece upon which its entire biomedical research enterprise rests.

# BIOBANKING

## (continued)

Stem cells derived from blood or skin tissue donated by adult patients – induced pluripotent stem cells – have become an important part of the Coriell biobank in recent years. Coriell is now offering stem cell reprogramming, characterization and biobanking as a service to customers, and expects to grow the stem cell service offerings over the coming year to include gene edited cell lines, differentiated cell lines like neuronal cells, and organoids such as mini-brains. The field of stem cell biology has advanced tremendously over the past decade, and applications include use of these cells for understanding developmental biology, disease in a dish modeling, drug discovery and therapeutics.

The collection of iPSCs housed and distributed by Coriell continued to grow. The NIGMS collection added six new iPSC lines to its repository representing rare genetic diseases such as Wolman disease, facioscapulohumeral muscular dystrophy, NGLY1 deficiency, and Vici, Rett and Pitt-Hopkins syndromes.

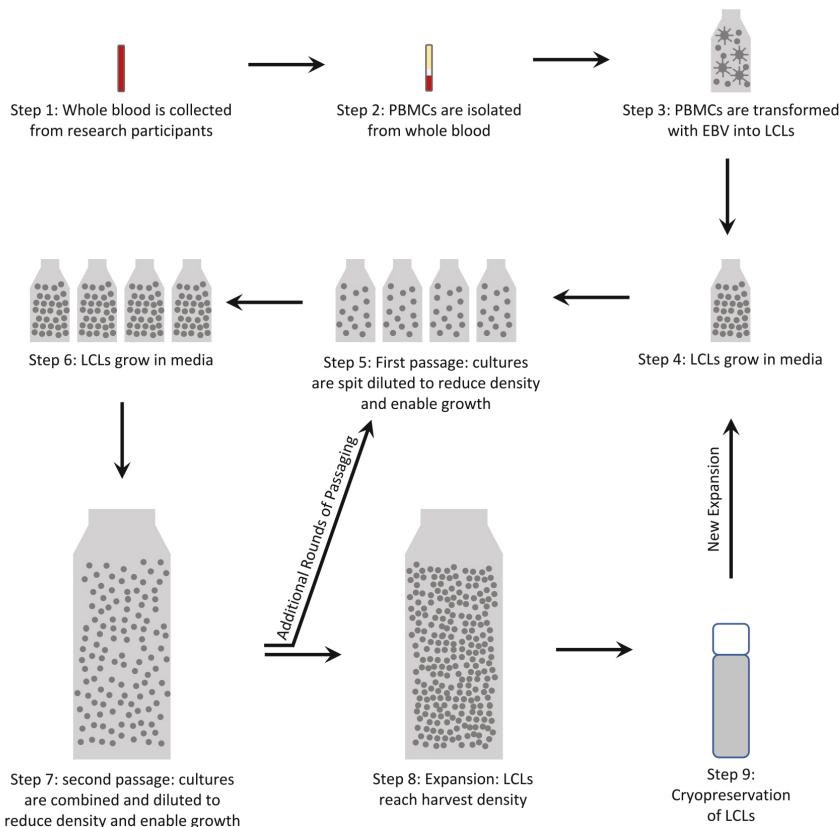
Three other iPSC lines were added to the NIA repository last year. Two of these lines represent rare diseases: Werner syndrome, a rare progressive disorder characterized by the appearance of unusually accelerated aging, and

Hutchinson-Gilford progeria syndrome, a rare, fatal genetic condition of childhood causing premature aging. The third line is an apparently healthy control sample.

Over the course of the last year, Coriell scientists continued to contribute to scientific literature related to biobanking with their investigation of the stability of DNA extracted from several generations of expanded cell lines. Their paper on the topic, titled “Genetic and genomic stability across lymphoblastoid cell line expansions,” was published in *BMC Research Notes* and sought to answer the question of how reliable the genetic material from lymphoblastoid cell lines is after they have been immortalized, passaged, and expanded multiple times.

Finally, the infrastructure of the Coriell biobank also expanded over the last year. In addition to the liquid vapor nitrogen tanks previously purchased which each hold 94,500 samples, the Coriell repositories purchased VarioTM tanks which use liquid vapor nitrogen to store 94,500 samples at a set temperature between -20°C and -150°C. The purchase of these tanks expands Coriell's storage capacity in multiple storage conditions for its growing collections of diverse biospecimens.

**Coriell is now offering stem cell reprogramming, characterization and biobanking as a service to customers, and expects to grow the stem cell service offerings over the coming year.**



Above: Scheinfeldt et al. BMC Res Notes (2018)11:558.

Left: Coriell representatives Jose Santana and Sherryann Wert meet with Glenna Steele, the executive director of the Glut1 Deficiency Foundation, an advocacy group dedicated to improving the lives of those in the GLUT1 deficiency community.

*Perhaps no area of Coriell grew as much over the preceding year as its research efforts did.*

# RESEARCH

## EPIGENETICS

Perhaps no area of Coriell grew as much over the preceding year as its research efforts did. The Institute gained several scientists when Dr. Issa joined Coriell as its President and Chief Executive Officer and brought members of his team with him. These new researchers are leading the charge in the field of epigenetics – or the turning “on” or “off” of certain genes – in cancer.

These new team members are administering the many research projects which came with Dr. Issa and position Coriell to pursue new opportunities in this space as well. The Institute gained a new chief research officer in Jaroslav Jelinek, MD, PhD, a director of bioinformatics in Jozef Madzo, PhD, a principal research scientist in Woonbok Chung, PhD, and several other scientists with focuses in epigenetics and bioinformatics.

This team is tackling a number of projects concerning the role of epigenetics in cancer. In one such study, Dr. Issa and team are working to improve the efficacy of an immunotherapy drug used to treat bladder cancer. The team of

investigators – including researchers from the Van Andel Research Institute, Johns Hopkins University, and others – suggest epigenetic therapy might be effective in reducing natural resistance to the drug. This work is funded by a grant from Stand Up To Cancer, a charitable organization which funds and develops promising cancer treatments.

Another new focus for the Coriell research team is studying the role of the microbiome in the development of colorectal cancer. Dr. Issa and team suggest certain components of the microbiome may contribute to colon cancer by triggering abnormal DNA methylation, an epigenetic process that controls gene expression. Supported by a grant from the National Cancer Institute, these researchers are seeking to test that hypothesis.

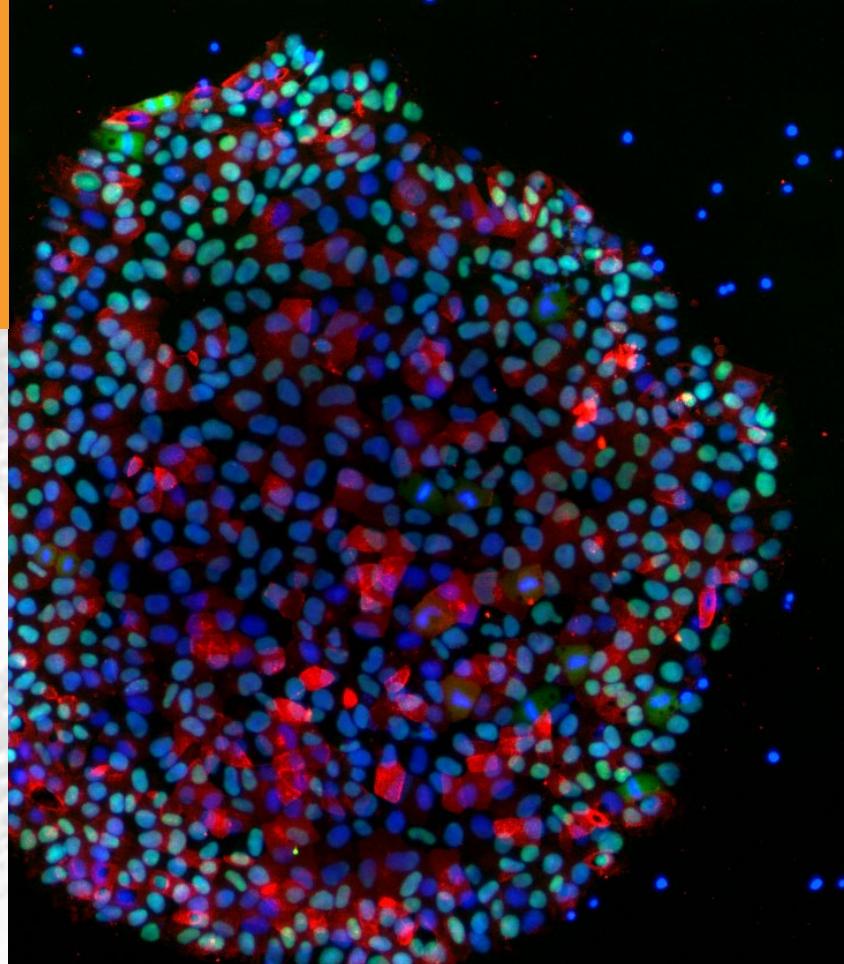
*The Camden Opioid Research Initiative, or CORI, continues to grow.*



## CAMDEN OPIOID RESEARCH INITIATIVE

The Camden Opioid Research Initiative, or CORI, continues to grow. Announced last year, CORI is a collaborative effort between Coriell and its Camden neighbors, Cooper University Health Care and Cooper Medical School of Rowan University, to study the basic genetic and non-genetic factors that contribute to opioid use disorder.

CORI takes a three-pronged approach to its mission. The first two prongs are clinical studies of chronic pain patients and current opioid use disorder patients to see what can be learned from the genetic and non-genetic data collected from them. The third prong is the creation of a biobank of cell, DNA, and brain tissue samples taken from people who have died as a result of opioid overdose.



*Induced pluripotent stem cells stained with multiple cell surface protein antibodies to confirm expression of four key stem cell markers – OCT4, SSEA4, SOX2 and TRA160 as a part of the quality control process.*

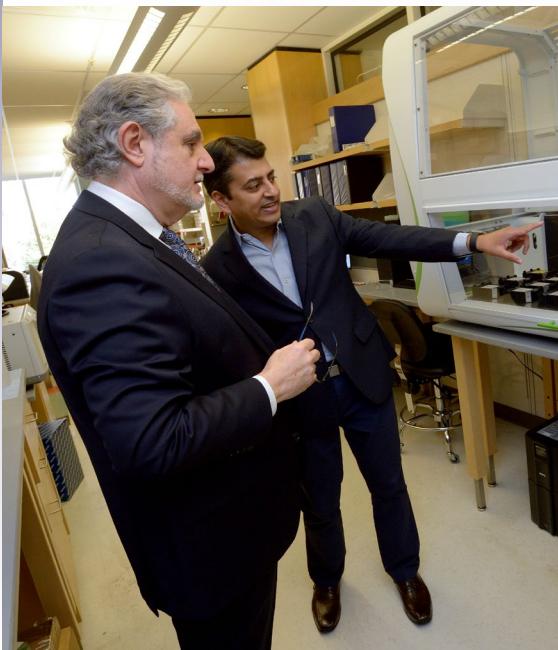
The neurological tissue collected for the CORI biobank is a critically important but rare resource.

# RESEARCH

## (continued)

The samples will be made publicly available to researchers with their associated toxicological and clinical data, making this unique biobank especially useful.

All arms of the study are now in the recruiting phase. In fact, the biobank collected its first brain donor samples in May. This neurological tissue is a critically important but rare resource for scientists who are working to help increase our understanding of opioid genetics and addiction.



## PUBLICATIONS

**A**t the end of 2018, Coriell researchers working in personalized medicine and pharmacogenomics published findings which suggest some people with ibuprofen sensitivity due to genetic variations are able to unknowingly adjust their doses of the drug.

The article detailing this research was published in the journal *Pharmacogenetics and Genomics*. This study utilized data from the Coriell Personalized Medicine Collaborative, a long-term personalized medicine study in which participants submitted DNA for analysis and answered extensive questions about their family, medical and lifestyle histories.

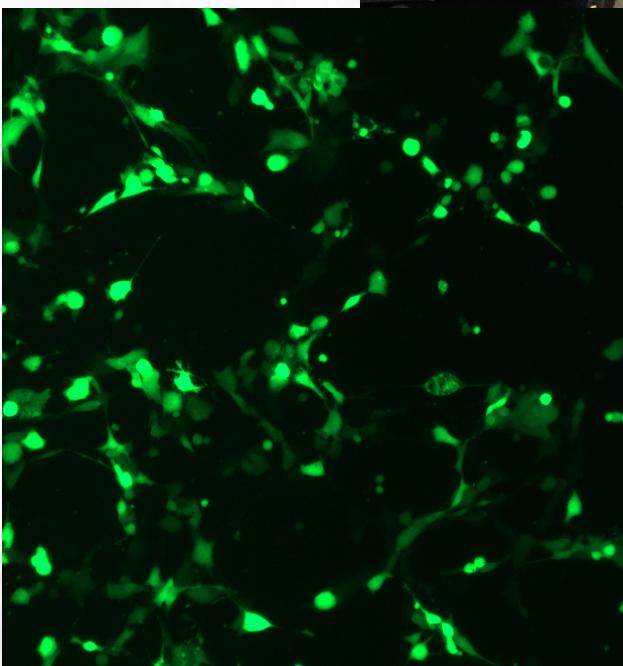
Two additional papers about genetic counseling for complex disease and pharmacogenetics in the age of personalized medicine were also published by the collaborative team of researchers from Ohio State University and the Coriell Personalized Medicine Collaborative. One paper was published in the *Journal of Genetic Counseling* and the other in the *Journal of Personalized Medicine*.

Director of Laboratory Operations  
Sameer Kalghatgi, PhD, and Dr. Issa  
examining new laboratory equipment.

*Another new focus for the Coriell research team is studying the role of the microbiome in the development of colorectal cancer.*



*Above: Coriell's Chief Laboratory Officer Nahid Turan, PhD, demonstrates lab equipment for New Jersey State Assemblyman William Spearman*



*Newly reprogrammed stem cells showing successful transduction.*

*For the past 66 years, Coriell has been dedicated to encouraging, engaging and educating the next generation of young scientists.*

# COMMUNITY ENGAGEMENT

**F**or the past 66 years, Coriell has been dedicated to encouraging, engaging and educating the next generation of young scientists. Coriell's student engagement programs include the Coriell Summer Experience Program and the annual Coriell Institute Science Fair. With a marked increase in the number of students participating, this year was no exception to Coriell's long history of dedicated community engagement.

The Institute redoubled its commitment to its local community over the last year with a concerted effort to include more students from Camden, New Jersey. Coriell has been proud to call Camden home since its founding in 1953 and has a long tradition of bringing its passion for science to the local youth. Through proactive outreach to Camden's public schools, Coriell dramatically boosted participation from these students in Coriell's annual Science Fair and increased the number of applicants for Coriell's Summer Experience Program this year.

Each summer, Coriell opens its laboratory doors to budding young scientists for the Coriell Summer Experience Program. For four weeks, a select group of highly motivated high school and

college students is offered the opportunity to work alongside Coriell's world-renowned scientists and researchers in real world lab settings. As a result of the efforts to recruit more local students, Camden students comprised half of this year's Summer Experience Program.

One of Coriell's longest-held traditions is the Coriell Institute Science Fair. This was its 38th year bringing together students from Burlington, Camden and Gloucester counties to demonstrate their scientific curiosity and prowess in hopes of taking home an award and moving onto the Delaware Valley Science Fair. The 2019 fair hosted 130 young scientists from across southern New Jersey, 29 of which were from Camden city schools. Most impressively, more than half of the fair participants moved on to the Delaware Valley Science Fair and nearly two dozen from that group placed first, second or third in their field of study. One even went on to earn fourth place in Animal Sciences at the international competition! On top of the success of the students, this year's fair boasted an increase in financial support from area businesses, which allowed the Institute to award 16 special awards, worth nearly \$5,000 and two full tuition scholarships to Camden County

*2019 marked the 38th year for the Coriell Institute Science Fair.*

College. And as is tradition, the Institute also celebrated National DNA Day at the Science Fair by leading the students through an experiment which explored the physical properties of DNA. DNA Day is supported each year by the NHGRI to commemorate the discovery of DNA's double helix structure, the completion of the Human Genome Project, and all of the important medical breakthroughs these discoveries have enabled.

Finally, this year Coriell participated in the Philadelphia Science Festival, where Coriell scientists and staff demonstrated how to extract DNA from strawberries using common household chemicals, and hosted a number of student groups – and even a group of senior citizens – for tours of the Institute.

*Above: A student participates in DNA Day activity at Coriell's annual Science Fair.*

*Below: Students in Coriell's Summer Experience Program.*



Coriell Institute  
receives the  
Cooper's Ferry  
Partnership  
Innovation Award.

# Coriell Institute for Medical Research Receives Innovation Award from Cooper's Ferry Partnership

The Coriell Institute for Medical Research received the inaugural Innovation Award from the Cooper's Ferry Partnership at its annual meeting. This distinction recognizes Coriell's role as a unique and critical resource to the global research community and its legacy of scientific foresight.

"It's an honor to receive this award from an organization with such an important mission and fantastic track record," Jean-Pierre Issa, MD, Coriell's President and CEO, said. "Like Cooper's Ferry, Coriell has long been committed to Camden, having called it home since our founding in 1953."



Today, Coriell's reputation is known far and wide and on behalf of everyone at the Coriell Institute, we're thankful to receive this recognition locally as well."

Cooper's Ferry Partnership's mission is to foster investment in the City of Camden and encourage revitalization. Over the years, Cooper's Ferry Partnership has shepherded more than \$2.5 billion in investments into Camden businesses and nonprofits.

"As Camden continues its rise and continues to draw new companies and new hope, it's important to us to recognize the Camden mainstays who have contributed to this city for many decades," Kris Kolluri, CEO of Cooper's Ferry Partnership, said. "The Coriell Institute is a one-of-a-kind institution and we're grateful we can call them a neighbor."

*Left to right:*

*Kris Kolluri, CEO of Cooper's Ferry Partnership*

*Robert Kiep, Chair of Coriell Institute for Medical Research Board of Trustees*

*Annette Reboli, MD, Dean of Cooper Medical School of Rowan University*

*George Norcross, Member of Coriell Institute for Medical Research Board of Trustees*

*Jean-Pierre Issa, MD, President and CEO of Coriell Institute for Medical Research*

*Phoebe Haddon, Chancellor of Rutgers University-Camden*

# FACTS & FIGURES



NUMBER OF EMPLOYEES

NUMBER OF  
RESEARCHERS  
ADDED THIS YEAR

**10**

# FACTS & FIGURES

(continued)

GALLONS OF LIQUID  
NITROGEN USED

>**305,000**

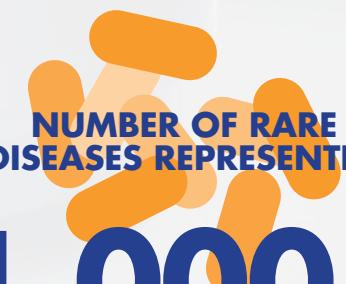


SAMPLES SHIPPED TO  
**85**  
COUNTRIES



NUMBER OF RARE  
DISEASES REPRESENTED

**1,000+**



**35 / 65**



BETWEEN  
MEN AND WOMEN  
IN SCIENTIFIC ROLES

**38 YEARS  
HOSTING**

CORIELL INSTITUTE  
**SCIENCE FAIR**





Young scientists extract DNA  
from strawberries at Coriell's  
booth at the Philadelphia  
Science Festival



# CORIELL INSTITUTE FOR MEDICAL RESEARCH

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