

IMPACT REPORT

Advancing genome research for a better world

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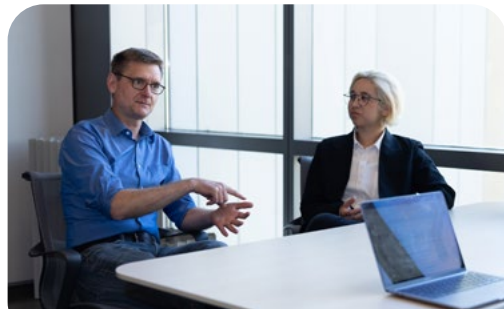
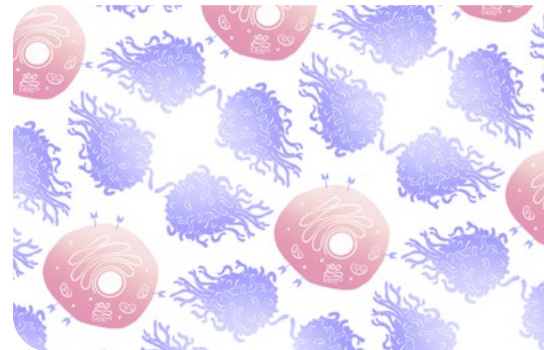
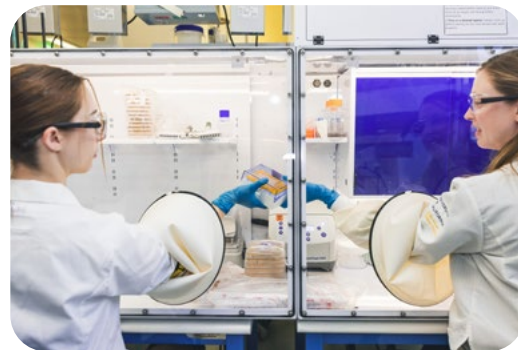
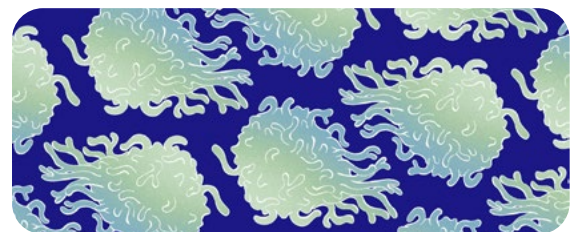




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Illustration by Maya Peters-Kostman

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Letter From the Executive Director

There has been an interesting pattern in recent Nobel Prizes. In 2020, IGI founder Jennifer Doudna shared the Nobel Prize in Chemistry with Emmanuelle Charpentier for their development of CRISPR genome editing. In 2023, the Nobel Prize in Medicine went to Katalin Karikó and Drew Weissman for their development of mRNA vaccines. Earlier this year, Demis Hassabis and John Jumper of Google DeepMind won the Nobel Prize in Chemistry for their development of the revolutionary AI protein structure prediction tool, AlphaFold2, sharing their prize with David Baker who developed breakthrough methods in protein design.

DNA gets copied into RNA, which is used as a template to make proteins — this is the “central dogma of biology” that every student learns in school. All of these recent Nobel-winning breakthroughs center around our growing ability to precisely control and engineer each step: editing DNA, using bespoke mRNA as a tool, building novel proteins with custom functions, and now AI has entered the picture as a force multiplier for all of these.

AI has also entered the laboratory, and rapidly. In a recent interview with *The Economist*, Jennifer described three key features of the laboratory of the future: experimental space for doing laboratory work, dry lab space for doing computational work, and robotics for automating wet lab work that will generate experimental data at the scale and quality needed for AI and machine learning. That future is becoming the present at the IGI, and we are actively bringing AI and robotics into our projects from early discovery work to the development of real-world applications in health, agriculture, and climate change.

When I joined the IGI in 2020 and kicked off a series of new climate change projects thanks to philanthropic support, genomic approaches were very much outside the mainstream climate change conversations. By 2024, the conversation had changed. This year at Climate Week in New York City, genomic approaches were part of the core discussion, and there was a strong focus on the unsolved problems in agriculture where CRISPR and other genomic tools can play an important role. *The Washington Post* wrote a feature story on our work to eliminate methane emissions from cows. IGI leaders also published an article in the *Bulletin of the Atomic Scientists* urging action now to use biotechnology to ensure global food security in the face of a rapidly changing climate and reduce agricultural greenhouse gas emissions.

The work represented in this report was only possible thanks to the passion and energy of the IGI community of scientists and staff and the generous funders who have partnered with the IGI and are critical to our continued growth. Entering 2025, which will mark the 10th anniversary of the IGI, I can see now that it will be a year of synthesis. Multiple fields — multiple revolutionary technologies — are coming together in new and exciting ways, and we’re poised and ready to use them all to help us solve some of the most pressing problems facing society today.



Brad Ringeisen
Executive Director, Innovative Genomics Institute



AI Meets CRISPR

AI was the technology story of 2024 and its impact on science has been undeniable. The IGI, as one of the leading centers for genome editing around the world, is at the forefront of combining these Nobel Prize-winning technologies, CRISPR and AI, and applying them to challenges in medicine, agriculture, and climate change.

// The potential to appropriately harness the joint power of AI and CRISPR, arguably the two most profound technologies of our time, is clear and exciting — and it's already started.

— Jennifer Doudna. Read more in *WIRED* →



Nobel Laureate panel at the 2024 Google for AI Science Forum featuring Jennifer Doudna with Demis Hassabis, John Jumper, and Paul Nurse.

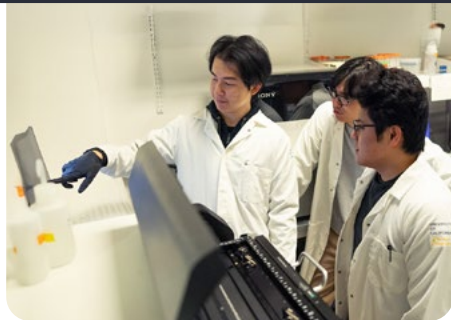
The IGI's location allows us to work collaboratively with UC Berkeley's new College of Computing, Data Science, and Society, researchers at Lawrence Berkeley Lab, as well as leading Silicon Valley companies to combine the latest in CRISPR innovation with cutting-edge AI and machine learning to accelerate the real-world impact of genome editing.

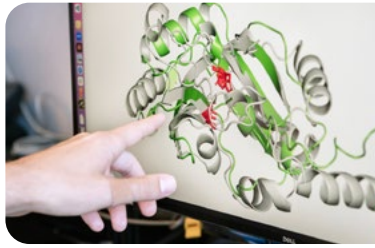
Key Opportunities for CRISPR + AI

1. Accelerating and Improving CRISPR Applications
2. Revolutionizing Protein and RNA Engineering
3. Empowering Discovery and Expanding Impact



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AI-Empowered Research at the IGI

1. New AI Tool Can Predict & Improve RNA Function

A team led by IGI Investigator Jamie Cate developed a language model that predicts how mutations in RNA sequence affect the function of ribosomes, which cells use to make proteins. This can expand the possibilities for engineering custom medicines, polymers, and more.

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2. Understanding How Viruses Invade Cells

Researchers in the Doudna Lab at the IGI and Gladstone Institutes used AI tools to predict the three-dimensional shapes of nearly 70,000 viral proteins. This led to the discovery of a previously unknown way that viruses evade immune systems.

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3. Discovering Hidden Genome Editors

A team in the Doudna Lab at the IGI used an AI tool in combination with an older computational tool to discover smaller genome editing proteins unnoticed within structural databases – neither tool by itself would have been able to perform the analysis.

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The Li Ka Shing Center for Translational Genomics

IGI's Li Ka Shing Center for Translational Genomics (CTG) is a first-of-its-kind innovation hub for the development of targeted genome-editing treatments for unaddressed genetic diseases. The CTG team is creating a platform to accelerate the discovery of new genomic therapies, focusing on underfunded research areas and unmet needs with the overarching goal of curing hundreds of rare and neglected diseases while dramatically improving affordability and accessibility.

As AI becomes more important in the discovery and development of genomic therapies, automation and robotics are essential to generate data at the scale and quality needed for AI and machine learning.

Research Spotlight: Bringing Robotics to CRISPR

Hanqin Li, PI of the laboratory for Advanced Translational Genetics, manages a unique robotic tissue culture system, ATTIS, that enables scaled genome-editing projects with an output up to 50x greater than can be achieved manually. ATTIS is operated by a team of expert molecular biologists and automation engineers, and Li and the ATTIS team are focused on research and development of novel models for rare disease, cancer, and neurodegenerative diseases.

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Human
Health

CRISPR for Human Health

2024 was a remarkable year for CRISPR in medicine. Just over 10 years after IGI founder Jennifer Doudna and colleagues first described CRISPR genome editing, patients are now receiving the first CRISPR-based therapies for sickle cell disease and beta thalassemia, and more CRISPR therapies for other diseases are entering clinical trials. See IGI's annual summary of **CRISPR clinical trials** →

At the IGI, our research teams are discovering new therapeutic targets in the genome, improving genome-editing proteins, and designing platform approaches to help accelerate the development and lower the cost of CRISPR therapies.

CRISPR: Delivered

Over 2024, a series of new developments at the IGI focused on a critical area for CRISPR in medicine: delivery. For genome-editing therapies to be safe and effective, they need to be delivered precisely to the targeted cells and tissues, and they need to be able to efficiently enter these cells to do their work.

Special Packaging

A new technology developed at the IGI called “enveloped delivery vehicles” uses tricks learned from viruses to precisely target specific cells in the body.

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Destination Brain

IGI researchers are developing self-delivering CRISPR molecules small enough to be used to target tissues in the brain for treating neurological diseases.

[Read More](#) →

Spare the Messenger

A new type of lipid nanoparticle developed in the Murthy lab helps deliver gene editors into a cell, but not get destroyed by the cell's mechanisms.

[Read More](#) →

Microbiome Editing

As part of the \$70 million gift through the TED Audacious Project to use microbiome editing to solve real-world problems, IGI investigators have been focusing on ways to **prevent the development of childhood asthma**. In 2024, the team successfully isolated and cultured key species known for producing an asthma-inducing inflammatory compound, and has been working to identify new genome-editing targets.

[Learn about the science of precision microbiome editing](#) →





Bringing CRISPR Cures to the World

The momentum behind the development of CRISPR cures is strong, but there are also many remaining challenges. How do we accelerate the pace of development of therapies for the roughly 7,000 known genetic diseases caused by mutations in single genes? How do we provide them to patients safely and affordably? The IGI's mission goes beyond just developing the CRISPR technology: we also are determined to develop viable paths from the lab bench to the doctor's office.

A Platform for Success

One possibility for treating neglected rare diseases: developing platform approaches so that clinical trials don't need to start from square one every time.

How Platform Therapies Could Work

New FDA guidance for platform therapies outlines how these could revolutionize the development of genomic medicines for patients with rare diseases.

[Read More](#) →

Building a Roadmap

The Beacon for CRISPR Cures, a collaboration between the IGI and Danaher Corporation, aims to create a roadmap for rapidly developing genome-editing therapies.

[Read More](#) →

CRISPR in Your Doctor's Office

When a patient presents with a rare genetic disease, what can a doctor do in practice? This question is being addressed by the IGI's Interventional Genomics Unit (IGU), which is creating the tools, data hubs, and workflows needed to incorporate interventional genomics into everyday clinical practice.

The IGU launched a research study called INGENUITI to establish how to create a standardized genomics assessment and share data from rare-disease patients across the globe to enable the development of CRISPR therapies for rare-disease patients.

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CRISPR for Climate & Sustainable Agriculture



Fighting climate change requires every tool available. The IGI is a world leader in applying CRISPR and genomics to the climate problem.



The IGI Climate & Sustainable Agriculture program is using our collective expertise in genomics to approach climate change in three key ways:

Reducing agricultural emissions to sustainably feed a growing population

Removing carbon from the atmosphere using plants and soils

Empowering farmers to adapt to a changing climate while maintaining yields and preferred varieties

CRISPR vs. Cow Burps

Nearly 15% of all greenhouse gas emissions worldwide come from livestock production. But the methane produced by livestock doesn't come directly from the animal — it comes from its gut microbiome.

Supported by the TED Audacious Project gift (see the Health section), IGI investigators at UC Davis and UC Berkeley are developing a one-time treatment that targets microbial genes to reduce the methane emissions from livestock for a lifetime.

Learn more in our video "The Cow Burp Problem" [→](#)

Editing Plants Made Easier

A new breakthrough by IGI Investigator Patrick Shih and collaborators makes it possible to edit more plants and fungi than ever before, and dramatically improves the efficiency of transforming plants overall.

Read More [→](#)

CRISPR in Agriculture Makes Strides

Avocados that stay green. Seedless blackberries. Disease-resistant pigs. Fish with more fish per fish. More and more CRISPR-edited products are heading to the farm — and the supermarket. Catch up on the latest in our review of CRISPR in Agriculture.

Read More [→](#)



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Inside IGI Climate 2024

In October, we held our second annual Inside IGI event. This conference brings together the IGI community to highlight the latest ways IGI researchers are using genome engineering to solve humanity's greatest problems and encourage the cross-fertilization and the culture of collaboration that makes IGI unique. Over 300 IGI members attended, and special guest speakers included USDA Chief Scientist Chavonda Jacobs-Young and California Natural Resources Secretary Wade Crowfoot.

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IGI Investigator Venkatesan Sundaresan Wins 2024 Wolf Prize in Agriculture

Considered by many the Nobel Prize for agriculture, the Wolf Foundation selected Sundaresan for his groundbreaking molecular research on plant reproduction, which led to a method for producing clonal seeds from hybrid plants.

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Innovative Genomics Institute

Entrepreneurship

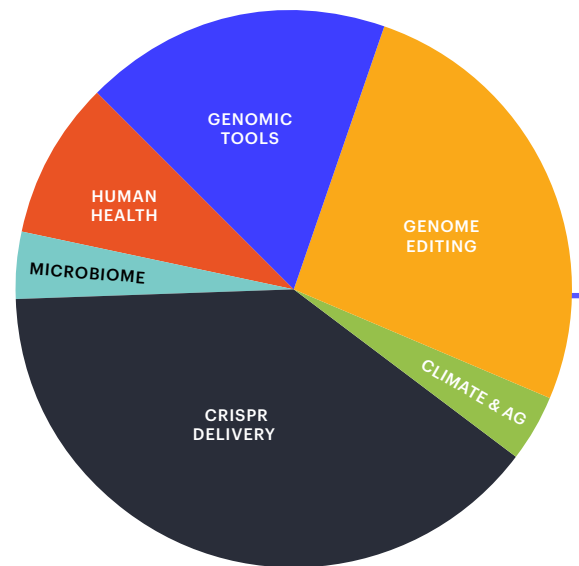
Innovation is key for the IGI, but impact is the ultimate goal. Commercialization can be one of the most direct routes to making a real-world impact with a new technology or application. In addition to licensing technologies that are developed in-house, IGI researchers have gone on to start important new companies in a range of fields, from CRISPR therapies to next-generation agricultural products.

Supporting Women in Biotech

Women have made significant gains in STEM degrees in college in recent years, but gender inequity remains a huge problem in the biotech industry, particularly in leadership positions. The HS Chau Women in Enterprising Science (WIES) Program at the IGI is helping to change the game by supporting budding entrepreneurs who are committed to addressing gender inequity in the field.

Over the first two years of the program, fellows launched 6 new companies. In 2024, two WIES Fellows, Derfogail Delcassian and Yue Clare Lou (pictured above), were selected to receive \$1 million in non-dilutive funding to support their entrepreneurial pursuits. Delcassian is working on vaccine-based approaches for hard-to-treat cancers like melanoma and pancreatic cancer. Lou is using AI to mine the microbiome for immune-modulating molecules to treat conditions ranging from autoimmunity to cancer.

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IGI 2024 invention disclosures by category



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26 New companies founded by IGI associates



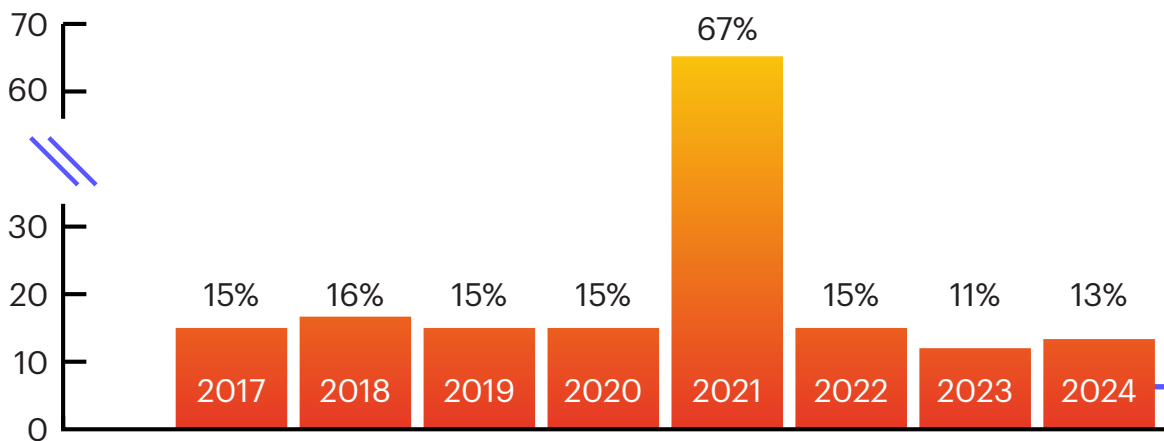
\$4.9B Raised
\$8.8B net worth



IGI Drives Innovation & Entrepreneurship

UC Berkeley is the number one public university in the world for generating startup founders, and the IGI is a key part of that success, helping to train entrepreneurs in the biotechnology sector.

The IGI is also responsible for a significant percentage of the patent applications at UC Berkeley every year, with a growing portfolio of innovations in medicine, sustainable agriculture, climate technology, biomanufacturing, and life science research tools.



Percentage of total invention disclosures for UC Berkeley by fiscal year ending in July of the listed year.



2500+ Employees at these companies

Fields: Therapeutics, Diagnostics, Delivery, Agriculture Traits, Gene Editing Tools, Agricultural Waste, Gene Regulation, Cell Therapy, Biomanufacturing



Public Impact

Science should serve the public good. True impact requires incorporating societal, ethical, and environmental considerations into our scientific research — and not as an afterthought. Every IGI project includes public impact planning from the very beginning.

Tackling the Affordability Crisis

New CRISPR-based therapies are estimated to cost \$1–3 million per patient, which leaves them inaccessible to many of the people who could benefit. IGI’s Public Impact team charted a new way forward, producing a new model that could cut current prices by a factor of 10, described in a paper in *Nature*.

[Read More](#) →

Guiding Gene-Editing Regulation

The IGI is a leading voice on genome-editing policy in health and agriculture. In 2024, the IGI Public Impact team worked with regulators and policymakers at the FDA, USDA, NIH, and other agencies on topics including biotechnology regulations, manufacturing standards, AI, and addressing rare diseases with genomic therapies.

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Training Global Scientists & Regulators

To fulfill the broader mission of the institute, IGI researchers and staff work internationally to train scientists to use genome editing to address local problems and to educate regulators on the technology, applications, and the global regulatory landscape.

Kenya

Each year, IGI researchers travel to Nairobi, Kenya to teach scientists from across Africa to use CRISPR to adapt crop plants to local needs.

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India

On invitation by the Indian Department of Biotechnology, a team of IGI scientists conducted a CRISPR training for 32 PhD candidates in New Delhi in 2024 and are returning for a larger training with early-career scientists and graduate students in 2025.

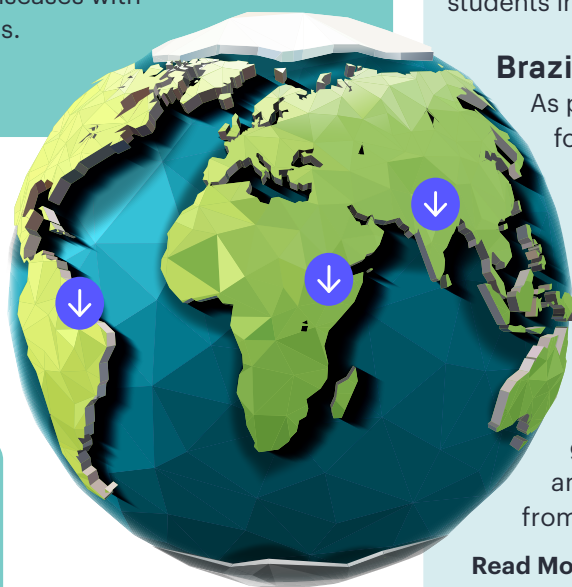
Brazil

As part of a partnership with the D’Or Institute for Research and Education (IDOR) in Brazil, IGI Investigators are hosting three Brazilian postdocs who are working on IGI projects related to sickle cell disease, irritable bowel, and neurodegenerative diseases.

And across the globe

In 2024, IGI’s Public Impact team held a workshop on building regulatory capacity for genome-editing in agriculture, with classroom and lab sessions for regulators from 18 countries from across Asia, Africa, Europe, and the Americas.

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Outreach & Education

At the IGI, we strive to create a STEM future that is more diverse, welcoming, and inclusive. Our education and outreach work is aimed at supporting a more diverse pipeline of STEM students and researchers, with efforts from local to global in scope.



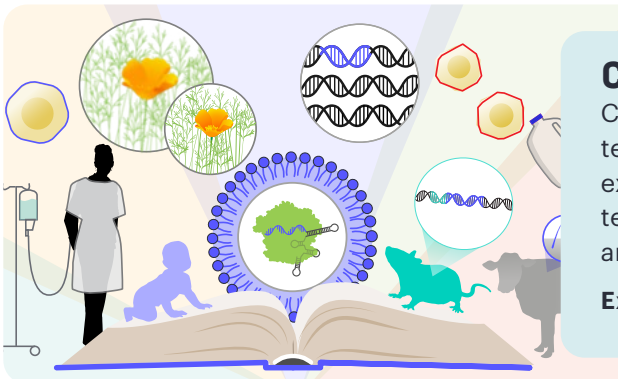
Connecting with Students

In 2024, the IGI had booths at two of the largest STEM diversity conferences. These conferences offer community, networking, and professional development opportunities for undergraduates from underrepresented groups. Over 200 students signed up for IGI's new opportunities list.

The IGI-Hampton Summer Research Program

For the past two summers, the IGI has hosted undergraduate researchers from Hampton University, a historically Black university in Virginia. The IGI is working to find funding to expand our partnership with Hampton and other HBCUs.

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CRISPRpedia

CRISPRpedia is our textbook-style resource on CRISPR technology and applications — now with a new chapter exploring the many ethical questions raised by this powerful technology! CRISPRpedia is fully online and free, in English and high-quality Spanish translation.

[Explore CRISPRpedia](#) →

Climate Week NYC

The IGI team joined the Emerson Collective Climate Science Fair on the High Line in New York City in Fall 2024, where we shared our work on using CRISPR to address climate change and support sustainable agriculture with thousands of curious visitors.



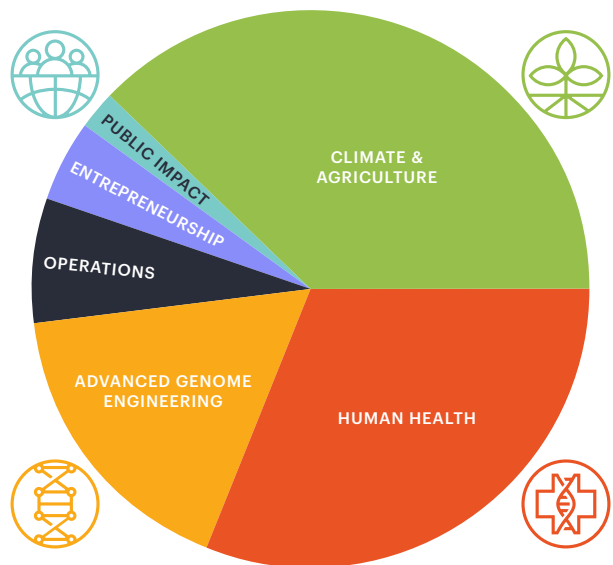
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A Growing Institute

Growth Through Gifts

The IGI's continued growth and broad portfolio of research projects is only possible thanks to the generous support of philanthropic individuals and organizations. This funding supports the IGI's research programs as well as the core institutional operations that support our research and build the partnerships that create real impact in the world.

In 2024, we received important new funding from our partnership with Danaher Corporation for our joint work on rare diseases, an anonymous gift of \$10 million to work in partnership with farmers to field test a new variety of hybrid rice that can be grown from seed, continued support from our TED Audacious Project initiative, and more.



New gifts and grants to the IGI over the past 12 months by area





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the IGI's research
and operations.
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