



CORIELL INSTITUTE

FOR MEDICAL RESEARCH

2020

A N N U A L R E P O R T

*Biobanking
Research
Community Engagement*



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Coriell's President and CEO*
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SARS-CoV-2 Colorized scanning electron micrograph of a cell showing morphological signs of apoptosis, infected with SARS-CoV-2 virus particles (green), isolated from a patient sample.

Credit: NIAID/NIH
Image captured at the NIAID Integrated Research Facility (IRF) in Fort Detrick, Maryland

Image on Front Cover:

The cerebellum of a mouse brain affected by Niemann-Pick Type C (NPC), a rare neurological disorder

Credit: Eunice Kennedy Shriver National Institute of Child Health and Human Development, National Institutes of Health

LETTER FROM DR. ISSA

PRESIDENT & CEO

This year was one unlike any seen in a lifetime. In just a few months, the deadliest pandemic in 100 years spread across the world, touching every nation and devastating many. As scientists race for a vaccine and public health professionals work to protect our communities from the virus's worst effects, our mission to bolster and advance biomedical research has never been more clear.

As you will read in this year's annual report, Coriell made leaps and strides towards that goal, serving as a necessary and one-of-a-kind link in the scientific infrastructure supply chain. And while many scientists pivoted their focus to the novel coronavirus, important work in other areas continued apace this year.

That's not to say this year was without challenges for Coriell. Located in Camden, New Jersey, one of the nation's deadliest outbreaks was in our backyard and required from us extensive adaptation and understanding. Because of our role supporting research and many critical industries, we were deemed an essential business and remained open. However, extreme precautions had to be taken to ensure our operations and research continued, biospecimens continued to ship around the world, and most of all, our staff were safe and felt comfortable coming into the Institute.

Unrelated to the COVID-19 pandemic, we have a great deal of good news to share. We renewed several of our most impactful biobanking contracts—some of which Coriell has held for nearly 50 years now. These contracts are the foundation for the Coriell Institute and the ongoing trust placed in us by these prestigious organizations means the world to us.

There is good news to share on the research front—a priority of mine since taking over Coriell's corner office—as well. We've hired promising new scientists, we are tackling new products and offering new services, and at the end of 2019, we were named a collaborator in a very exciting new research project with esteemed population genetics researchers from around the world.

COVID-19 did affect plans for our two primary education outreach efforts in 2020—the Coriell Institute Science Fair and the Coriell Institute Summer Experience—but thanks to hard work and willingness and ability to adapt, both were a success and encouraged a love of science in the next generation.

Thank you for your interest in Coriell and I, as well as the rest of the Institute, hope you have fared well in this difficult time.



Jean-Pierre Issa, MD

President &

Chief Executive Officer

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The Allen Institute hiPS cell line AICS-0059 is a dual-edited line, labeling the endoplasmic reticulum (ER) and nuclear envelope.

A cinematographic rendering of this line using AGAVE shows the ER (mEGFP-tagged Sec61 beta) in blue and the nuclear envelope (mTagRFP-T-tagged lamin B1) in teal.

COVID-19 AND THE CORIELL INSTITUTE

The novel SARS-CoV-2 virus has upended life around the world. The United States was especially hard hit and the state of New Jersey, where Coriell is based, faced a particularly serious wave in early 2020.

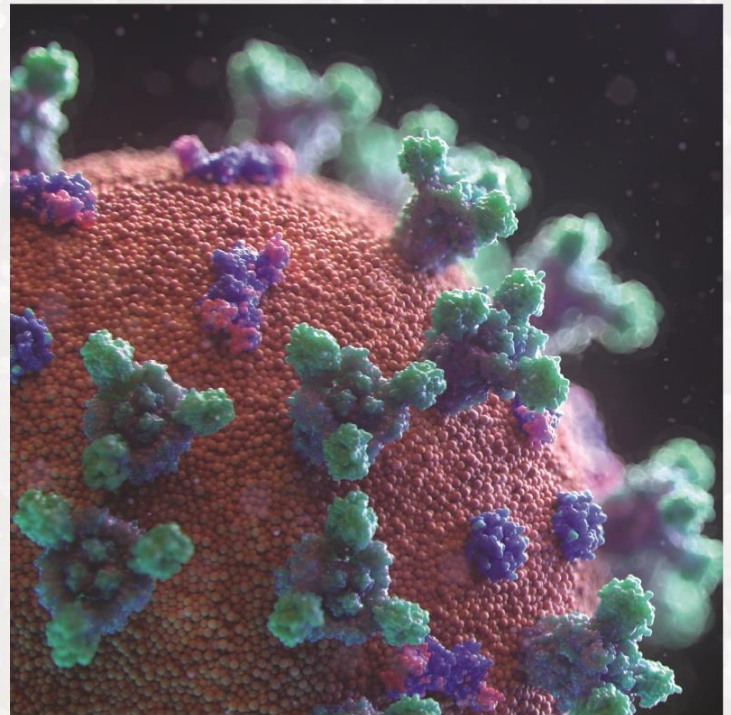
We at Coriell are fortunate to have weathered the storm well. Coriell was quick to move to a work-from-home model and all members of staff with the ability to work remotely were asked to do so. This was no small task and required quick action from teams across the Institute.

Coriell's Information Technology department jumped into action and found suitable online platforms and developed workflows which made this possible. They made sure everyone had the hardware at home needed to accomplish their work and understood the new software so they could be in touch with their teams as needed. As it became clear this new model for work was more long term than the original few weeks that most had envisioned, adjustments were made to make sure it was sustainable for all.

Staff quickly adapted and worked hard to develop creative solutions to some of the most serious challenges posed by the pandemic. Even as much of the state closed down, operations and production at our laboratory facility did not pause. Leadership developed safety protocols to allow Coriell's technicians to continue their work, ensuring that the scientific community could rely on uninterrupted access to the biological samples they need.

Coriell's flagship science fair moved from a gymnasium to the computer. The paid Summer Experience for Students changed gears entirely for 2020. Instead of inviting students into the facility to work hands-on in a production lab, the program focused on bioinformatics and was held virtually, instructed by Coriell's bioinformatics team.

Thanks to the swift efforts of many different teams across the Institute, Coriell was able to continue in its critical role in the scientific community and with these new protocols in place, that will remain true throughout this health crisis.



Digital rendering of SARS-CoV-2 virus

BIOBANKING

This year was one of renewal for Coriell's biobank, the keystone of the Institute. In early 2020, the National Institute of General Medical Sciences (NIGMS) renewed its cooperative agreement with Coriell, through a competitive review process. This award allows Coriell to maintain its Human Genetic Cell Repository, a diverse collection of cells and DNA representing human genetic diversity, for another five years. Coriell has managed this collection of biological samples since 1972 and it is an honor to continue to be trusted with the stewardship of this exceptional resource.

Additionally, the National Institute on Aging (NIA) and the National Institute of Neurological Disorders and Stroke (NINDS) each signed new contracts that keep Coriell in place as the steward of their respective Aging Cell Repository and Human Genetics Resource Center biospecimen collections. Each of these renewals will support the respective collection for an additional five years.

The Allen Institute for Cell Science, a research institute founded by the late Microsoft founder Paul Allen, also renewed its contract with Coriell in the beginning of 2020. Coriell first partnered with the Allen Institute at the end of 2016 to maintain and distribute gene-edited stem cells from the Allen Cell Collection.

These cells are fluorescently-tagged for specific markers and allow researchers to observe the inner workings of a cell in real time with unprecedented clarity. In the years since it was first launched, this collection has grown from six cell lines to more than 40.

Improvements were made to the collections in Coriell's care as well. A major component of the Human Genetic Cell Repository is its collection of cells and DNA representing rare, heritable diseases. Many new samples representing rare diseases were added to the NIGMS Human Genetic Cell Repository, and collaborations with the rare disease community as well as researchers were strong this year. Coriell's repository teams participated in many conferences and advocacy group meetings this past year and had the honor of representing the Institute and the NIGMS Repository as invited speakers and discussion leaders at many of these meetings.

Over the years, the NIGMS Repository team at Coriell has built and maintained critical relationships with the rare disease advocacy community and this year, the team organized and hosted the first ever Rare Disease Day at Coriell. Leaders in rare disease advocacy and research spoke at Coriell to a crowd of scientists and patient advocates, showcasing their efforts and the role of the patient advocate in research.

The NIGMS Repository online collection was also recognized by *Genetic Engineering & Biotechnology News* (GEN) as part of its “Best of the Web” series. GEN said the NIGMS catalog page “provides an enormous amount of resources, including information about the lines available and how to order them, information about characterized mutations, and phenotypic overviews for a set of diseases” and gave it a rating of “excellent.”

The National Human Genome Research Institute (NHGRI) Repository team at Coriell joined a prestigious new research project called the Human Pangenome Reference Sequence Project, or the Human Pangenome Project. The scientists in this initiative are working to update the Human Reference Genome, making a new pangenome reference assembly that is more comprehensive and reflects the full range of genomic diversity across the globe. The NHGRI Repository team is coordinating with the Pangenome sample collection and consent teams to receive blood samples which will be used to establish new cell lines. Coriell is also assisting in the cell line creation, quality assessment, storage and distribution of the newly created sample resources and will support the sequencing teams at partnering institutions by providing high quality biomaterials for this prominent project.



Above: Speakers and guests tour Coriell's cryogenic storage facility during Rare Disease Day at Coriell



Left: Coriell's Sam Sander-Effron and Sherryann Wert at Rare Disease Day at the National Institutes of Health

BIOBANKING

(continued)

The NIA's Aging Cell Repository added hundreds of new samples to its catalog collection, which were collected as part of The 90+ Study, an aging study in which researchers investigated the basic lifestyle and biological factors which underlie advanced aging. These samples were collected from members of the study and are now available to scientists around the world. The Aging Cell Repository also added six novel lines of induced pluripotent stem cells to its budding stem cell collection.

The NINDS Human Genetics Resource Center team continued to grow their collection as well.

Representing cerebrovascular disease, dystonia, epilepsy, Tourette syndrome, and neurologically healthy population controls, biospecimens from more than 400 new subjects were added to the collection's offerings in the past year. Laura Scheinfeldt, PhD, the principal investigator of this collection, was also a co-author on a paper titled "Defining research priorities in dystonia" which was published in *Neurology* in early 2020. The article addressed the natural history of dystonia, the underlying etiology, pathophysiology, research resources available, and therapeutic approaches and offers dystonia research recommendations to the clinical research community.



*Coriell's Dajah Solomon
working in the Molecular
Biology Laboratory*

RESEARCH

Coriell is more than a supplier of materials and services to the scientific community. Coriell researchers are also tackling big questions about the role and impact of DNA on human health through their own scientific investigations. Led by Coriell's President and CEO Jean-Pierre Issa, MD, and Chief Research Officer Jaroslav Jelinek, MD, PhD, the research team focused last year on investigating epigenetic changes associated with aging, the microbiome, and cancer. One scientist on the team, Shoghag Panjarian, PhD, won a grant from the W. W. Smith Charitable Trust, a private foundation established by William Wikoff Smith, to support her search for epigenetic factors that contribute to the development and growth of breast cancer. Woonbok Chung, PhD, developed DNA methylation assays that could be used as biomarkers of biological aging and frailty. The bioinformatics group, headed by Jozef Madzo, PhD, provided data processing and analysis support while also exploring the epigenomics of aging and cancer.

The research team also contributed to scientific literature through several peer-reviewed publications. Dr. Chung published an article in *Clinical Epigenetics* about biomarkers which can predict a person's response to the epigenetic drug guadecitabine when treated for relapsed/refractory acute myeloid leukemia.

The bioinformatics team also collaborated with international scientists on a pair of papers which characterized DNA methylation changes in canine lymphomas and identified new epigenetic markers of atherosclerosis.

The research team saw growth with two new notable hires as well. In 2020, Coriell hired Jian Huang, MD, PhD and technician Zhaorui Lian, PhD. Before coming to Coriell, Dr. Huang was an Associate Professor at Temple University and his expertise in hematopoietic stem cells and CRISPR gene editing technology will increase the capabilities of Coriell's research and biobanking efforts.

It was a productive year for Coriell's other research initiatives as well.

The Camden Opioid Research Initiative (or CORI) continued to recruit patients for its novel study of the underlying genetic and non-genetic factors which influence one's risk for opioid use disorder. This work began at the end of 2018 and is a collaboration between Coriell and its two neighbors in Camden, Cooper University Health Care and the Cooper Medical School of Rowan University. Nearly 200 volunteers joined the two clinical arms of the project in the last year.

RESEARCH

(continued)

Coriell's long-time personalized medicine study, the Coriell Personalized Medicine Collaborative (CPMC), underwent a significant shift this year as it moved from its recruiting phase to one focused entirely on research and analysis. For the CPMC, thousands of people trusted Coriell with their genetic data and personal health information, and in exchange Coriell returned to them information about their risk for certain complex diseases. Now that the CPMC is in the research phase, scientists will continue to study this data in the hopes of learning new insights about the role of the human genome in health and how it can be used to predict and prevent negative outcomes. In early 2020, Dara Kusic, PhD, a researcher at Coriell, published an article in the journal *Military Medicine* titled "rs11670527 upstream of ZNF264 associated with body mass index in the Coriell Personalized Medicine Collaborative." This paper detailed Dr. Kusic's discovery of a new genetic indication for obesity.

Coriell is deeply grateful for all who saw the potential of the CPMC and elected to participate. Their contribution has bolstered our scientific understanding of complex diseases such as diabetes or obesity.



I am interested in devising models and strategies to discover epigenetically modified breast cancer drivers and in unraveling novel synthetically lethal targets within the context of epigenetically modified breast cancer driver genes. I'm also studying epigenetic changes in aging breast epithelium and designing novel platforms for drug screening of epigenetic targets.

Shoghag Panjarian, PhD

Research Scientist



My laboratory studies signal transduction pathways that regulate hematopoietic stem cell (HSC) self-renewal and differentiation as well as drug resistance of hematological malignancies.

Our recent work identified a new connection between GSK3 and PPAR- δ /mitophagy pathway, which will provide new insights into the mechanisms of the regulation of HSC activity and may improve the therapy of many hematopoietic disorders.

Jian Huang, MD, PhD

Senior Scientist for Stem Cell Biology and Gene Engineering

COMMUNITY ENGAGEMENT

Science education has long been an important focus of the Coriell Institute. Our founder, Dr. Lewis L. Coriell, was committed to cultivating the next generation of scientists and the Institute today continues his commitment primarily through two programs, the Coriell Institute Science Fair and the Summer Experience for Students.

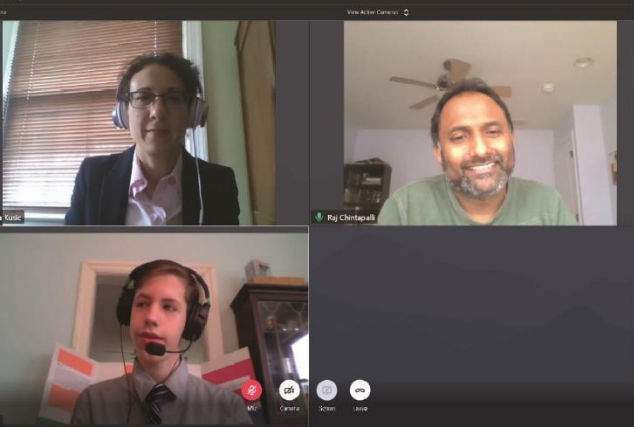
Through the Summer Experience Program, Coriell opens its doors to eight student scientists each year for the month of July. These high school and college students rotate through Coriell's working laboratories, earning real life experience at a professional lab bench. In the final week, the students each demonstrate what they have learned during their internship by presenting how the work performed at Coriell impacts the scientific community and society at large.

In July 2019, some of the topics presented included:

- Intersection of Chronic Pain Management in Sickle Cell Disease with the Opioid Epidemic
- Practical Applications to Viral Usage
- Use of Pluripotent Stem Cells in Therapeutic Cloning

This was also the first year of a grant from the RNR Foundation to support one student in the Summer Experience Program. The purpose of the grant was to honor the memory of Dr. Michael Christman, the Institute's previous CEO who passed away at the end of 2017. An internship was deemed appropriate since Dr. Christman was a teacher and mentor who always sought to develop the capabilities of those who served with and under him.

Recognizing that the pandemic would dramatically impact the Summer Experience for Students in 2020, Coriell's organizers created a new, separate opportunity focused on conducting bioinformatic research which allowed students to participate virtually on projects and receive instruction from Coriell's team of bioinformatic experts. In the three-week application period, Coriell received 160 applications from students seeking to participate in this new internship program. Coriell intends to host both programs next summer.



Above: Students participate in Coriell's Summer Experience for Students

Below: Coriell Institute Science Fair participant presents his project to judges via video chat

Each year, the Coriell Institute Science Fair brings together more than 100 middle school and high school students to demonstrate their scientific prowess. Selected winners then have the opportunity to progress to the Delaware Valley Science Fair (DVSF), and from there middle school winners move onto the Broadcom MASTERS (Math, Applied Science, Technology, and Engineering for Rising Stars) national competition, while high school students are invited to the International Science and Engineering Fair. As a feeder fair to the international level, Coriell's event must adhere to the international rules and regulations, as well as a strict timeline. Scheduled for mid-March of 2020, this year's in-person event was made impossible by the COVID-19 pandemic.

Because the fair plays an important role in the progression of students from South Jersey, Coriell's Fair organizers did not want to simply cancel the event. Once DVSF made the decision to move their fair to a virtual setting which required them to postpone their date, organizers of the Coriell Institute Science Fair knew they could do the same. The event was pushed back two weeks to allow organizers time to redesign the fair into a virtual platform. Instead of presenting a poster in person, students submitted their paperwork and posters online, and instead of answering questions from judges face-to-face, students utilized virtual meeting spaces organized by Coriell staff. Ultimately, the fair was a hit and was featured in the *Philadelphia Inquirer* and the Camden-focused *TAPinto Camden*.

"Being able to participate in the Coriell Science Fair has offered me a sense of normalcy," Lesslie Montiel, an 11th grader at Camden Academy Charter High School, told *TAPinto Camden*. "Being able to disconnect from the current global climate and talk about science is just one way I am coping with the situation. I am very fortunate to be able to participate in this year's program."

Science Fair Sponsors

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Christine Zajac
RNR Foundation

PHILANTHROPY

Researchers around the world right now are engaged in a never before seen effort to stop the spread of the SARS-CoV-2 virus. This call to arms went out to all members of the global scientific and medical community, Coriell included. Coriell is a critical part of the infrastructure that enables biomedical research and our reputation for excellence has developed over decades of trustworthy service.

The Coriell Institute for Medical Research was born from another effort to eradicate another frightening and deadly virus. Our founder and namesake, Dr. Lewis L. Coriell, was instrumental in the effort to eradicate polio. As a well-regarded virologist, Dr. Coriell contributed to a major scientific breakthrough that allowed the virus to be easily grown in the lab and dramatically accelerated polio research. As the history goes, the vaccine was a success and polio was ultimately eradicated in the United States, perhaps the greatest medical success of the 20th Century. With the goodwill earned from this work, Dr. Coriell returned to Camden, New Jersey and successfully raised public funds to launch what was originally known as the South Jersey Medical Research Foundation, and later was renamed the Coriell Institute for Medical Research.

Dr. Coriell knew that life-changing research did not occur in a vacuum; rather, major scientific advances often require a collaborative and global effort. So over the next 67 years, the Coriell Institute amassed the scientists, technicians, infrastructure and expertise necessary to facilitate biomedical research. Whether a research scientist needs critical biospecimens to investigate the cause of a disease, or develop novel treatments, study genetic differences in humans, or obtain standardized DNA for state-of-the-art sequencing technologies, Coriell is their trusted source. Coriell samples have been distributed to scientists in 85 countries worldwide.

Today, Coriell is led by our President and CEO, world-renowned cancer expert Jean-Pierre Issa, MD who is also spearheading Coriell's epigenetics research efforts to unmask cancer's causes at the cellular level. This year, Dr. Issa was called on by New Jersey's Governor Phil Murphy to sit on the Governor's Restart and Recovery Advisory Council, a group tasked with advising the state on thoughtfully easing out of its COVID-19 lockdown.

Now, while biomedical research is more important than ever, we are especially grateful to our supporters who were moved by our mission to donate to our efforts over the last year.

DONORS:

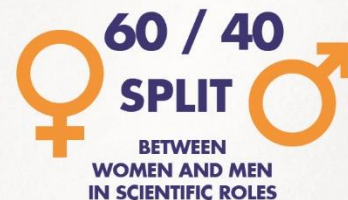
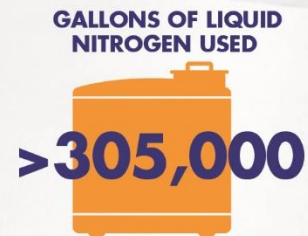
THANK YOU to all our generous donors! Your backing inspires us to push forward on our critical mission: “To prevent and cure disease through biomedical research.” One of our greatest accomplishments is to earn your trust as you deem the Coriell Institute worthy of your support.

We gratefully recognize donors who partnered in our success throughout Fiscal Year 2020 (July 1, 2019 – June 30, 2020).

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