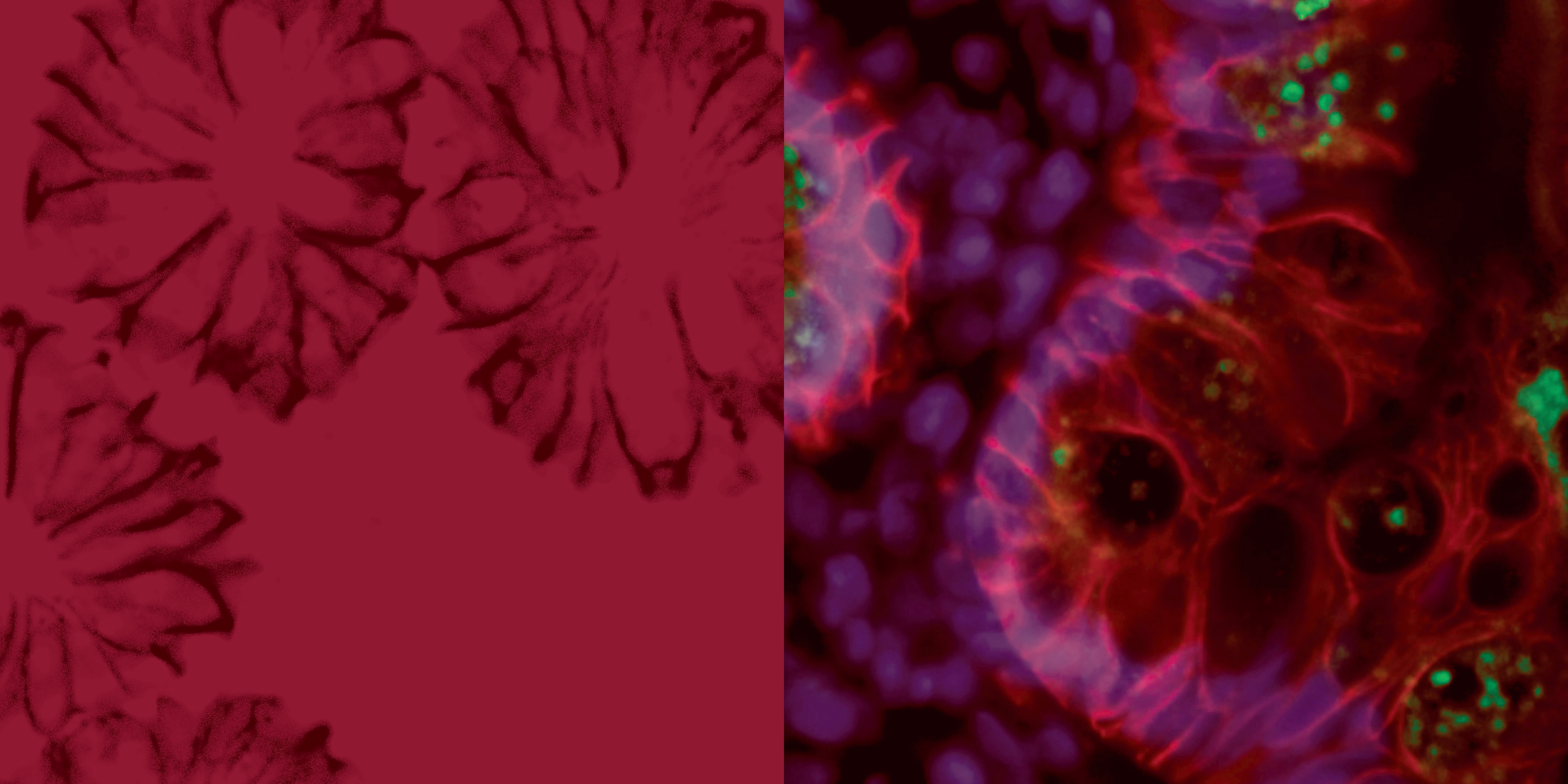
2020

THE ROCKEFELLER UNIVERSITY

Annual Report



DEAR FRIENDS,

Never was there a year in which so many stepped up to have greater impact on our scientific enterprise and on human health.

This 2020 report highlights a pandemic year in which our mission of "science for the benefit of humanity" took on heightened meaning and urgency.

When the pandemic exploded last March, our first priority was to keep our staff and the university safe, and we innovated to keep people safe at work, in Rockefeller housing, and on the commute to campus, as well as providing safe and welcoming childcare solutions for children from 3 months to age 14. Relying on the dedication of essential personnel, rigorous safety measures, weekly testing, and contact tracing, we were able to prevent transmission on campus and had no severe cases of COVID-19 and only one hospitalization among staff and trainees.

Within weeks of the pandemic's start, 23 of our 70 faculty turned the focus of their laboratories to the challenges of COVID-19. By studying patients recruited to The Rockefeller University Hospital who had recovered uneventfully from COVID-19, our scientists identified the most potent antibodies yet described to prevent or stop ongoing infection; these are now in late-stage clinical trials. Rockefeller scientists also provided answers to the mystery of why many people have innocuous infections while others become gravely ill. Additionally, researchers discovered small molecule leads for novel inhibitors of SARS-CoV-2 enzymes required for replication, and human proteins that are essential for the viral life cycle. These contributions have been nothing short of extraordinary.

At the same time, faculty, scientific staff, and trainees continued to advance other critical research, publishing more than 800 papers, including many of the highest impact discoveries of the year. These included new insights into the mechanisms by which memories are established and maintained, mechanisms that allow cancer cells to access blood vessels and metastasize, and the discovery of how the central nervous system monitors and responds to metabolites being made by bacteria in the intestines.

Despite the pandemic's challenges, we continued in our vital education missions. We matriculated a full complement of new graduate students, and our RockEDU science outreach program for high school students pivoted to online sessions. We completed recruitment of two remarkable new faculty members and welcomed them to campus in 2020. And to inform a public hungry for trusted information, we established monthly webinars, "Virtual Discussions with Genuine Experts," featuring timely presentations by faculty on current issues in the pandemic and the state of ongoing research.

Rockefeller's scientists and science continued to win accolades throughout the year. Charles M. Rice won a Nobel Prize for his studies of hepatitis C, which led to a cure for this often-fatal disease. This was our third Nobel Prize in Physiology or Medicine in the last ten years, a number unmatched by any other institution. Elaine Fuchs won the Canada Gairdner International Award for revealing the molecular mechanisms by which skin stem cells repair tissues. And Rockefeller ranked #1 in the world for having the highest fraction of our scientists' publications in the top 1% of the most-cited papers in their respective scientific fields.

Through it all, we benefited from exceptionally committed and generous trustees and donors whose ongoing partnership enabled our labs to race into areas with critical knowledge gaps and make major contributions to science and the battle against COVID-19. Ours is a remarkable collaboration for which we are truly grateful.

Finally, 2020 was a year in which national issues of systemic racism came to the fore following the murder of George Floyd. The months that followed produced deep discussions across campus and demands for equality and justice in protests across the city and country. We have committed to furthering the promotion and achievement of diversity, equity, and inclusion on our campus.

As we look back on the pandemic year, I reflect on how the last 75 years of basic science—dating back to Oswald Avery's discovery at Rockefeller that DNA is the chemical of heredity—provided a rich and deep understanding of the biochemistry of life. With that knowledge in hand, scientists confronted with a previously unknown and deadly virus were able to fully characterize it, identify its vulnerabilities, and develop a safe and highly effective new type of vaccine against it—all in less than a year.

It's hard to imagine a stronger affirmation of our continuing mission. I'm proud and humbled to be part of such a remarkable community.

Thank you for your commitment to Rockefeller during an unprecedented year.

Richard P. Lifton, M.D., Ph.D.
Carson Family Professor
Laboratory of Human Genetics and Genomics
President
The Rockefeller University

Image: Mario Morgado

Pivoting to the pandemic

In 2020, the COVID-19 pandemic thrust fundamental biomedical research into the public eye and underscored its enduring value to society. Grounded in the latest basic science of virology, immunology, and many other disciplines, more than two dozen Rockefeller laboratories pivoted to adapt current investigations to the mysteries of the SARS-CoV-2 virus. As hospitals rushed to save the infected and governments scrambled to respond, our researchers dug into the fundamentals: mapping out the mechanics of SARS-CoV-2 replication, identifying crucial genes and proteins that could serve as drug targets, and pinpointing antibodies with potential for therapeutic use. In concert with colleagues in-house, nationally, and globally, important new insights into SARS-CoV-2 emerged from these laboratories.

Image: Zach Veilleux

Published in *Nature*, June 2020

Taming COVID-19 infections

Severe COVID-19 in vulnerable patients has been a critical challenge throughout the pandemic. But Michel C. Nussenzweig's Laboratory of Molecular Immunology offered hope. The team discovered two monoclonal antibodies through sampling the blood plasma of over 250 COVID-19 patients who had recovered from their infections. These antibodies might prevent severe disease in people with early-stage COVID-19. Researchers including Paul Bieniasz, Theodora Hatziioannou, and Charles M. Rice helped characterize the antibodies and moved them closer to use as a treatment through partnerships at Caltech and with Bristol Myers Squibb. Now in human clinical trials, this therapy may prove effective against multiple strains of SARS-CoV-2, and could potentially be delivered by simple injection unlike currently available antibody treatments.

"Thanks to volunteers and many scientists bringing their expertise together, we have two potent antibodies that could prevent or treat COVID-19. While we work toward mass immunity, such treatments will save lives."

Michel C. Nussenzweig
Zanvil A. Cohn and Ralph M. Steinman Professor

“Our evidence suggests that disruption of type I interferon is often the cause of life-threatening COVID-19 pneumonia. This paves the way for prevention and treatment with existing medications and interventions.”

Jean-Laurent Casanova
Levy Family Professor

Published in *Science*, October 2020

Predicting severe COVID-19

In a sense, COVID-19 seemed like a cruel game of chance: Some patients faced life-threatening disease while many escaped with hardly a symptom. However, Jean-Laurent Casanova's St. Giles Laboratory of Human Genetics of Infectious Diseases uncovered some of the rules, finding that the absence of key anti-viral proteins normally made by the body can lead to critical COVID-19 pneumonia. They found that approximately 15 percent of such critical COVID-19 cases involved a deficiency of type I interferon proteins, due either to autoantibodies that neutralize them rather than the virus, or to genetic abnormalities that reduce their production. The findings, a result of the international COVID Human Genetic Effort co-led by Casanova, explain why some people develop very severe disease.

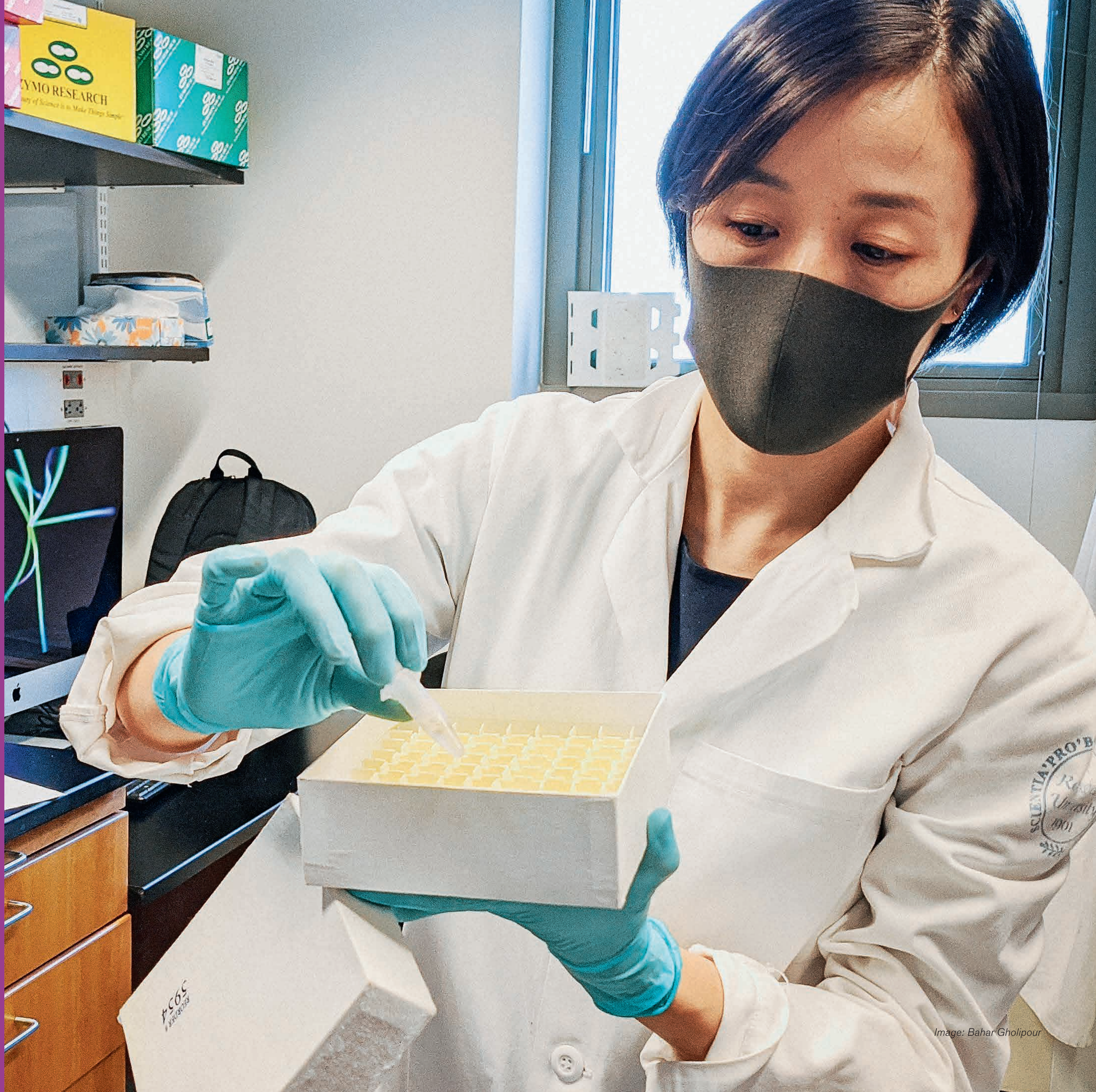
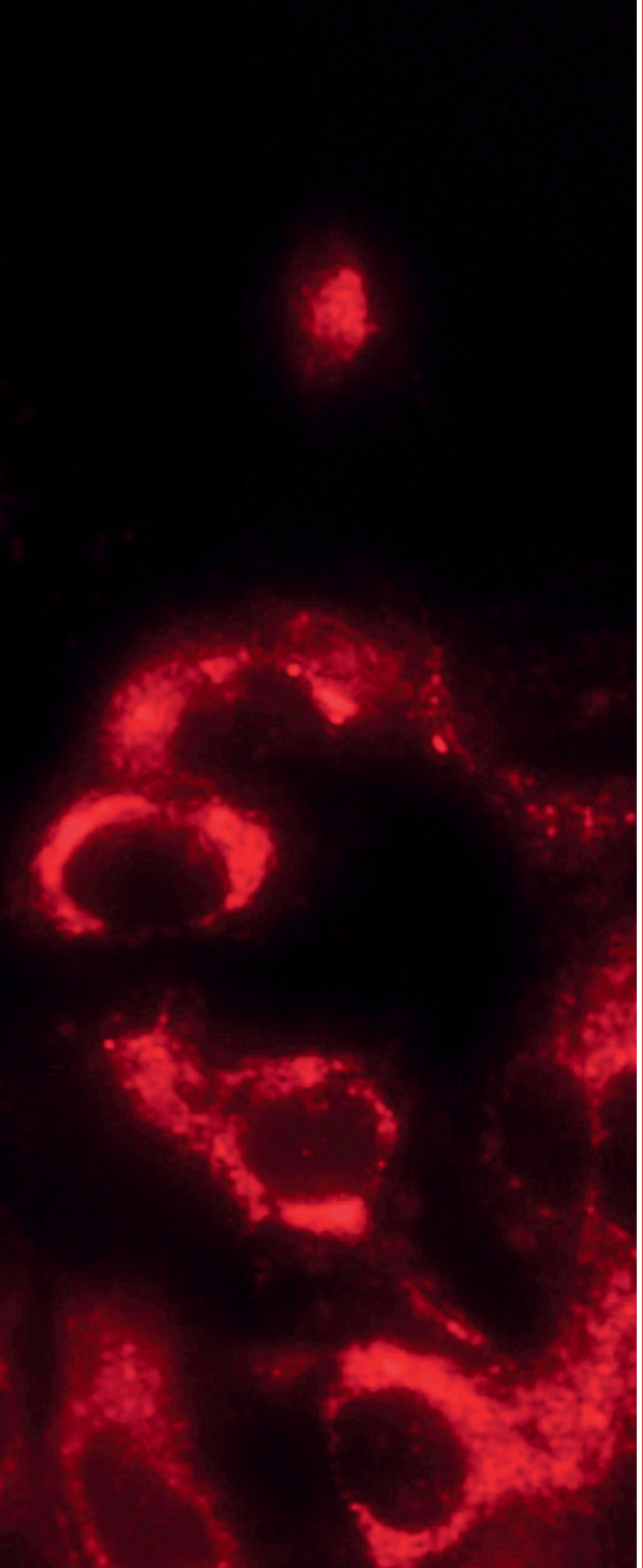


Image: Bahar Gholipour



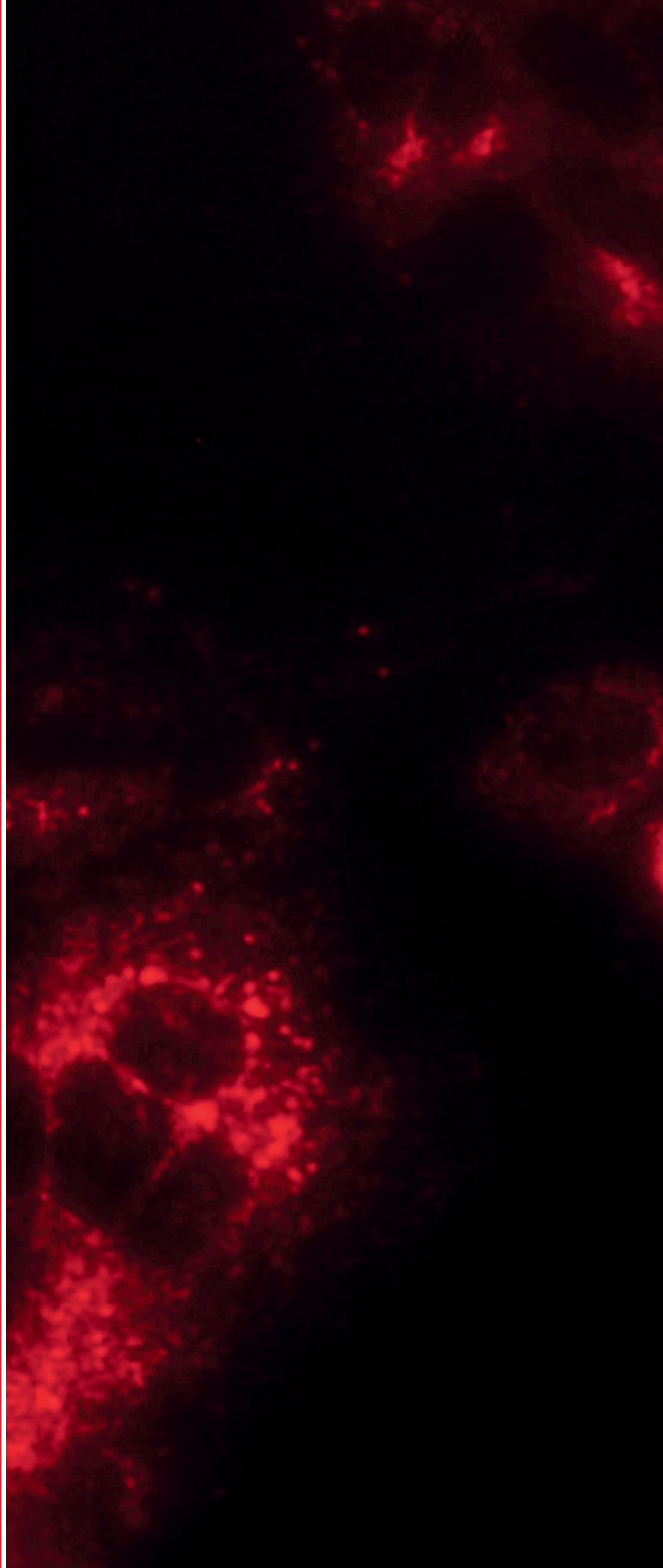
> "The fact that this protein is important to multiple different viruses makes it a promising and high-priority target for drug development efforts."

Charles M. Rice
Maurice R. and Corinne P. Greenberg Professor in Virology

Published in *Cell*, January 2021

The proteins SARS-CoV-2 can't live without

All viruses hijack proteins in the cells of their hosts in order to reproduce. Studies conducted in 2020, co-led by Charles M. Rice, head of the Laboratory of Virology and Infectious Disease, identified over 100 human proteins required by the SARS-CoV-2 virus that causes COVID-19, as well as other coronaviruses that cause the common cold. Using CRISPR-Cas9 technology, the researchers selectively disabled genes in test cells to find out which proteins the SARS-CoV-2 virus couldn't do without. The catalogue of proteins will not only help target new drugs against COVID-19, but also against future coronavirus disease outbreaks. The protein TMEM41B, shown in red in a cluster of infected cells, is particularly interesting—required not just by coronaviruses but also by flaviviruses, which cause yellow fever, West Nile, and Zika.



“We now have new insights into the structural template that could help drug developers find new compounds to interrupt the molecular machinery needed by the virus for replication.”

Elizabeth Campbell
Research Associate Professor,
Laboratory of Molecular Biophysics

Published in *Cell*, September 2020

Mapping the coronavirus, targeting its vulnerabilities

Efforts to stop the SARS-CoV-2 virus from replicating and spreading throughout the body would require precisely targeted drugs that physically interfere with the virus. Seth A. Darst's team in the Laboratory of Molecular Biophysics created an atomically detailed structural map of the machinery used by the virus to reproduce itself. Using cryo-electron microscopy, Darst, Rockefeller's Jack Fishman Professor, and colleague Elizabeth Campbell, with their collaborators Brian T. Chait and Tarun Kapoor, revealed important structural vulnerabilities in the SARS-CoV-2 replication system, giving drug developers a leg up.

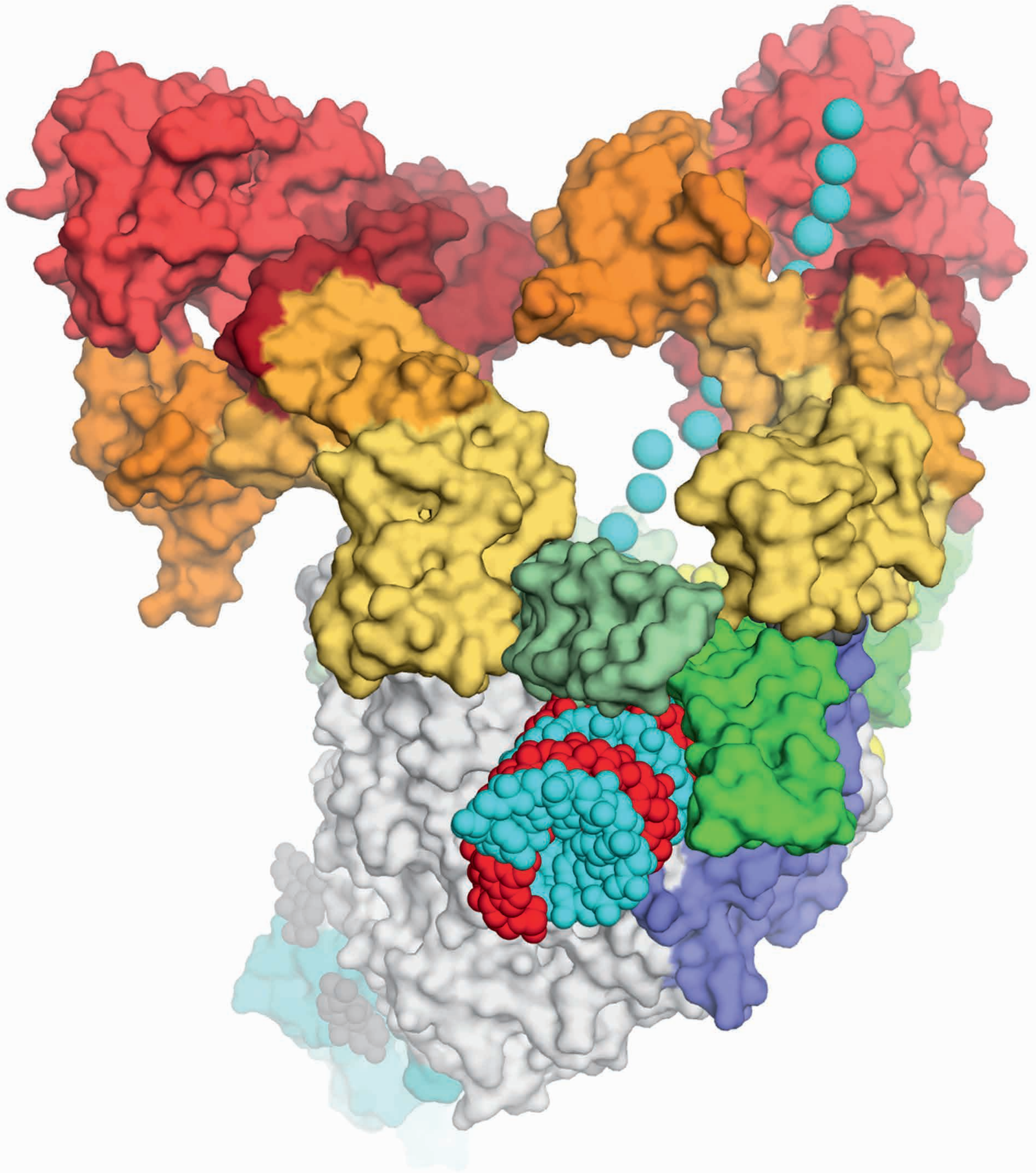


Image: Courtesy of the European Patent Office

> "We're looking for starting points—small molecule compounds that can be made more potent against the virus. This may not be the last pandemic of this kind. Because of research we're doing today, we'll be more prepared for the next one."

Thomas Tuschl
Professor, Laboratory of RNA Molecular Biology

Preventing the next pandemic

Despite vaccines, the search for effective treatments for COVID-19 remains urgent. Rockefeller scientists are uncovering compounds that could be made into antiviral drugs that inhibit the virus's reproduction. Pels Family Professor Tarun Kapoor and his lab, pivoting from cancer to COVID-19 research, are looking for inhibitors against helicase protein NSP13, which prepares viral genes for replication. Meanwhile, Thomas Tuschl, head of the Laboratory of RNA Molecular Biology, and his team have focused on the methylase NSP14, which helps manage and stabilize the virus's genetic information when it reproduces. By screening hundreds of thousands of compounds, Tuschl's team identified drug candidates that have since entered a rapidly progressing medicinal chemistry program to enable cell-based inhibition of viral replication.

OTHER NOTABLE 2020 SCIENCE

“It’s rare to find a single gene with a strong influence on a complex cognitive function like working memory. But it happened to be true in this case.”

Priya Rajasethupathy
Jonathan M. Nelson Family Assistant Professor,
Laboratory of Neural Dynamics and Cognition

Published in *Cell*, September 2020

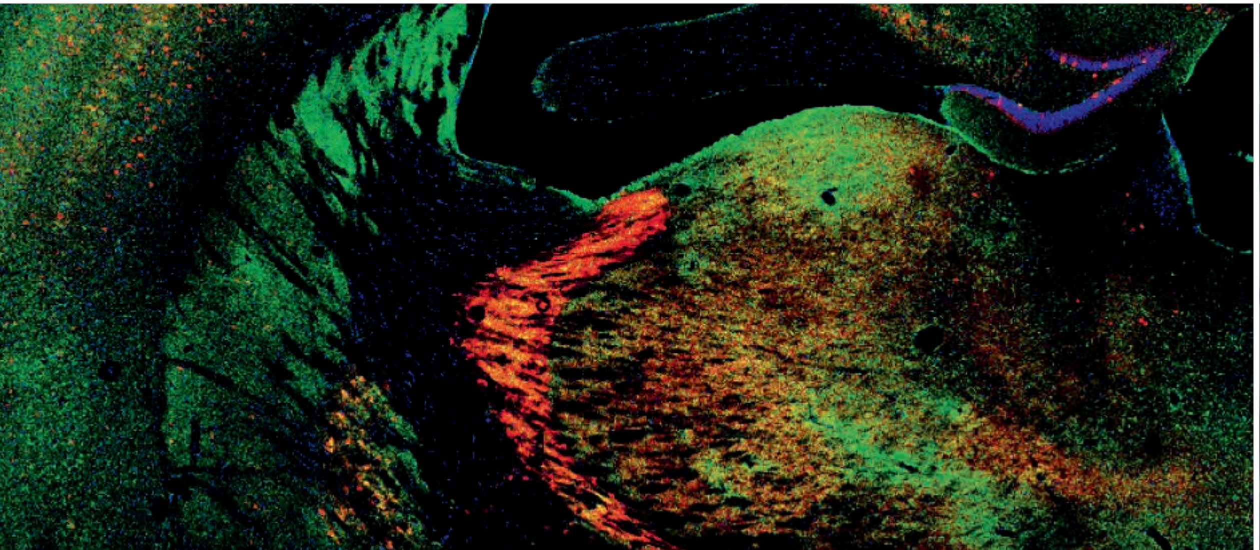
Working memory enhanced by partnership

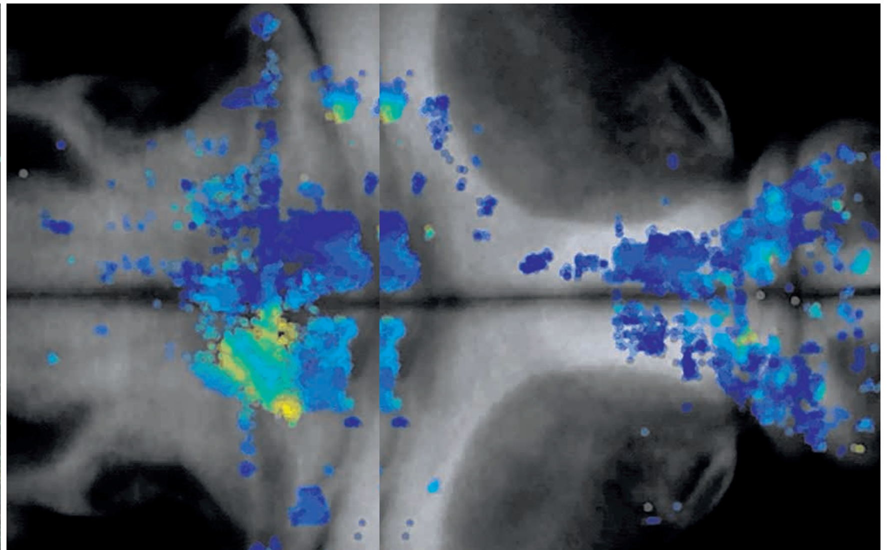
Working memory—the system that briefly holds information in mind so it can be used—requires cooperation from more of our brain than was previously appreciated, according to Priya Rajasethupathy and colleagues. While working memory was believed to reside predominantly in the prefrontal cortex, they found that a signaling receptor in the thalamus, Gpr12, functions to synchronize neural activity between the thalamus and prefrontal cortex to boost working memory.

Published in *Cell Metabolism*, January 2021

New targets for limiting tumor growth

The lab of Kıvanç Birsoy has discovered potential new targets for cancer therapeutics, identifying metabolic genes required for pancreatic cancer growth and spread in a living tumor. They found that the ability to make heme, a compound that helps cells cope with stress, is a limiting factor to tumor growth. Moreover, they demonstrated that tumor cells evade the immune system partly by activating a self-eating mechanism. Drug developers may seek to block these metabolic pathways to fight cancer progression.





Published in *Nature*, September 2020

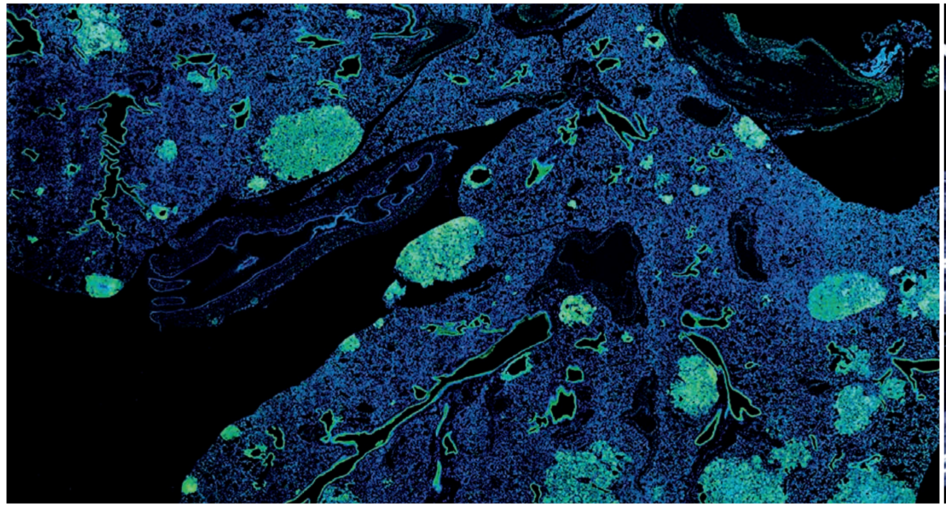
How cancers engineer their escape

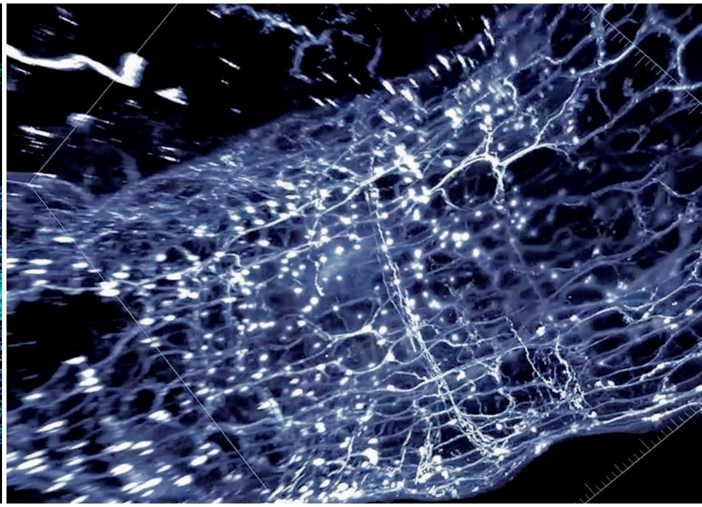
Sohail Tavazoie’s lab uncovered a key mechanism by which cancers metastasize to distant organs. They found that breast and lung tumors force blood vessels to emit a signaling protein that tells cancer cells to travel to new sites. This finding may eventually help researchers diagnose metastatic cancer earlier, or develop drugs to curb metastasis.

Published in *Nature*, July 2020

A bacterial gut check

Gut microbes directly influence the pace at which the intestines transport food, according to Daniel Mucida’s lab. The team found that the presence or absence of bacterially produced compounds caused changes in gut movement by triggering a neural circuit stretching from the gut to the brain and back. This discovery may have applications for treating digestive disorders like irritable bowel syndrome.

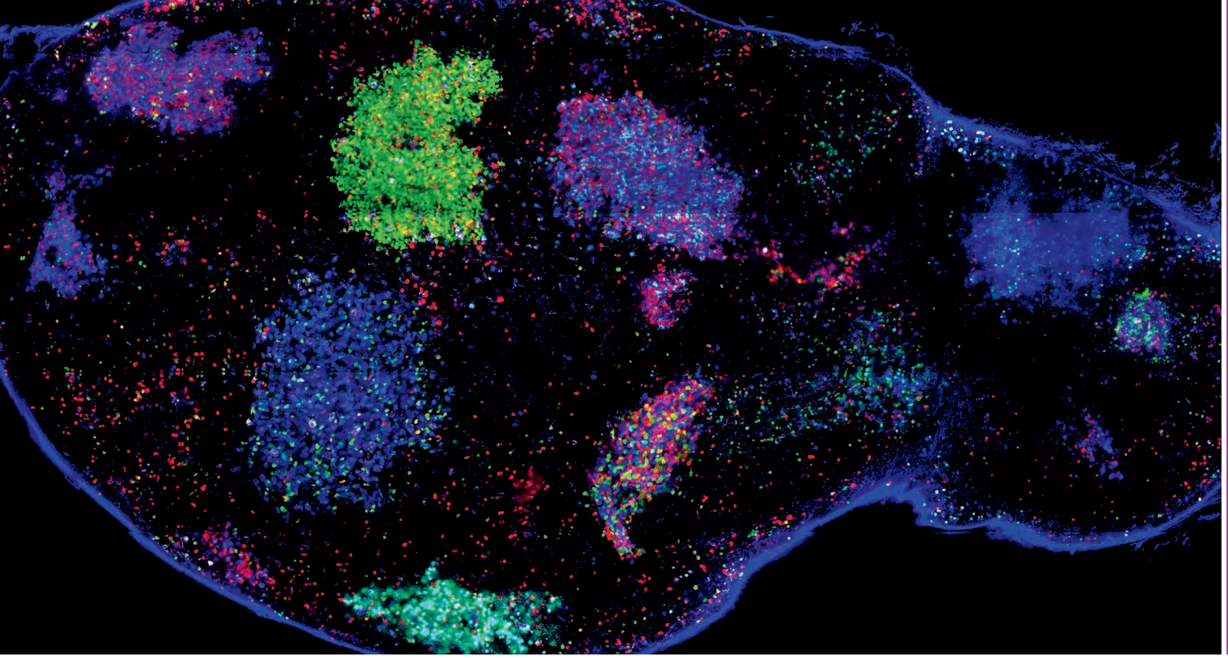




Published in *Cell*, January 2020

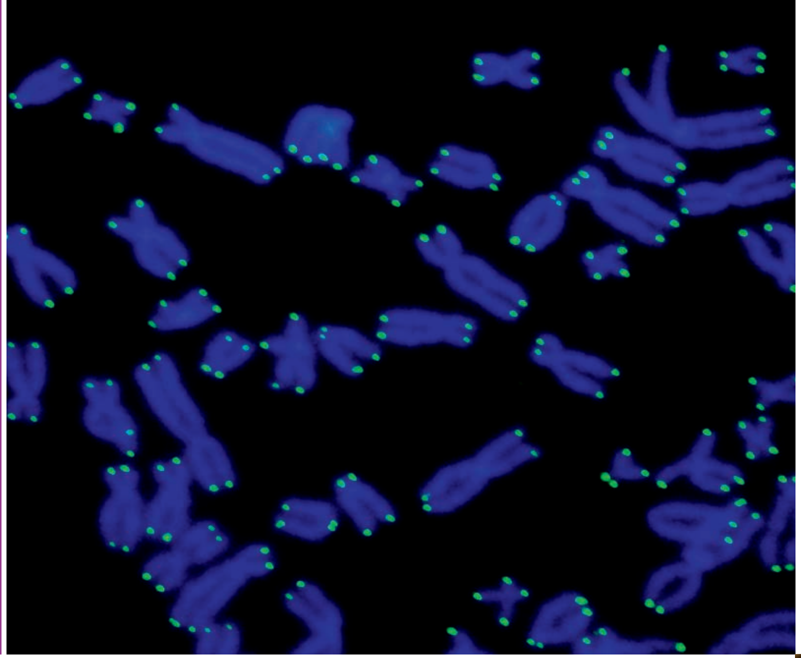
The cerebellum proves decisive

Scientists in Alipasha Vaziri’s lab used their new light field microscopy technique to track the activity of neurons in the entire brain of zebrafish larvae with remarkable precision. Among other discoveries, they found that the cerebellum was a key site predicting the decision-making activity; this brain region might be involved in more cognitive functions than previously thought.



Our Research Impact

The 2020 CWTS Leiden Ranking, an international assessment of research impact, placed Rockefeller in the top spot of a scale that weighs the fraction of an institution's scientific publications that are widely cited by other scientists.



Published in *eLife*, December 2020

The danger of un-pruned telomeres

Researchers in Titia de Lange's lab confirmed that the normal aging process of cells protects against cancer. Telomeres—the tips of chromosomes—shorten over time, preventing the outgrowth of early cancers. The researchers demonstrated that a mutation in the TINF2 gene leads to telomeres that are too long at birth. As a result, early cancers persist, and patients develop multiple malignancies of a variety of cancer types.

Published in *Cell*, January 2020

Elusive universal flu vaccines

Training the immune system to attack many forms of a given pathogen could help fight mutating viruses. But this would require memory B cells to undergo "training" by several stages of evolution within specialized centers in the lymph nodes. Research in Gabriel D. Victora's lab discovered that most B cells don't return to these training centers, even in response to multiple vaccinations. Overcoming this limitation will be key to developing universal vaccines for influenza or HIV.

Published in *eLife*, May 2020

The 1-2-3 of ABC transport

A type of cellular machinery vital to all known forms of life, ABC transporters actively pump important molecules—including therapeutic drugs—into and out of cells. Using structural data and single-molecule fluorescence spectroscopy, scientists in the labs of Jue Chen and Shixin Liu characterized the sequence and speed of chemical reactions and shape changes by which an ABC transporter accomplishes its job.

Published in *Science*, July 2020

A new step in the immunity arms race

Luciano Marraffini and his colleagues discovered a protein that allows a virus to disable a bacterium's immune system with only a single infection. AcrVIA1, an unusually potent inhibitor, prevents the bacterial CRISPR-Cas13 complex from destroying the virus's genetic material. An example of the never-ending arms race between bacteria and viruses, this finding may have applications for CRISPR-based technologies.

"How telomeres are regulated is a fundamental problem, and by working on a fundamental problem, we were eventually able to understand the origins of a human disease."

Titia de Lange
Leon Hess Professor, Laboratory of Cell Biology and Genetics

Published in *Nature*, November 2020

Bringing bird diversity into focus

The evolutionary diversity of birds is now a great deal clearer thanks to research by Erich D. Jarvis and colleagues, who sequenced and compared the genomes of 363 species representing 92 percent of bird families. Their freely available data provide an excellent resource for biodiversity conservation and a higher-resolution view of how species develop unique traits.

Image: NPD stock – stock.adobe.com

Rockefeller recruited two standout junior scientists through an open, international search across all areas of biomedical study

A unique approach to the study of gene expression

Junyue Cao

ASSISTANT PROFESSOR, LABORATORY OF SINGLE-CELL GENOMICS AND POPULATION DYNAMICS

Equipped with identical DNA, cells diversify into tissues and organs—and proceed to do many different jobs—by activating and deactivating different genes. Cao, a molecular biologist, examines how gene expression varies among large populations of individual cells over time, giving focused insights into everything from embryonic development to cancers and aging-related disorders. Cao has developed techniques to study gene expression patterns across big cell populations, and used them to map the symphony of gene activity required to create every major human organ.

Images: Matthew Septimus

Novel chemical probes to explore immune functions

Ekaterina V. Vinogradova

ASSISTANT PROFESSOR, LABORATORY OF CHEMICAL IMMUNOLOGY AND PROTEOMICS

Understanding immune disorders requires understanding how proteins of the immune system function—and how they malfunction in disease. This is no small feat: Proteins are extremely complex, and so are the ways they interact with each other and other molecules. A chemical biologist, Vinogradova has developed chemical proteomic platforms that provide unique functional and structural information about proteins in health and disease—including about changes in their interactions and 3-D structures—allowing her to globally study the role of proteins in immune system malfunction. These chemical platforms are also an important resource for creating new, tailored chemical probes with therapeutic potential.

AWARDS

A Nobel Prize and a Gairdner Award are among the honors bestowed on Rockefeller scientists

Charles M. Rice, the Maurice R. and Corinne P. Greenberg Professor in Virology, became The Rockefeller University's 26th Nobel laureate. He won the 2020 Nobel Prize in Physiology or Medicine along with two other virologists. Their discoveries led to the development of drugs that can cure the vast majority of people infected with hepatitis C, a potentially fatal disease that affects over 70 million people worldwide and can lead to liver scarring or cancer.

Rice's contributions were the result of more than three decades of antiviral research. His Laboratory of Virology and Infectious Disease has also investigated yellow fever, hepatitis B, influenza A, dengue, Zika, chikungunya, and coronaviruses. In response to the COVID-19 pandemic, Rice used CRISPR technology to identify novel therapeutic targets for SARS-CoV-2 and other coronaviruses. He also translated techniques developed in his hepatitis C work to screen candidate drugs for the ability to inhibit coronaviruses.

Image: Katherine Fenz

Complying with pandemic safety guidelines, Elaine Fuchs receives her Gairdner Award on campus from President Richard P. Lifton, rather than at the customary dinner and ceremony. A photographer readies the outdoor shot along the East River.

Also in 2020, **Elaine Fuchs** received a Canada Gairdner International Award for revealing the molecular mechanisms by which skin stem cells make and repair tissues. Fuchs is the Rebecca C. Lancefield Professor and head of the Robin Chemers Neustein Laboratory of Mammalian Cell Biology and Development.

A pioneer in the use of reverse genetics, Fuchs's studies have shed light on the biology of all types of stem cells, and the processes by which they lose pluripotency as an organism develops and ages. Her work has implications for understanding and treating human disease, including through the development of regenerative medicine. Most recently, she has explored how mechanical forces nudge tumors toward malignancy, identified proteins critical for maintaining stem cells that make hair, and elucidated a mechanism that allows skin cells to sense changes in their environment and quickly respond to reinforce the skin's outermost layer.

2020 Major Award Winners

KIVANÇ BIRSOY
VILCEK PRIZE FOR CREATIVE PROMISE

JEAN-LAURENT CASANOVA
LEGION D'HONNEUR

ELAINE FUCHS
CANADA GAIRDNER INTERNATIONAL AWARD

A. JAMES HUDSPETH
LOUISA GROSS HORWITZ PRIZE

LUCIANO MARRAFFINI
MAX PLANCK-HUMBOLDT MEDAL

CHARLES M. RICE
NOBEL PRIZE

JEREMY M. ROCK
RITA ALLEN FOUNDATION SCHOLAR

AMY E. SHYER
SEARLE SCHOLAR

LESLIE B. VOSSHALL
PRADEL RESEARCH AWARD

Image: Jeff Hennefeld

Rice took questions from reporters during a virtual press conference hosted by the university on October 5, a few hours after news broke about his Nobel Prize.

A community leads with innovation and care

Over the course of this year, the entire Rockefeller community rose to meet many challenges with ingenuity, dedication, and generosity toward each other. Through myriad acts large and small, the university was able safely to move biomedical science forward in ways that had immediate benefits and will also lead to further progress over time.

Robert B. Darnell and his team developed a simple, highly sensitive saliva test for the SARS-CoV-2 virus suitable for both adults and children and enabled city approval to open the university daycare facility. Weekly testing of all who came to campus kept the community safe, confident—and able to focus on crucial research problems.

To assist parents of K-8 children with the challenge of balancing the demands of work with the realities of virtual schooling, Rockefeller's Human Resources department collaborated with the YMCA to create small, supervised learning pods on campus.

Staff manufactured face shields via 3-D printing in the "PIT"—the Precision Instrumentation Technologies facility. Rockefeller donated face shields to nursing homes and extra gloves from our labs to local hospitals.

Laboratory Safety provided N95 respirators to employees commuting by public transit, along with sterilization boxes to enable their safe reuse.

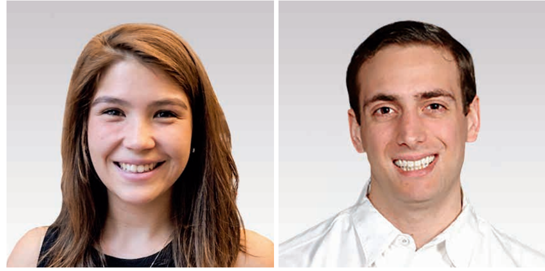
Many of the essential personnel in Security, Plant Operations, Housing, Laboratory Safety, Purchasing, Facilities, and the Comparative Biosciences Center lived on campus during times of peak infection rates to keep the university secure and operational.

A weekly president's letter served as a signature communication during the pandemic, keeping the community updated and connected.

Image: Matthew Septimus








President Richard P. Lifton conferred Ph.D. degrees on the 30 graduate students of the class of 2020 during Rockefeller's 62nd Convocation, held virtually on June 11. In keeping with tradition, each student was presented by his or her mentor, and congratulatory messages filled the screen at the program's conclusion.



Lifton also presented the David Rockefeller Award for Extraordinary Service to Alzatta Fogg and Torsten N. Wiesel, and granted honorary degrees to trustee emerita Marnie S. Pillsbury and developmental biologist Lucy Shapiro. (awardees/honorees not pictured)


Row 1: Sarah Ackerman, Sarah Kathleen Baker, Mariel Bartley, Kate Bredbenner, Ian Andrew Eckardt Butler, Daniel Alberto Cabrera; Row 2: James Chen, Brooke Conti Trousdale, Amelia Dunn, Nicholas Hernandez; Row 3: Alexis Jaramillo Cartagena, Nathaniel Kastan, Mariya B. London, Emily M. Lorenzen, Paul Andrew Muller; Row 4: Lisa Brooke Noble, Philip Mojsov Nussenzweig, Sean O'Connor, Benjamin Ostendorf; Row 5: Luca Parolari, Rudolf Piša, Cristina Santarossa, Stephanie Lena Sarbanes, Aylesse Sordillo; Row 6: Leonid Alexeevich Timashev, Waring "Buck" Trible, Zikun Wang, Daniel Neil Weinberg, Anna Yoney, and Aryeh Zolin.

Adapting education for a remote world

With support from the Dean's Office, 23 new graduate students from nine countries arrived at Rockefeller in the fall after navigating rapidly changing pandemic-related constraints. Another five students from China also matriculated remotely, due to travel restrictions and consular closures.

Online classes, virtual office hours, and a new peer-mentoring program—conceived of by and for graduate students—helped new arrivals bridge some of the pandemic's hurdles. Rockefeller offered a hybrid of virtual and in-person classes, which took place in larger lecture halls where social distancing could be observed.

Continuing to connect with schools

Rockefeller's outreach team, RockEDU, continued to fulfill their educational mission, with faculty, staff, and students flexing to adopt new modes of learning. The Summer Science Research Program was reinvented to give high school students a powerful sense of their own agency as scientists. This pandemic-year class received materials by mail for research tracks that included RNA bioinformatics, ant social biology, and the cultivation of wild yeast. They documented and analyzed their projects online, while taking part in research projects away from the screen in their own rooms and at kitchen tables.

The majority of RockEDU programming continued throughout 2020, including the LAB Jumpstart program for students from under-resourced schools and communities; LAB Backstage brought virtual tours to middle and high school student groups. The winter *Talking Science* lecture expanded to become a five-part virtual event.

FUNDRAISING

In 2020, more than $28 million was raised for COVID-19 research

Rockefeller is in the unique position of uniting top scientific research talent with passionate supporters who believe in the power of science to improve life. When faced with COVID-19, Rockefeller scientists put their minds to the urgent questions, and the university's trustees and donors were right with them, responding with the necessary resources.

"Rockefeller University's scientists are world leaders in biomedicine with a track record for doing work that can transform human health, so when the pandemic arose there was no question. The university undertook all that was necessary to battle COVID-19, including providing childcare and a learning center for scientists and their families so work in the lab could continue around the clock.

Give to Rockefeller and they will get it done."

Joelle Kayden
Managing Member, Accolade Partners

Sharing knowledge in real time

A robust calendar of virtual events featuring faculty working on COVID-19 was organized to maintain communication with Rockefeller supporters, scientists, and the public. The Virtual Discussions with Genuine Experts webinars reached attendees in the United States and 22 other countries. Shared widely on social media, the webinar recordings have been viewed by more than 25,000 people.

Antibodies Against COVID-19: The Path to Effective Treatments and a Vaccine

Why Are Some Young and Previously Healthy People Very Sick? The Role of Human Genes in COVID-19

Antibody Therapeutics and Pathways to Prevention

The Race to Control COVID-19: Innovative Strategies to Develop New Drugs

Fighting COVID-19 with Convalescent Plasma, Potent Antibodies, and an Understanding of Immunity to SARS-CoV-2

COVID-19: Where are We Now and Where are We Headed?

Racing to Beat COVID-19: The Oxford Vaccine and Other Tales from the UK

Breaking News on COVID-19: Global Research Pinpoints the Causes of Many Severe Cases

Fighting COVID-19 with Antibody Therapy

Images: Matthew Septimus; Mario Morgado

"The moment that our Rockefeller laboratories shifted their focus to a broad attack on COVID-19, the university's trustees and benefactors responded with immediate and exceptionally generous support.

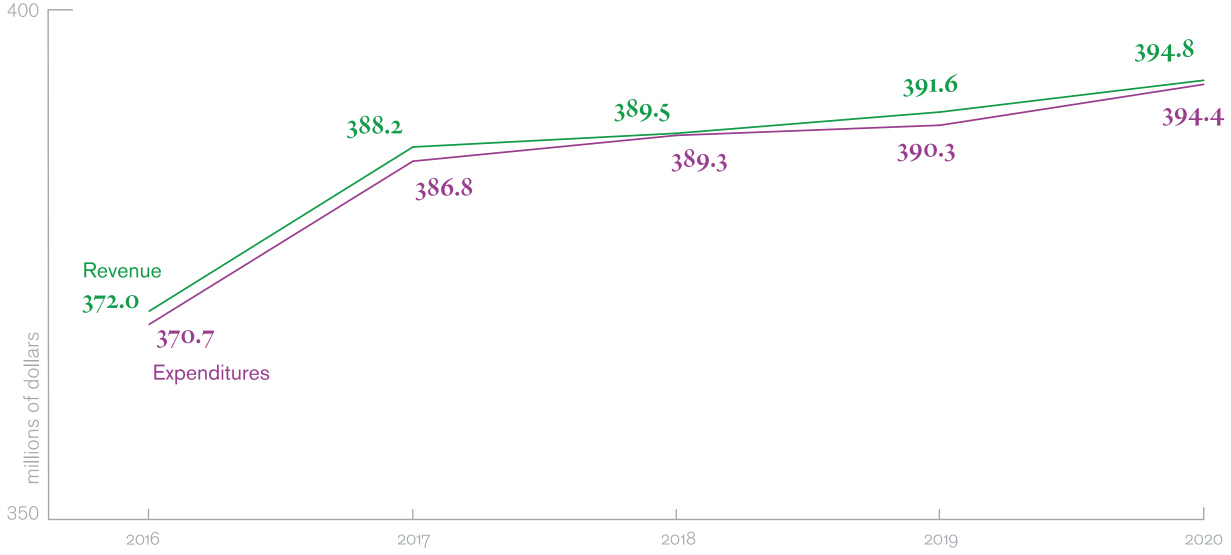
They have been with us every step of the way, helping to provide the tools needed for us to understand and eradicate the virus and prepare for and prevent future pandemics."

Richard P. Lifton
President and Carson Family Professor, The Rockefeller University

Operating revenue and expenditures, fiscal year 2020

The university ended fiscal year 2020 with a modest $400,000 surplus, which will be directed to a reserve account dedicated to future capital projects. Strong performance of the endowment and exceptional fundraising and royalty income offset slight declines in government and private grants. Facility expenditures and debt service increased modestly from fiscal year 2018 as a result of the campus expansion. Research and education expenses accounted for 61.6 percent of operating expenditures.

Operating revenue and expenditures, five-year trend



Operating revenue

$394.8 million

$86.8 million (22 percent)
Government grants and contracts

$48.9 million (12.4 percent)
Private grants and contracts

$81.1 million (20.6 percent)
Development gifts

$106.9 million (27.1 percent)
Endowment income

$36.3 million (9.1 percent)
Auxiliaries (including food service, housing, RUP)

$24.9 million (6.3 percent)
Royalty net income

$9.9 million (2.5 percent)
Other

Operating expenditures

$394.4 million

$241.8 million (61.3 percent)
Research and education

- Laboratory operations: $191.5 million (79.2 percent)
- Hospital: $13.6 million (5.6 percent)
- Educational programs: $12.4 million (5.1 percent)
- Shared resource centers: $23.8 million (9.8 percent)
- Archive Center: $0.5 million (0.3 percent)

$38.3 million (9.7 percent)
Facilities operations

$38.9 million (9.9 percent)
Central administration

$28.2 million (7.2 percent)
Auxiliaries (including food service, housing, RUP)

$37.2 million (9.4 percent)
Debt service

$10.0 million (2.5 percent)
Deferred maintenance

Endowment performance, fiscal year 2020

The assets in the endowment were valued at $2,317 million at the close of the 2020 fiscal year. The $106.9 million draw from the endowment represented 27.1 percent of the university's 2020 budget and remains a critical and stable source of research support.

The endowment generated a 10.7 percent return for the fiscal year that ended June 30, 2020, which is in the top decile of performance for endowments with over $1 billion in assets, as ranked by Cambridge Associates. Rockefeller's disciplined asset allocation and careful manager selection has resulted in top decile performance for the university on a one-, three-, five-, and ten-year basis. In 2020, performance was driven by successful investments in venture capital, disciplined rebalancing during the turbulent spring, and significant outperformance by the university's managers, particularly in equity markets.

The endowment represents the cumulative generosity of generations of steadfast patrons of transformational science. The Investments Office invests these assets with the goal of maximizing returns within an acceptable level of risk.

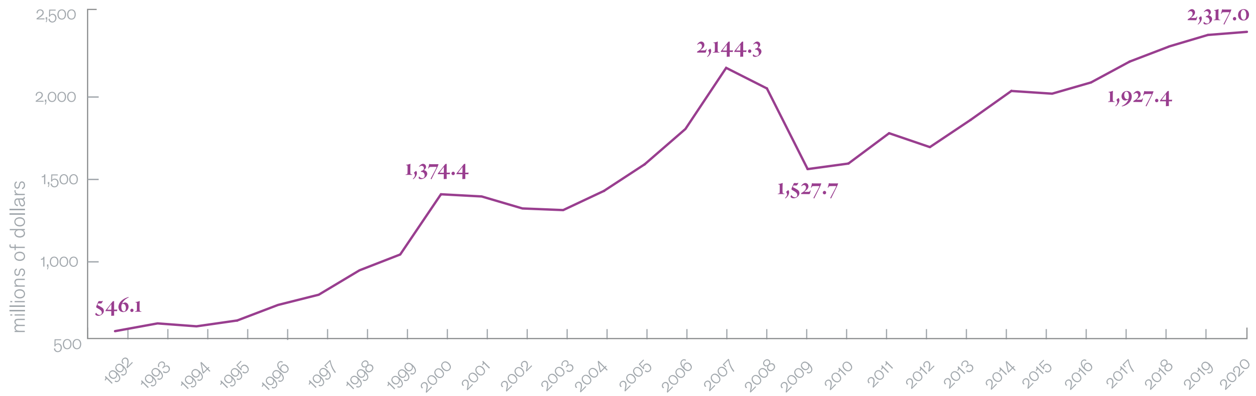
Image: Mario Morgado

Endowment highlights

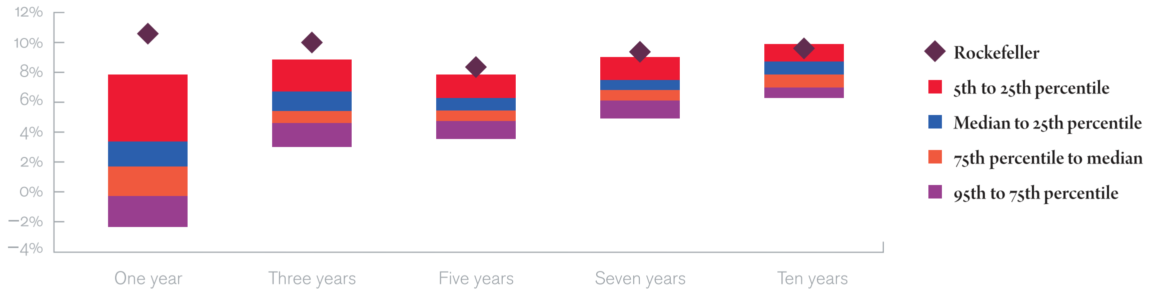
Fiscal year*	2016	2017	2018	2019	2020
Market value (millions)	$1,927.4	$2,089.4	$2,204.2	$2,293.2	$2,317.0
Return	–0.8%	13.3%	11.3%	8.5%	10.7%
Spending (millions)	$97.9	$99.8	$100.5	$103.4	$106.9
Operating budget revenue (millions)	$372.0	$388.2	$389.5	$391.6	$394.8
Endowment percentage	26.3%	25.7%	25.8%	26.4%	27.1%

*July 1 through June 30

Endowment value by fiscal year



Endowment performance compared to peer institutions

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