

2022

Annual Report

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LETTER FROM

Dr. Jean-Pierre Issa, Coriell's President & CEO





As you will read in these pages, this past year has been one of growth for the Coriell Institute. Growth in our two scientific focuses: Biobanking and original research.

I am very proud of the accomplishments achieved by Coriell’s biobanking team. We renewed our collaborative with the National Human Genome Research Institute, keeping its Sample Repository for Human Genetic Research at Coriell for another five years.

And many new samples were added across the collections in our care. The team responsible for the National Institute of General Medical Sciences’ Human Genetic Cell Repository traveled across the country to collect blood samples from people affected by heritable diseases, new induced pluripotent stem cell lines were added to the National Institute on Aging’s Aging Cell Repository, and an exciting new sample type, high molecular weight DNA, was added to Coriell’s offerings.

Growth carried into Coriell’s research efforts as well. Coriell and our partner Van Andel Institute in Grand Rapids, Michigan were awarded a \$12.4 million grant from the National Cancer Institute to establish a SPORE (or Specialized Program of Research Excellence) to investigate epigenetic therapies for cancer. This money will support scientists at our Camden facility and around the country as they hunt for new ways to tackle cancer through epigenetic therapies.

A member of Coriell’s faculty, Jian Huang, MD, PhD, received new funding, as well, from the National Heart, Lung, and Blood Institute to study signaling regulation of blood stem cells. Dr. Huang, an associate professor and Senior Scientists for Stem Cell Biology and Gene Engineering at Coriell, joined Coriell in the summer of 2020 and this new funding demonstrates the real potential his work has to improve care for blood cancers.

And this year we returned the cherished Coriell Institute Science Fair to an in person event, after two years of virtual events. Students packed into the gymnasium where it was held and showed off dozens and dozens of impressive projects. It was lovely to see and meet these bright students again in person.

The growth and progress achieved by Coriell this year has no signs of slowing. I look forward to sharing in this letter next year comments on some of the biggest and most exciting projects Coriell has taken on in many years.

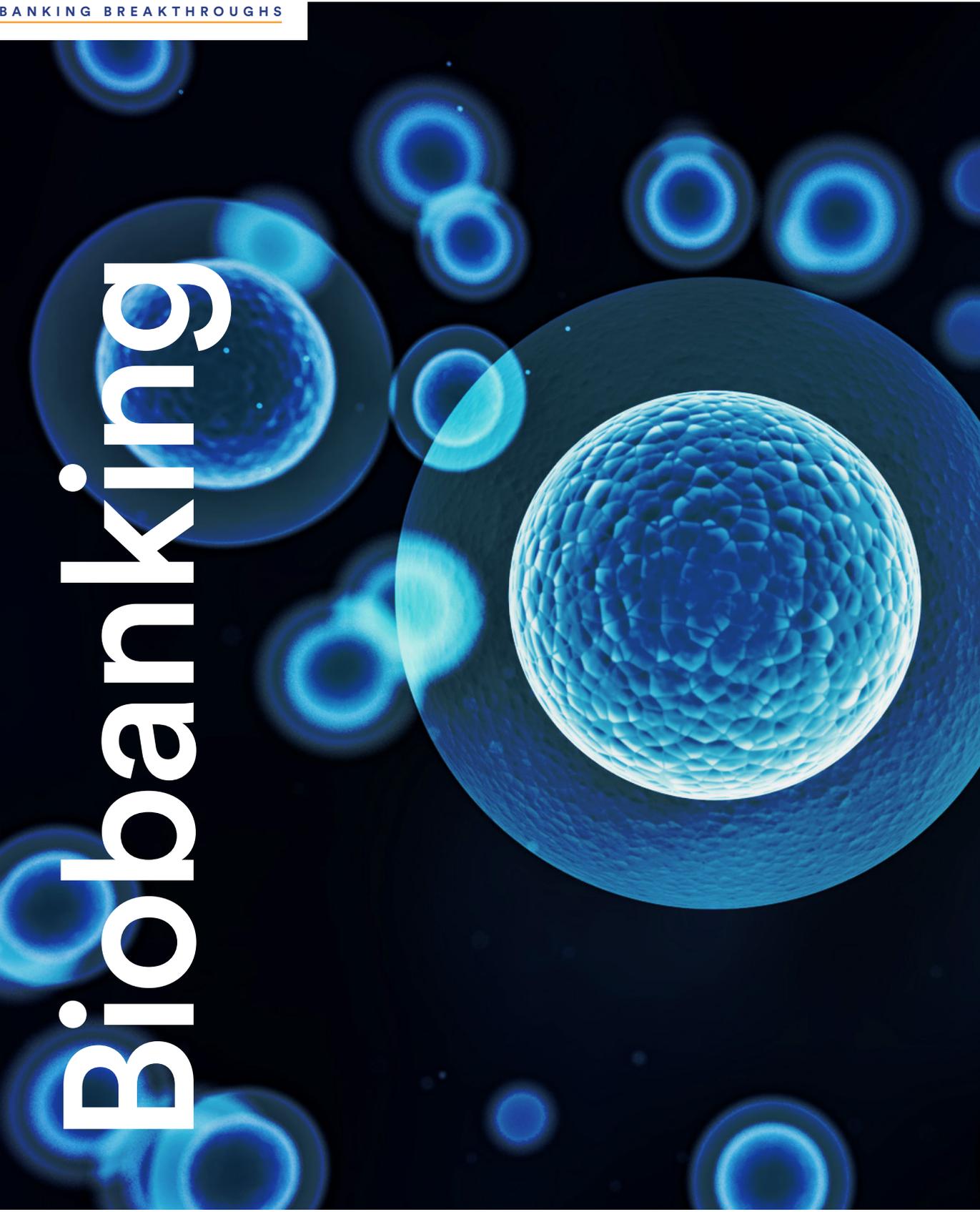
Thank you for your interest in our organization. Your interest and support makes the work that we do possible. I am confident you will be as impressed by the achievements documented in these pages as I am.

**JEAN-PIERRE ISSA, MD
PRESIDENT & CHIEF EXECUTIVE OFFICER**

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Biobanking



The foundation for the Coriell Institute for Medical Research continues to be its biobank. For decades, Coriell has been the trusted supplier of biological materials for use in research around the world.

The millions of samples in cryogenic storage at the Institute include some of the most diverse, most important samples in genetic research and advances over the last year have cemented Coriell's role as the world leader in the industry and scientific field.

Milestones

This year, the National Human Genome Research Institute (NHGRI) renewed its nearly \$5 million collaborative agreement with Coriell, keeping NHGRI's Sample Repository for Human Genetic Research in Coriell's care for another five years.

This collection was first established by NHGRI in 2006 and now contains unique collections of samples such as the landmark International HapMap and 1000 Genomes Projects, which are known for diverse DNA and cell lines characterized by large-scale genomic data.

This year also marked the 20th anniversary for the National Institute of Neurological Disorders and Stroke's Human Genetics Resource Center. This collection was created at Coriell in 2002 and has established itself as an invaluable resource for scientists studying neurological disease and disorders.

Growing Collections

The National Institute for General Medical Sciences' (NIGMS) Human Genetic Cell Repository, held at Coriell for 50 years, includes important samples ranging from distinct human populations, to samples used in standards and validations work, and this collection is always working to grow the number of samples representing rare, heritable diseases.

To grow the number of those samples, the NIGMS team at Coriell collaborates directly with disease advocacy groups, informing them of this valuable resource and assisting their members in the sample donation process at no cost to the donors. The team resumed its in person work with rare disease groups this year, attending advocacy group meetings to answer questions and collect blood samples on the spot.

Danaé Bartke is the executive director of HCU Network America, a disease advocacy group, and helped organize the 2022 HCU/OAA/PAF Family Conference in Bethesda, which Coriell attended.

“Coriell did its own presentation. They had their own booth. They hired and brought their own phlebotomist. It's great that Coriell makes it so easy.” Bartke said. **“You donate blood one time and you've contributed to this vast wealth and future that can improve things not just for yourself, but all patients.”**

The National Institute on Aging's (NIA) Aging Cell Repository—housed and managed at Coriell for nearly 50 years—added three human induced pluripotent stem cell lines to its collection in April, bringing the total number of hiPSc lines in the collection to 28.

The three new lines represent Parkinson's disease, a common neurodegenerative disorder, Rothmund-Thomson syndrome, a rare disease caused by a genetic mutation which manifests clinical features of accelerated aging, and non-healing wounds, a condition frequently associated with bedbound older individuals.

For the NIGMS and NHGRI collections, Coriell developed and launched a new product called high molecular weight DNA (or HMW

DNA). This type of DNA is useful for long-read next-generation sequencing and studies that investigate large-scale genomic variation such as structural variation. Several samples within these collections are currently available as HMW DNA, and any can be made on demand for researchers interested in this novel sample type.

Biobanking Science

A team of Coriell scientists developed a novel microsatellite (or MSAT) assay for sample authentication that better protects donor information. When a biological sample enters Coriell, all personal information is stripped from it in a process known as de-identification. From there, a standard six-marker MSAT assay is used to authenticate samples.

In rare instances when that six-marker assay was not precise enough to authenticate a sample against the original donation, a secondary MSAT assay was used—the same assay used by the Combined DNA Index System (or CODIS), a national DNA database used by law enforcement agencies. Though not connected in any way to CODIS itself, the use of this assay could raise privacy concerns.

Coriell scientists developed and validated a new secondary assay which relies on MSATs unused by the one with CODIS. An article detailing their work was published in the journal *Biopreservation and Biobanking* and the team was awarded the International Society for Biological and Environmental Repositories' inaugural Best Paper Award.

In awarding this team the Best Paper Award, ISBER said **“this practical and useful assay has wide applicability to human biobanks, offering a fast and cost-effective way to establish a biospecimen genetic profile.”**

Research



Each day at Coriell, researchers are investigating DNA, seeking new knowledge about the ways this molecule affects our life and our health.

One particular focus of Coriell's research team is the way the turning on or off of our genes can affect our risks for various cancers. This is the study of epigenetics. This work is not focused on the DNA sequence itself, but instead how the genes along the sequence are expressed.

Coriell made history this year when it was awarded a Specialized Program of Research Excellence grant from the National Cancer Institute for the investigation of epigenetic therapies for cancer. This is the first grant of its kind to be awarded to an organization in New Jersey and the first SPORE grant to support research into epigenetic therapies. Coriell shares this award with Van Andel Institute in Grand Rapids, Michigan.

This grant, worth \$12.4 million over five years, supports nearly 20 scientists working to improve these new therapies for cancer. The SPORE is led by **Jean-Pierre Issa, MD**, Coriell's President and Chief

Executive Officer, as well as Van Andel Institute's Chief Scientific Officer **Peter A. Jones, PhD, DSc (hon)**, and Johns Hopkins University and VAI's **Stephen Baylin, MD**.

of improving stem cell and bone marrow transplants. Dr. Huang's team will focus their research on the role played by an enzyme named glycogen synthase kinase 3 (or GSK3),

“SPORE grants hold a special place in translational cancer research. Through them, the NCI enables groundbreaking work and the trust it puts in the awarded scientists allows for unparalleled freedom and collaboration,” said Dr. Issa. “It’s a true honor to receive this grant and it’s a sign of more exciting things to come for the Coriell Institute.”

Scientists within the SPORE are working on three research projects in particular. One investigating a certain group of enzymes as a potential target for new therapies, one investigating a new way to treat solid tumors by inhibiting targeted enzymes, and the third is researching the impact of epigenetic therapy on cancers driven by BRCAness, a major cancer-related vulnerability caused by a defect in the repair of DNA breaks.

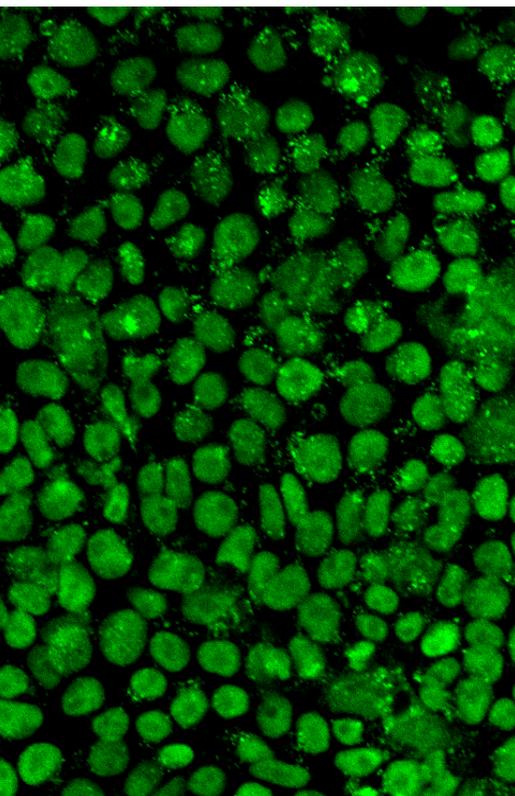
This SPORE award includes the creation of a Career Enhancement Program and a Developmental Research Program, which provide research awards to faculty (inside and outside of the SPORE group) to support recruitment and retention of scientists with a focus of bolstering diversity in the field.

Coriell's **Jian Huang, PhD** was awarded \$2.5 million by the National Heart, Lung, and Blood Institute (NHLBI), to study stem cells in hopes

an enzyme previously demonstrated by Dr. Huang to be important in regulating the regeneration of hematopoietic stem cells (HSCs), a type of stem cell that can differentiate into the various types of blood cells found in the human body.

Coriell's cancer research efforts also earned an award from the William G. Rohrer Charitable Foundation in February of 2022. The foundation awarded Coriell \$500,000 to support the hiring of new scientists and the purchase of new state-of-the-art equipment.

Jozef Madzo, PhD, Director of Bioinformatics, and his lab contributed to several publications in leading journals—including *Nature Communications*, *Cancer Research*, and *PLoS Pathogens*. These papers detailed investigations into cell diversity in rodents, basic functions of the Epstein-Barr virus, and more.



Featured Publications

Hypoxia drives hematopoiesis with the enhancement of T lineage through eliciting arterial specification of hematopoietic endothelial progenitors from hESC

Wang N, Chen C, Cheng Y, Fu Y, Zhong Z, Yang Y, Lv L, Chen H, Huang J, Duan Y.

Stem Cell Research & Therapy. June 2022 28;13(1):282. doi: 10.1186/s13287-022-02967-0. PMID: 35765115; PMCID: PMC9241298.

Single cell transcriptomic analysis reveals cellular diversity of murine esophageal epithelium

Kabir MF, Karami AL, Cruz-Acuña R, Klochkova A, Saxena R, Mu A, Murray MG, Cruz J, Fuller AD, Clevenger MH, Chitralla KN, Tan Y, Keith K, Madzo J, Huang H, Jelinek J, Karakasheva T, Hamilton KE, Muir AB, Tétreault MP, Whelan KA.

Nature Communication. Apr 2022 20;13(1):2167. doi: 10.1038/s41467-022-29747-x. PMID: 35443762; PMCID: PMC9021266.

The nuclear lamina binds the EBV genome during latency and regulates viral gene expression

Caruso LB, Guo R, Keith K, Madzo J, Maestri D, Boyle S, Wasserman J, Kossenkov A, Gewurz BE, Tempera I.

PLoS Pathogens. April 2022 14;18(4):e1010400. doi: 10.1371/journal.ppat.1010400. PMID: 35421198; PMCID:PMC9009669.

The Two-Hit Hypothesis Meets Epigenetics

Issa JP

Cancer Research. April 2022 1;82(7):1167-1169. doi: 10.1158/0008-5472.CAN-22-0405. PMID: 35373289.

Humanized anti-interleukin-6 antibody HZ0408b with anti-rheumatoid arthritis therapeutic potential

Liu X, Li L, Wang Q, Jiang F, Zhang P, Guo F, Liu H, Huang J. A Novel

Frontiers in Immunology. January 2022 19;12:816646. doi:10.3389/fimmu.2021.816646. PMID: 35126375; PMCID: PMC8808405.

Transcriptome-guided resolution of tumor microenvironment interactions in pheochromocytoma and paraganglioma subtypes

Batchu S, Hakim A, Henry OS, Madzo J, Atabek U, Spitz FR, Hong YK.

Journal of Endocrinological Investigation. May 2022;45(5):989-998. doi: 10.1007/s40618-021-01729-8. Epub 2022 Jan 28. PMID:35088383.

The three-dimensional structure of Epstein-Barr virus genome varies by latency type and is regulated by PARP1 enzymatic activity

Morgan SM, Tanizawa H, Caruso LB, Hulse M, Kossenkov A, Madzo J, Keith K, Tan Y, Boyle S, Lieberman PM, Tempera I.

Nature Communication. Jan 2022 17;13(1):187. doi:10.1038/s41467-021-27894-1. PMID: 35039491; PMCID: PMC8764100.

Microsatellite markers in biobanking: A new multiplexed assay

Smith G, Mathews D, Sander-Effron S, Requesens D, Turan N, Scheinfeldt L.

Biopreservation and Biobanking. October 2021;19(5):438-443. doi: 10.1089/bio.2021.0042. Epub 2021 Sep 1. PMID: 34468209; PMCID: PMC8665806.

Pharmacogenomics: From Basic Research to Clinical Implementation

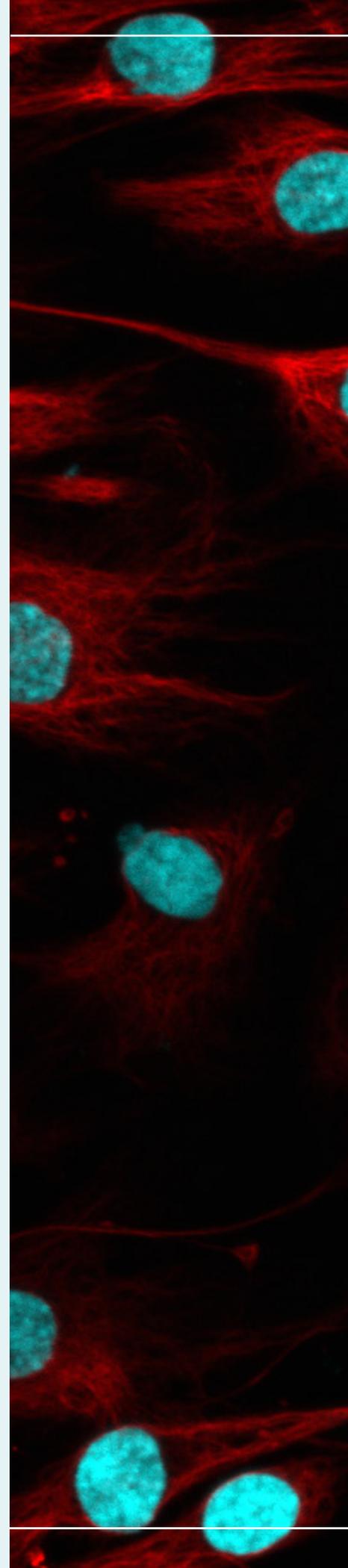
Scheinfeldt LB.

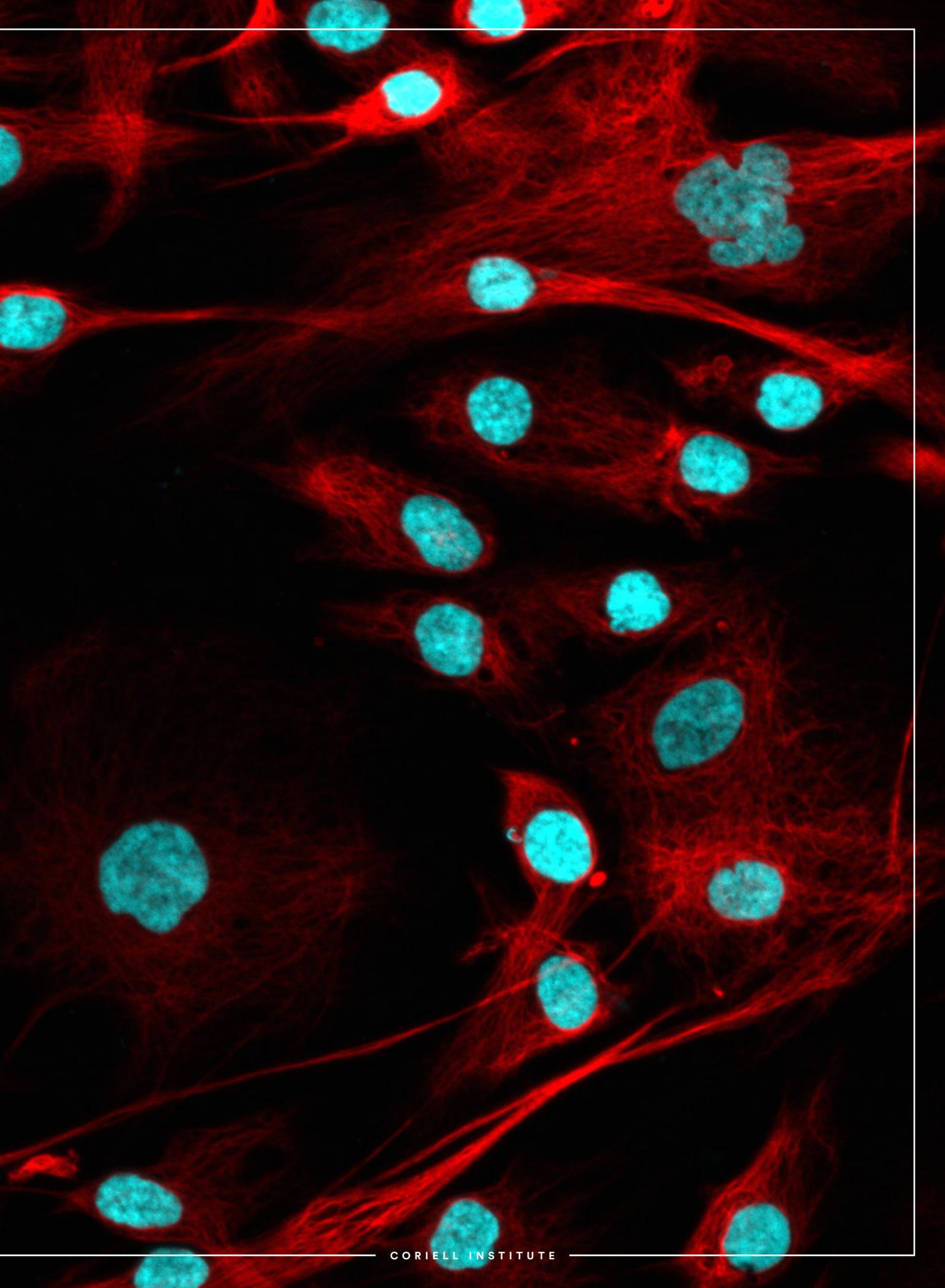
Journal of Personalized Medicine. 2021 Aug 17;11(8):800. doi: 10.3390/jpm11080800. PMID: 34442444; PMCID: PMC8402167.

TET2 and DNMT3A mutations exert divergent effects on DNA repair and sensitivity of leukemia cells to PARP inhibitors

Maifrede S, Le BV, Nieborowska-Skorska M, Golovine K, Sullivan-Reed K, Dunuwille WMB, Nacson J, Hulse M, Keith K, Madzo J, Caruso LB, Gazze Z, Lian Z, Padella A, Chitralla KN, Bartholdy BA, Matlawska-Wasowska K, Di Marcantonio D, Simonetti G, Greiner G, Sykes SM, Valent P, Paietta EM, Tallman MS, Fernandez HF, Litzow MR, Minden MD, Huang J, Martinelli G, Vassiliou GS, Tempera I, Piwocka K, Johnson N, Challen GA, Skorski T.

Cancer Research. October 2021;81(19):5089-5101. doi: 10.1158/0008-5472.CAN-20-3761. Epub 2021 Jul 2. PMID: 34215619; PMCID: PMC8487956.





Community Engagement



- ▶ The science that happens at Coriell is only possible because of the educational foundation laid for us by teachers—the many teachers, mentors and friends who shared their passions, their knowledge, and advice for young scientists.

At Coriell, we believe it's our duty to continue that tradition. We know the importance of cultivating the next generation of scientists—the very scientists that will pick up our work and look at these problems with a fresh set of eyes and perspective.

Coriell fulfills this duty each year by hosting the Coriell Institute Science Fair, a renowned science fair for students in southern New Jersey, and by working with students directly through an educational summer program.

Coriell again held its Bioinformatics Research Experience in the summer of 2021. This month-long virtual program allowed interested students to learn the basics of bioinformatics and scientific biological data analysis. Participants learned programming skills, how to read and judge scientific

literature, and how to communicate their work and data with others.

This year's science fair, the 41st annual, was held in person in March, and brought more than 100 of the brightest young minds together to show off their scientific curiosity and compete for prizes which include scholarship money.

There is no problem faced by the world that these students weren't interested in tackling. One eighth grade student studied ways to reduce the use of fossil fuels and greenhouse gas emissions; another utilized 3D printing technology to develop gloves for use with virtual reality on a computer; one high school junior examined which plants might best survive life on Mars.

Winners from the Coriell Institute Science Fair have the option to continue on to the Delaware Valley Science Fair, and—if successful there—move on from that fair to the International Science and Engineering Festival, a global competition for young scientists.

In fact, one student from the Coriell Institute Science Fair not only made it to the international competition, but won a first place prize in Biochemistry for her project “Novel Plant-Derived Scaffolds Influence Cellular Mechanotransduction and Differentiation.” This student, Maya Butani, worked for years to study the utility of plant material in human tissue engineering and won the same prize at the ISEF competition last year as well. She is heading to Princeton University in the fall of 2022.



PICTURED:
Maya Butani



Maya Butani, Coriell Institute Science Fair Winner, Wins International First Place Award

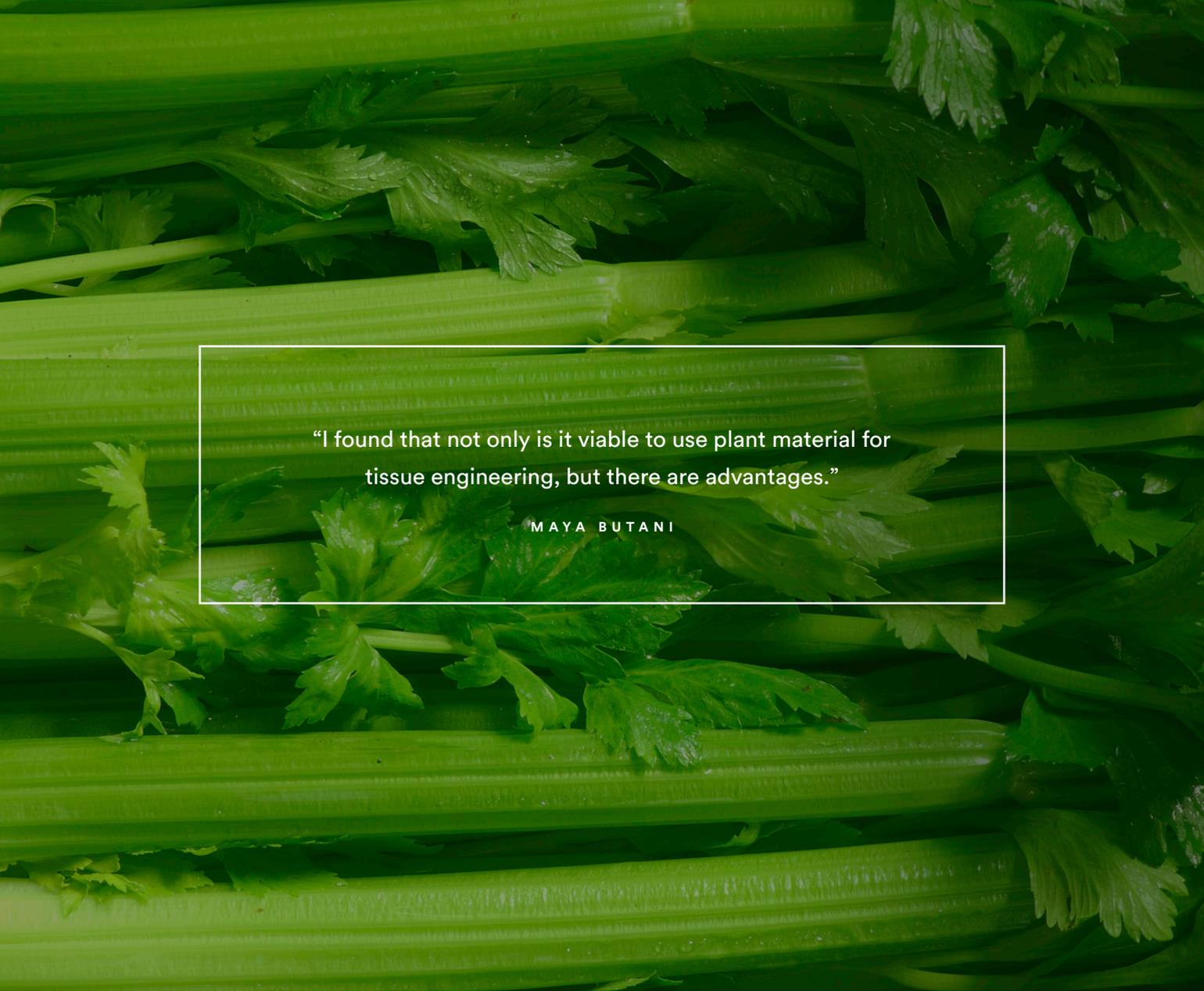
CONGRATULATIONS TO MAYA BUTANI, a winner in this year's Coriell Institute Science Fair, for her recent first place award at the 2022 International Science and Engineering Fair! Maya received the first place award in the Biochemistry category for her work investigating the utility of plant tissue in human tissue engineering.

Maya admits she caught the science fair bug young. She first participated in the Coriell Institute Science Fair six years ago, when she was in sixth grade. Now a senior at Moorestown High School, Maya has focused her work on the field of

engineering human-like tissue—specifically for finding out if tissue can be grown using plant material that could be used safely in humans.

"I found that not only is it viable to use plant material for tissue engineering, but there are advantages which is a fascinating conclusion of my research over the last four years," Maya said.

This is certainly lofty work for a high school student, but Maya has help.



“I found that not only is it viable to use plant material for tissue engineering, but there are advantages.”

MAYA BUTANI

“I started doing this research in my kitchen, trying to create these plant scaffolds. I monopolized the kitchen, much to my parents’ dismay,” Maya said. “I realized if I wanted to really do this work, I’d need access to a lab. I completed a summer camp at Rowan University and I talked to one of the professors there. She reached out to researchers for me and Dr. Sebastian Vega talked to me. We’ve been able to grow the project as a team since then.”

From here, Maya graduates in June and will attend Princeton University in the Fall, allowing her to stay close to home, with an initial focus on studying Molecular Biology.

“The people I’ve met have changed my life. My mentors who have taught me and have given me opportunities, to the other science fair competitors who share my passion, and the judges who make me feel like I’m on the cutting edge of science,” Maya said. “It’s the people and the network that truly make the research.”

Philanthropy

This has been an important year for the Coriell Institute for Medical Research, as you've read thus far.

We're continuing to grow and support the one-of-a-kind repositories in our care. We attended meetings of rare disease advocates and assisted in the collection of samples for research, developed and launched new and in demand products, and added news lines of induced pluripotent stem cells across many of the collections at Coriell.

In the new Epigenetic Therapies SPORE (or Specialized Program of Research Excellence), researchers at Coriell are working with a national team of scientists to better understand the epigenetic underpinnings of cancer and how to use that knowledge to improve cancer treatments. This exciting new collaborative investigating epigenetics of cancer is the first of its kind to be supported by the National Cancer Institute.

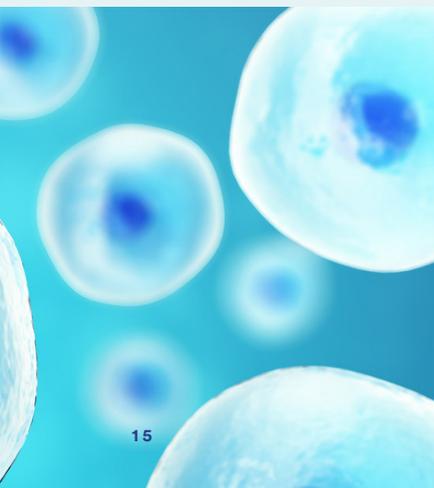
As always, we're training the next generation of scientists through our Coriell Institute Science Fair—which just celebrated its 41st anniversary—and our summer educational

programs. One student from our fair went on to win a first place prize in the International Science and Engineering Fair for her work investigating the possibility of using plant tissue in human tissue engineering—this was her second first place prize at the international fair in a row!

What we think of as medical miracles are the direct results of extraordinary people putting forth extraordinary effort to make the extraordinary happen. Big or small, support for Coriell empowers this global effort.

This is what we've done for the last seven decades and it would not be possible without the support of the public.

For more information on how to give, visit [Coriell.org](https://www.coriell.org).



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We gratefully recognize donors who partnered in our success throughout Fiscal Year 2022 (July 1, 2021 - June 30, 2022).

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2021



2022

Figures

100+

EMPLOYEES

56/44

PERCENTAGE OF WOMEN TO
MEN IN SCIENTIFIC ROLES

52

NUMBER OF SCIENTISTS

2,436

SCIENTISTS SERVED

258,572

UNIQUE SAMPLE
DONORS REPRESENTED

8,721

DISEASES REPRESENTED

222

NEW DISEASES ADDED

87

COUNTRIES THAT HAVE
ORDERED SAMPLES

183 BILLION

CELLS THAT WE'VE
CULTURED IN-HOUSE
AND SHIPPED

12

RESEARCH PUBLICATIONS

A Legacy of Innovation. A Future of Possibility.

