



# CORIELL INSTITUTE

FOR MEDICAL RESEARCH

DECODING THE GENOME

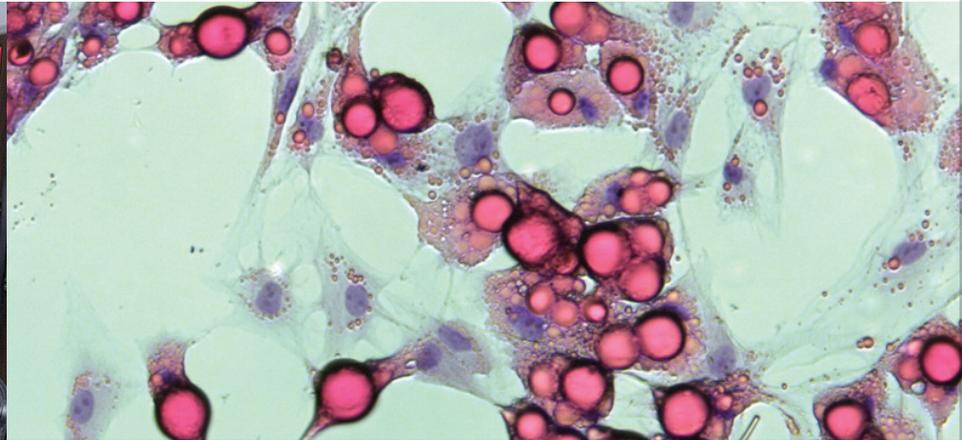


# 2018

## ANNUAL REPORT

*Biobanking*  
*Personalized Medicine*  
*Stem Cells*  
*Community Engagement*





# COMMITMENT TO EXCELLENCE

*Coriell's commitment to excellence in biobanking and the diversity of its collections are both without parallel.*

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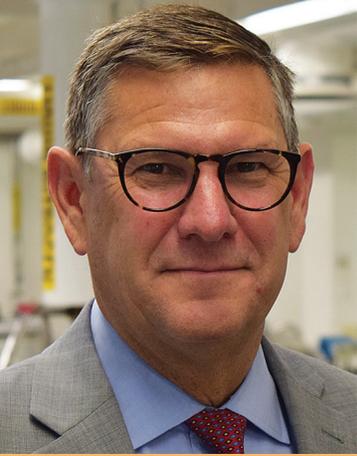
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*Dividing cell showing chromosomes  
(purple) and microtubules (green)*

Photo credit: Nasser Rusan, National Heart, Lung,  
and Blood Institute, National Institutes of Health

# LETTER FROM ROBERT KIEP, III

CHAIRMAN,  
CORIELL BOARD  
OF TRUSTEES



*Robert P. Kiep, III  
Chairman,  
Coriell Board  
of Trustees*

Last year was one of both success and change at the Coriell Institute for Medical Research. The sudden passing of our friend and leader Dr. Michael F. Christman, Coriell's then-president and CEO, was a shock to the Coriell Institute family. For 10 years, Dr. Christman led the Institute with a unique and determined vision. Because of that vision, Coriell has become a renowned leader in the increasingly important field of personalized medicine. The Institute is fortunate that in his time, Dr. Christman built an exceptionally strong team around him and because of that Coriell is thriving.

I am pleased to report that there have been significant advances in each of Coriell's four pillars of focus: biobanking, personalized medicine, stem cells and community outreach. On the pages that follow, you will read about these achievements, including Coriell's continued commitment to excellence in biobanking demonstrated by marked growth of the collections, the Institute's application of its unparalleled genetic expertise to the fight against the growing opioid addiction problem, the rapid expansion of the already robust offerings of induced pluripotent stem cell lines, and its reinvigorated commitment to its community.

Coriell closed the chapter on two initiatives this year, including the ending of the contractual work with the United States Air Force through the Coriell Personalized Medicine Collaborative and the decision to transfer the California Institute for Regenerative Medicine collection to a different biobank. This year also saw the beginning of a new major partnership between the Institute and two of its neighbors, Cooper University Health Care and the Cooper Medical School of Rowan University, to investigate the role of genetics in opioid use disorder (sometimes called opioid addiction).

I am proud of the commitment of the staff at Coriell whose hard work and dedication to our mission has made this year successful despite challenges.

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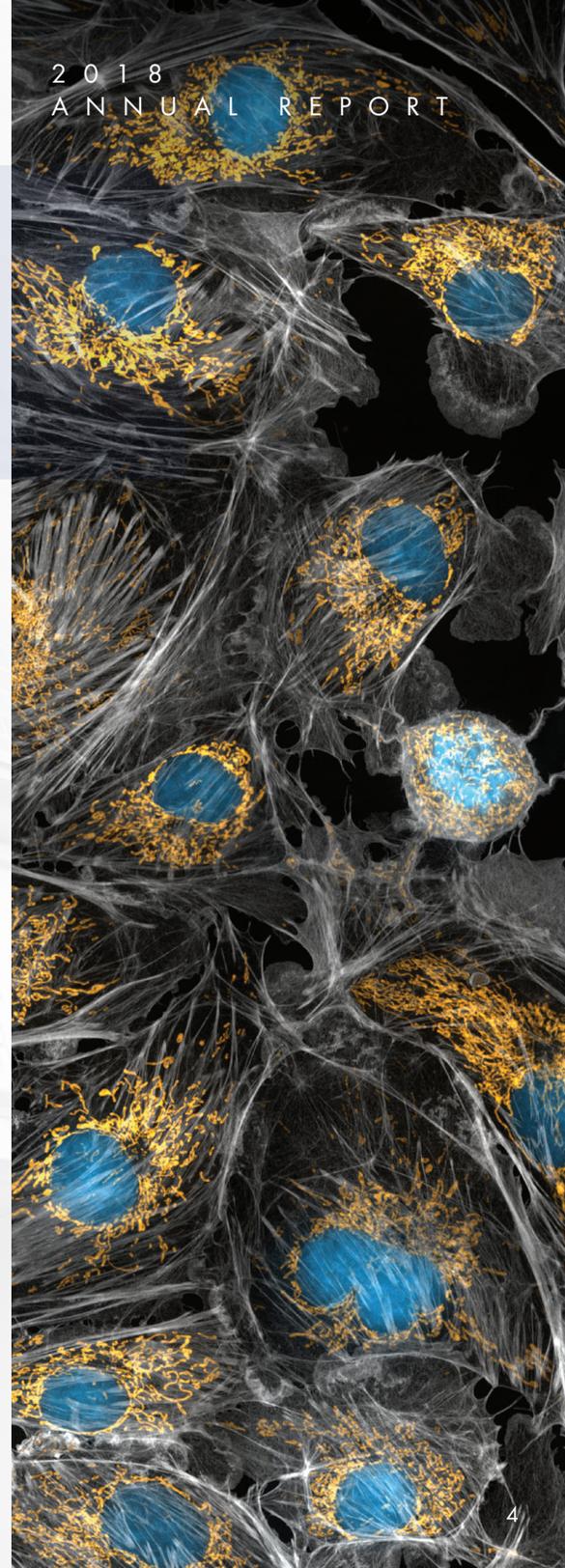
*John Piccone*

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*Mitochondria are the powerhouses of the cells, generating the energy the cells need to do their tasks and to stay alive. In this photo the mitochondria were stained in bright yellow to visualize them in the cell. The large blue dots are the cell nuclei and the gray web is the cytoskeleton of the cells.*

Photo credit: Torsten Wittmann,  
University of California, San Francisco



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

# BIOBANKING

Coriell's biobank is the centerpiece upon which its entire biomedical research enterprise rests. Coriell sets the international gold standard in biobanking and is the trusted steward of world-renowned collections for the National Institutes of Health, disease foundations and commercial clients. Coriell houses the most diverse collection of biospecimens representing diseased and healthy human populations in the world. The collection includes the National Institute of General Medical Sciences' (NIGMS) Human Genetic Cell Repository, which contains more than 11,400 cell lines, over 5,800 DNA samples and more than 50 induced pluripotent stem cell lines. The NIGMS collection represents the longest standing contract between an institution and the NIH and serves as a valuable resource for the rare disease research community.

Coriell is also home to the National Institute of Neurological Disorders and Stroke's (NINDS) Human Genetics Resource Center. These samples help to further NINDS' commitment to gene discovery as a strategy for identifying the genetic causes and correlates of nervous system and neurological disorders. This year, the NINDS

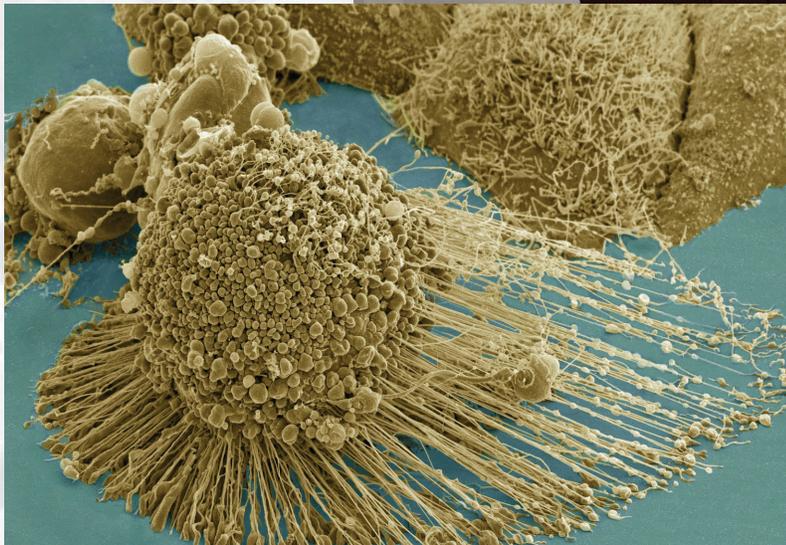
Repository incorporated samples from the The REasons for Geographic And Racial Differences in Stroke (REGARDS) Study which is comprised of 897 African-American control DNA samples. In fiscal year 2019 the Repository will incorporate over 1,000 REGARDS study participants with cerebrovascular disease. Coriell is also the biobank of choice for the National Institute on Aging's Aging Cell Repository, which facilitates cellular and molecular research studies on the mechanisms of aging and the degenerative processes associated with it. The National Human Genome Research Institute's Sample Repository for Human Genetic Research contains samples that include no identifying or phenotypic information that are all broadly consented for data release in scientific publications and studies. This collection offers DNA samples and cell lines from the populations previously used for the International HapMap Project, the HapMap3 Project and the 1000 Genomes Project.

Coriell's commitment to excellence in biobanking and the diversity of its collections are both without parallel. The depth and breadth of these collections continued to grow this year with the addition of new cells lines from rare diseases,

*Trusted steward of world-renowned collections for the National Institutes of Health, disease foundations and commercial clients.*

such as NGLY1 deficiency, a newly-diagnosed and devastating inherited metabolic disease that normally presents itself in childhood. These extraordinarily well characterized samples come from the National Human Genome Research Institute Undiagnosed Disease Program.

This year, Coriell's online presence also underwent a major overhaul which consolidated two different websites – one for information about the Institute and another for our catalog – into one website to meet both of these needs. This consolidation project was just one of the many ways Coriell made steps toward becoming a more nimble institute.



*Our founder, Dr. Lewis L. Coriell, championed the effort to create a national biobank to store and distribute well characterized and high quality cell lines.*

*Later, Dr. Coriell recognized the added benefit of biobanks for providing a resource for pristine biological samples as many cell lines relied upon by researchers were frequently contaminated with foreign materials or cells like the HeLa cells pictured here.*

Photo credit: Tom Deerinck

# PERSONALIZED MEDICINE

*Coriell remains a pioneer in the constantly evolving field of personalized medicine.*

In early 2018, Coriell entered into a new partnership with Cooper University Health Care and the Cooper Medical School of Rowan University to study the genetic underpinnings of opioid use disorder. That partnership, named the Camden Opioid Research Initiative (CORI), was awarded a three-year grant worth \$9 million by the State of New Jersey to apply its expertise in personalized medicine, genomic research and pharmacogenomics to the ever-growing battle against opioid addiction. The first study will focus on chronic pain patients in Cooper's Pain Management Center. Participants enrolled in the study will have their DNA sequenced and will complete questionnaires about their health history. Using this data, CORI researchers will prepare reports for the participants' physicians, detailing how their patients' genetic makeup may influence their response to common opioids. The second study will enroll patients in Cooper's Addiction Medicine program who are receiving medication-assisted treatment for opioid use disorder. This prospective research will analyze any common genetic signatures for patients who successfully achieve recovery and those who do not. Finally, a first-in-the-nation opioid overdose biobank will be established to collect samples and

data from individuals who have suffered deadly overdoses, as well as family members who wish to participate and make this information available to researchers investigating the basic genetic underpinnings of addiction, in ways aligned with important privacy protocols, to the global research community.

While still in the early days of the project, Coriell scientists are optimistic that this novel approach to addiction research and treatment will provide insight and knowledge that will give health care providers new tools in the fight against this dire public health emergency.

Around the same time the Camden Opioid Research Initiative was forming, Coriell saw the ending of one of its long standing research partnerships. In February 2018, the contract between the Coriell Personalized Medicine Collaborative (CPMC) and the United States Air Force came to a conclusion.

At its inception in 2008, the CPMC was a revolutionary approach to studying a person's unique genetic code and understanding the clinical utility of such information in the prevention and treatment of disease.

*The partnership with the Air Force Medical Service generated invaluable genomic data which fostered a wide variety of insights with implications for everything from military sponsored genomic research study design through to bedside clinical care.*

In 2010, the CPMC was chosen as a key partner in the Air Force Medical Service (AFMS) Patient-Centered Precision Care (PC2-Z) Program. This seven-year, multimillion dollar contract enrolled thousands of Air Force service members and their spouses into a customized research study. Over the course of its life, this partnership generated invaluable genomic data which fostered a wide variety of insights with implications for everything from military sponsored genomic research study design through to bedside clinical care.

Coriell is deeply honored to have been chosen to partner with the Air Force. We are proud of our multitude of shared scientific publications, and while this contract has come to an end, we look forward to future collaborations.

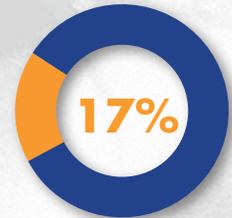
## NEW JERSEY/CAMDEN COUNTY OPIOID CRISIS FACTS

More than **2,000** opioid related deaths in NJ in 2017

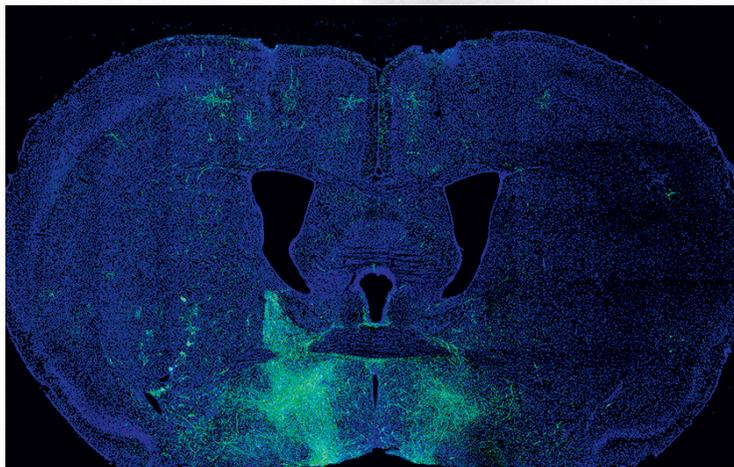


Of which, **10%** occurred in Camden County

Nearly **15,000** doses of Naloxone administered in 2017 in NJ



Of which, **17%** were administered in Camden County



*Left: To better understand the brain's role in addiction, external researchers mapped new connections in the extended amygdala related to reward-seeking and aversion. Here neurons in that pathway are labeled in fluorescent green in a cross-section of a mouse brain.*

Photo credit: William J. Giardino (Luis de Lecea Lab/Stanford University)

# STEM CELLS

*Coriell has earned a reputation for generating, banking and distributing the highest quality induced pluripotent stem cells.*

For nearly a decade, Coriell has been at the forefront of stem cell science and in that time has earned a reputation for generating, banking and distributing the highest quality human induced pluripotent stem cells (iPSCs).

iPSCs are stem cells derived from adult human blood or skin tissue that can be differentiated into virtually any specialized cell type. Fiscal Year 2018 saw growth in the number and variety of iPSCs offered through Coriell's catalog.

The National Institute on Aging released two novel iPSC lines for researchers studying Alzheimer's disease. These lines were donated by patients with the devastating disease and were reprogrammed at Coriell to a pluripotent state.

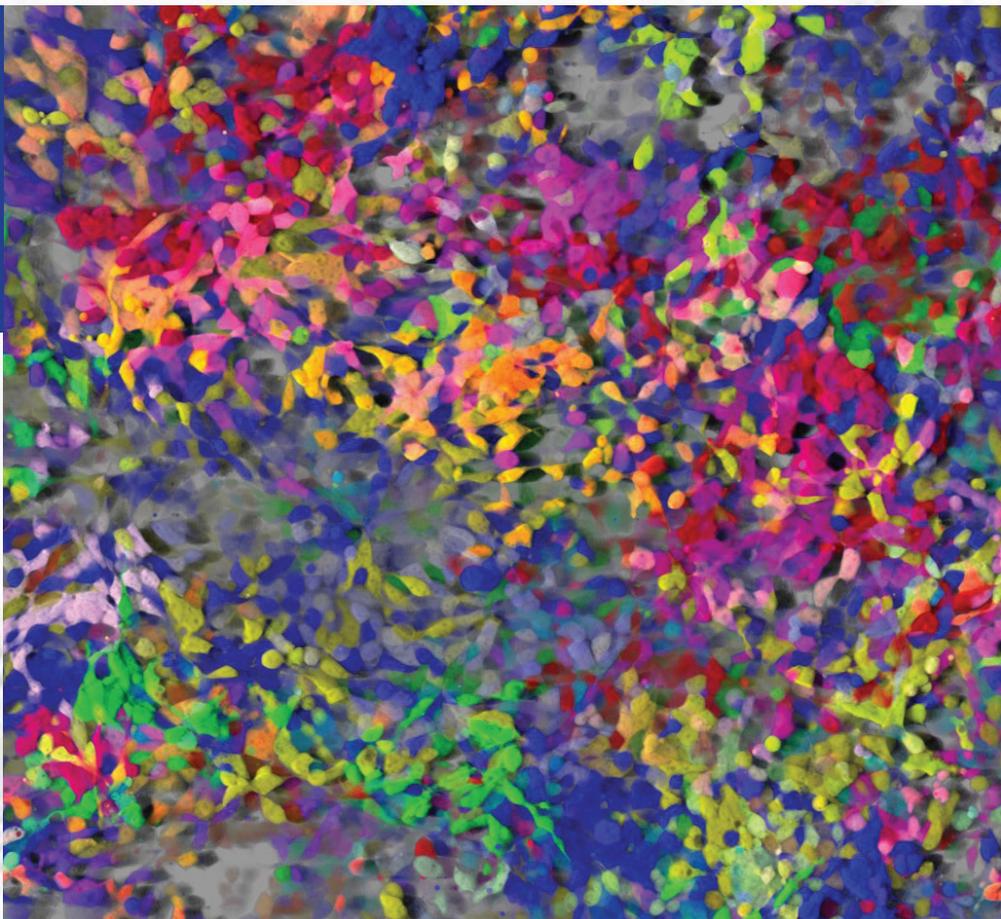
Over the last year, Coriell added iPSCs to its collection of highly characterized cell lines for the National Institute of Standards and Technology. This collection provides researchers with reliable, high quality cell cultures and DNA samples to be used as reference standards, and now offers these highly valued iPSCs as part of the collection. The iPSC lines were

reprogrammed at Coriell from cell lines from the Personal Genome Project.

Coriell continues to house and distribute the Allen Cell Collection of iPSCs, the first publicly available collection of fluorescently-tagged, gene-edited iPSC lines. This collection has grown to comprise 25 separate lines with tags targeting 22 key structures/substructures. The first of several cell lines with a fluorescently tagged cardiomyocyte-specific structure was recently incorporated into the collection.

Coriell is also poised to release additional iPSC lines related to cystic fibrosis. These lines were genetically edited by Coriell researchers using cutting-edge CRISPR-Cas9 technology to correct for the mutation causing cystic fibrosis. These isogenic cell lines will be a valuable resource for researcher trying to identify cures for this debilitating disease.

*IPSCs are stem cells derived from adult human tissue that can be differentiated into virtually any type of specialized mature cell.*



*Above: Tracking stem cell colony growth with a 3D rendering of live cells. Groups of nearby cells of the same color descended from same stem cells.*

Photo credit: Daniela Malide, Jean-Yves Metais, Cynthia Dunbar, National Institutes of Health

*Left: Coriell scientist in Stem Cell Laboratory*



# COMMUNITY ENGAGEMENT

*Coriell's staff is committed to engaging with the local community and creating opportunities to share its passion for science with the local youth.*

Coriell's staff is committed to engaging with the local community and creating opportunities to share its passion for science with the local youth. This is a legacy left by Dr. Lewis Coriell, Coriell's founder, and the Institute is proud to carry on this tradition today.

Each summer, Coriell opens its laboratory doors to budding young scientists. For four weeks, highly motivated high school and college students are offered the opportunity to work alongside Coriell's scientists and researchers in real world laboratory settings. This past year, two grand-children of Dr. Coriell were accepted into this program. Charlie and Peter Coriell, both students at a high school in nearby Moorestown, were excited by the opportunity to follow in their grandfather's footsteps and to learn more about his important contributions to science.

One of Coriell's longest-held traditions is the Coriell Institute Science Fair. This was its 37th year bringing together hundreds of students from Burlington, Camden and Gloucester counties to demonstrate their scientific curiosity and investigative prowess in hopes of taking home an award, earning scholarships and the chance of moving onto the Delaware Valley Science Fair.

Each year at the Science Fair, Coriell takes time to recognize National DNA Day, a scientific holiday organized each year by the National Human Genome Research Institute, to celebrate the discovery of DNA's molecular structure in 1953 and the completion of the Human Genome Project in 2003 (the latter of which was supported by the Coriell Institute). To celebrate these momentous achievements, the students of each year's Science Fair participate in a hands-on activity which teaches them about DNA and its importance to biology. This year, the focus was on the structure of DNA itself as students tackled DNA origami and constructed the DNA double helix using pipe cleaners and beads.

Coriell was especially honored to host Camden's own Congressman Donald Norcross as keynote speaker. Congressman Norcross spoke to the fair participants about the importance of a STEM-based education and encouraged them all to continue working toward their goals in STEM fields.

2018 marked the 37th year for the Coriell Institute Science Fair.



*Above: Students in Coriell's Summer Experience Program gain hands-on training in our laboratories.*



*Left: Congressman Donald Norcross participated in this year's DNA Day activity before addressing students on the importance of STEM education.*

# A Note About Dr. Michael F. Christman

*Dr. Michael F. Christman,  
Visionary Scientist,  
Dedicated Leader,  
Celebrated Entrepreneur.*



*Dr. Michael F. Christman  
former President & CEO, Coriell Institute*

Coriell was deeply saddened by the passing of its former President and CEO in December 2017. Dr. Christman was a respected mentor and leader and the Institute mourns his loss.

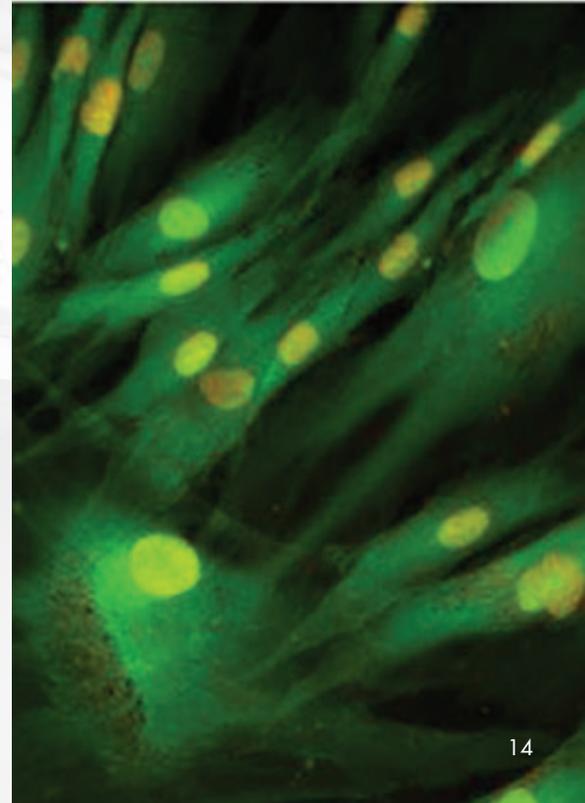
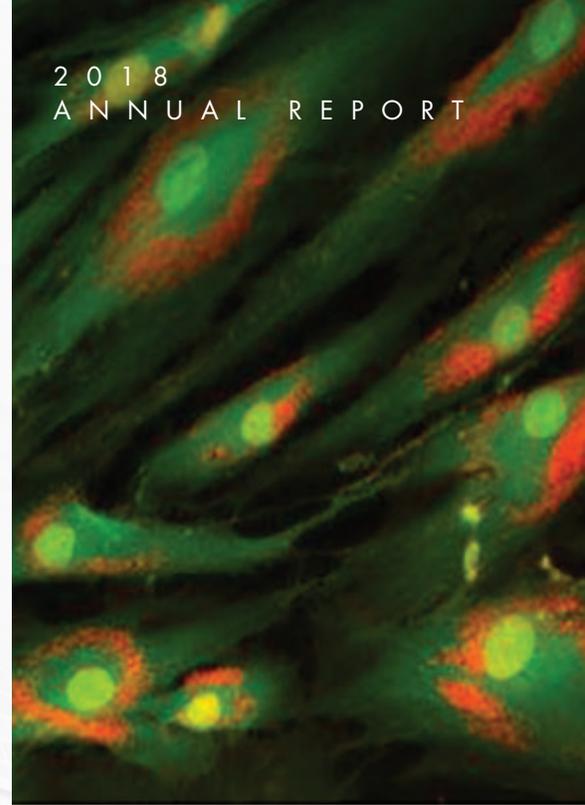
When Dr. Christman first took the helm at Coriell, he brought with him ambitious plans which dramatically transformed the Institute. It was Dr. Christman who saw the promise held by personalized medicine – long before many others in the scientific community did – and maneuvered to put Coriell at the forefront of this new science. The Coriell Personalized Medicine Collaborative, a prized initiative at Coriell, was led by Dr. Christman and has since become a model study of its kind, recognized globally for setting the best standards for personalized medicine.

Members of the Board of Trustees and the Coriell Institute have begun to search and vet candidates for the CEO position. We will honor his legacy by continuing our work in his footsteps.

# FACTS & FIGURES

*Niemann-Pick disease type C1 (NPC) is a rare and fatal genetic disease. Coriell's biobank houses some of the most pristine cell lines of this rare disease. In this photo from a clinical trial, the top image shows fibroblasts homozygous for mutations in NPC1 that demonstrate an increased accumulation of red Lysotracker staining indicative of the storage disease. On the bottom, addition of cyclodextran rescues this lysosomal storage defect.*

Photo credit: National Center for Advancing Translational Sciences (NCATS), National Institutes of Health



# FACTS & FIGURES

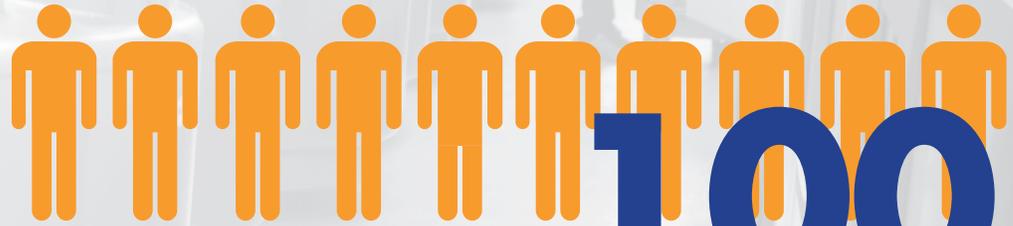


MORE THAN  
**\$20 MILLION**  
ANNUAL REVENUE



NUMBER OF  
FACILITIES





**NUMBER OF EMPLOYEES**

**100**

**SIZE OF FACILITIES**

**75,000**  
**SQUARE FEET**

**OVER**

**250,000**

**NUMBER OF  
UNIQUE DONORS  
REPRESENTED**



# FACTS & FIGURES

(continued)

MORE THAN  
**250,000**



**RISK REPORTS  
GENERATED**

SAMPLES SHIPPED TO

**85**

COUNTRIES



**7,565**

CPMC PARTICIPANTS GENOTYPED

NUMBER OF RARE  
DISEASES REPRESENTED

1,000+

30/70

♂ SPLIT ♀

BETWEEN  
MEN AND WOMEN  
IN SCIENTIFIC ROLES

37 YEARS  
HOSTING

CORIELL INSTITUTE

SCIENCE FAIR





# CORIELL INSTITUTE

FOR MEDICAL RESEARCH

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DECODING THE GENOME

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*Coriell's mission is to accelerate scientific discovery  
by generating world-class biomaterials and  
conducting groundbreaking research in biobanking,  
personalized medicine and stem cell biology.*

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**Coriell Institute for Medical Research**

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