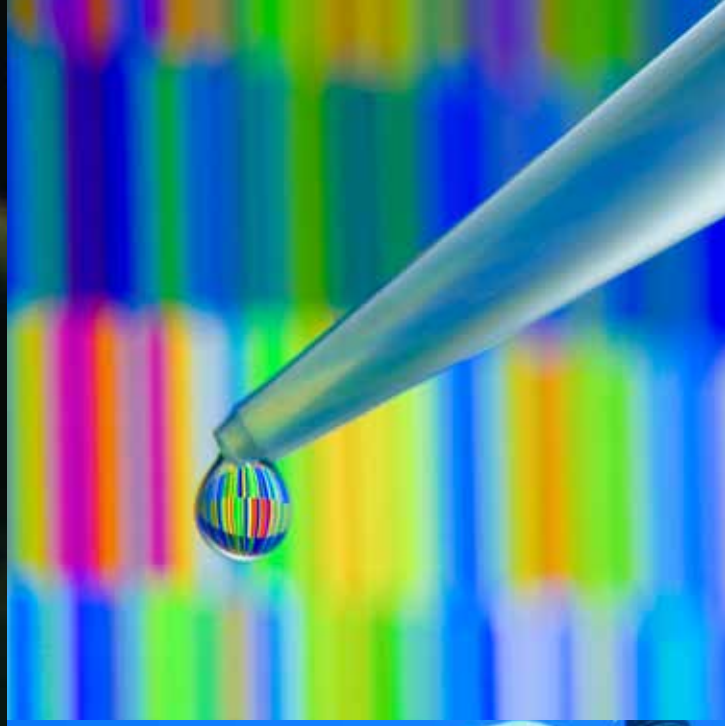


THE GLOBAL GENOME INITIATIVE

Preserving and Understanding the Genomic Diversity of Life on Earth

a component of

The Smithsonian Institute for Biodiversity Genomics

SmithsonianCampaign | National Museum of Natural History

Letter from the Director

There are moments in time when we need to think big and lay the foundation for a new era of scientific research. This is one of them.

Two seemingly unrelated trends have motivated the Smithsonian National Museum of Natural History to launch the Global Genome Initiative. Extinction is threatening more and more species, before we even know they exist. Meanwhile, the cost of sequencing a genome continues to plummet.

The genome is an organism's instruction manual. It consists of all the DNA in a species and determines how it looks and lives. Through genomics we can decode the full spectrum of Earth's biodiversity. This research will enable us to unravel life's mysteries, such as how certain organisms purify our air and water, while others produce toxins. Discoveries like these will drive innovations in medicine, agriculture, and environmental sustainability for decades to come.

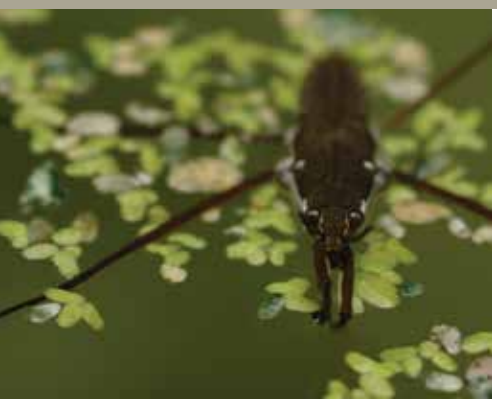
As part of a Smithsonian-wide effort, the Global Genome Initiative will gather, sequence, preserve, and share the molecular makeup of Earth's flora, fauna, and other inhabitants. Our vision is the Human Genome Project for the rest of the planet's species.

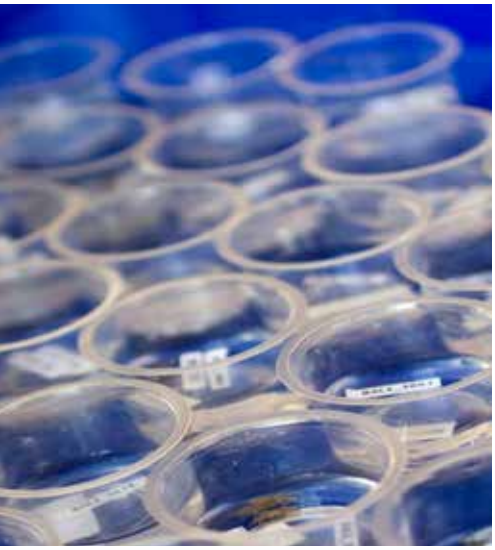
For more than a century, our biologists have studied the myriad species that have inhabited the planet throughout its 4.6-billion-year history. And we preserve 127 million specimens and artifacts for researchers worldwide to analyze. The Global Genome Initiative will catapult non-human genomic research, at the Museum and around the world, to a level needed to meet the challenges of the 21st century.

With support from visionary thinkers like you, this new endeavor will build upon our unrivaled expertise and spawn a new generation of scholarship that transforms our understanding of Earth's biological diversity.

Kirk Johnson

Sant Director, National Museum of Natural History





Pursuing Scientific Breakthroughs

The Global Genome Initiative (GGI)—part of the Smithsonian Institute for Biodiversity Genomics—is a bold, science-based endeavor to capture the planet's genomic diversity, preserve it on ice, and make it accessible to researchers everywhere, in perpetuity.

By gathering and safeguarding specimens from across the Tree of Life, GGI will ensure that researchers can tap into the reservoir of nature's adaptations to solve scientific and societal problems at any point in the future.

Nearly everything we hope to learn about life and how it has evolved can be uncovered through genomics. GGI will make it possible to discover new species and relationships; explore nature's spectacular innovations; improve epidemiology; and illuminate the inner-workings of ecosystems and how they support us.

Because of the Global Genome Initiative, answers to questions that were once beyond our limits are now within reach.

Ambitious. Critical. Possible.

> "The biological world is filled with wondrous technology, and genomics will be key to understanding and using it."
>
> **Dr. Jonathan Coddington**
> **Director of the Global Genome Initiative**

PRESERVING GENOMES

Now is the Time

More than a decade after the sequencing of the human genome, scientists are starting to map and decode the DNA of Earth's other residents.

Genomics will be the biggest transformation in how we study life on Earth since Darwin.

At the Museum, we are expanding our research on the origins and relationships of species and the genetic drivers of adaptation and extinction. This work is already spawning novel ways to protect endangered species, solve forensic cases, and study the impact of climate change.

To make more breakthrough discoveries, researchers need the essential ingredients: genome-quality specimens, high-tech laboratory facilities, DNA sequence data, and, for tomorrow's scientists, training.

Enter: the Global Genome Initiative.

> "We should judge every scrap of biodiversity as priceless while we learn to use it and come to understand what it means to humanity."
>
> **Dr. E.O. Wilson**
> **Professor Emeritus, Harvard University**

Gathering the Evidence

Smithsonian scientists possess an unparalleled wealth of knowledge about Earth's flora and fauna. They are experts on the Tree of Life and know which organisms to collect. Surprisingly, we only need to sample a small fraction of the planet's species in order to vastly improve our knowledge of its genomic diversity.

Collecting will begin in the areas where species are concentrated: biodiversity-rich ecosystems, marine and terrestrial research observatories, botanical gardens, and zoos. Participating countries will select which native specimens to gather and determine where and how best to preserve them.

GGI partners will gather and provide access to samples, while respecting the rights of sovereign nations and adhering to the Nagoya Protocol on Access to Genetic Resources and the Fair and Equitable Sharing of Benefits.

Earth's Bounty, On Ice

Researchers from a variety of disciplines will study the plant and animal samples we gather, today and far into the future. We are preserving them in huge sub-zero freezers—in perpetuity.

The Museum's new biorepository can hold more than 4 million samples. As the tools for decoding genomes improve, researchers can return to these collections to extract new information.

Collaboration is essential, which is why the Global Genome Initiative is organizing an international network of biorepositories. It will be a one-stop index to all scientifically-relevant genomic samples on Earth. The expanding network already has more than 25 partners; they are on every continent except Antarctica.

A NEW ERA OF EXPLORATION

Open Access Drives Discovery

One of the biggest roadblocks to non-human genomics research is finding information. Do samples exist? What do we know about them? And, most importantly, what are we missing?

The Global Genome Initiative is building a portal that aggregates all this information to accelerate discovery. An ecologist studying elephant conservation in Kenya will have access to the same information as a researcher at the Smithsonian's National Zoo. Each can pursue his own questions.

As our collaborators collect samples and sequence and analyze genomes at high-tech facilities, like the Smithsonian's Laboratories of Analytical Biology, all the data will become available through the GGI portal.

Training the Next Generation

The Museum has always prepared emerging scientists to investigate life, in all its fascinating forms. The Global Genome Initiative will continue this tradition. We will attract the brightest minds and increase our ability to train pre- and postdoctoral students.

Equally important, we are introducing preteens and teens to genomics through our exhibitions, school programs, and award-winning internship program, Youth Engagement through Science (YES!). These are transformative experiences that open their minds to the power and possibilities of science careers.

Empowering Scientists at Home and Abroad

GGI at Work: Restoring Polluted Environments

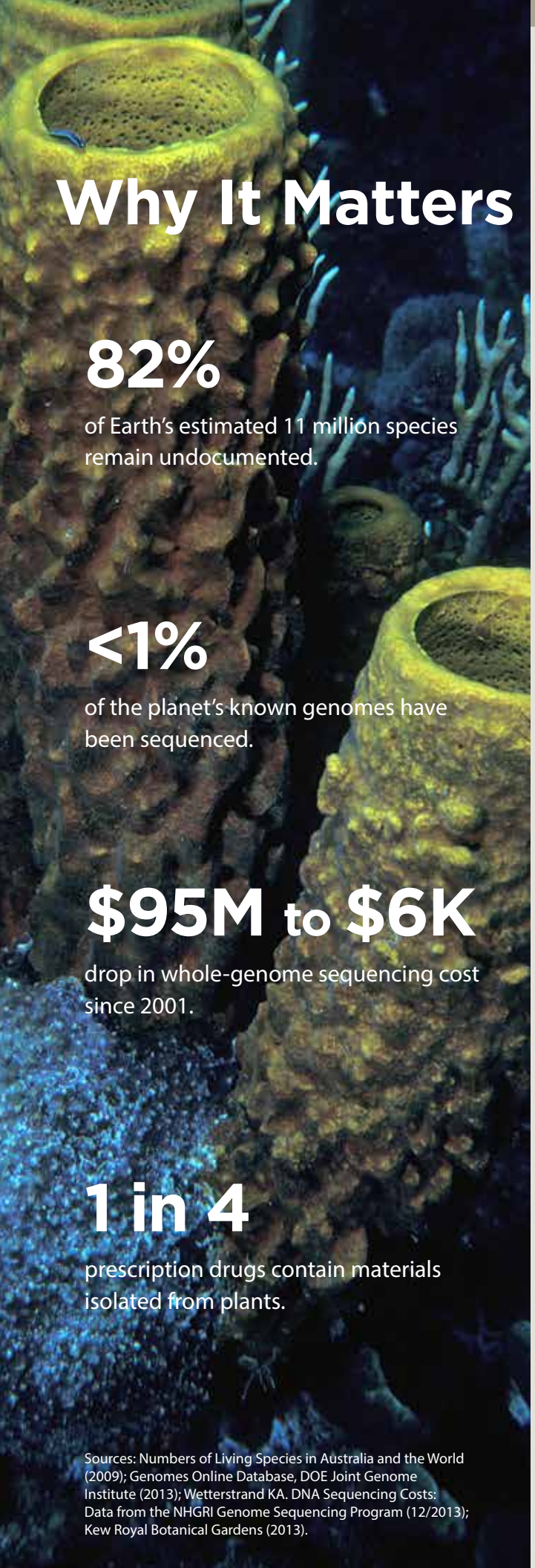
Across Appalachia and in many developing nations, abandoned coal mines drain dangerously-high levels of manganese into the waterways. It turns out that nature may have the best fix for this problem. Smithsonian geomicrobiologist Cara Santelli studies the microbes that remove this pollutant from the water column by helping convert the dissolved manganese into an insoluble mineral form.

Santelli has identified a number of microorganisms—bacteria, fungi, and algae—that kick-start this transformation of manganese. Now she wants to figure out just how they do it. Thanks to GGI, she will. By comparing the genetic profiles of these microbes, she aims to uncover the pathways and mechanisms responsible for converting the dissolved metal compounds to solid minerals and identify which species do it best. Her results promise to inform how we restore contaminated streams and other polluted environments.

Galvanizing Partners Worldwide

The Global Genome Initiative is bigger than one institution. Working in tandem with the larger Smithsonian Institution, the Museum is using its trusted brand and convening power to partner with universities, research centers, government agencies, industry, and museums from around the globe. Together, and with your support, we will succeed.

Photo Credits: Maggy Benson, Barry Brown, Chip Clark, Brian Gratwicke, Marcos Guerra, Donald E. Hurlbert, Meghan F. Murphy, Klaus Ruetzler, František Šaržík, Smithsonian Institution



Why It Matters

82%

of Earth's estimated 11 million species remain undocumented.

<1%

of the planet's known genomes have been sequenced.

$95M to $6K

drop in whole-genome sequencing cost since 2001.

1 in 4

prescription drugs contain materials isolated from plants.

Sources: Numbers of Living Species in Australia and the World (2009); Genomes Online Database, DOE Joint Genome Institute (2013); Wetterstrand KA. DNA Sequencing Costs: Data from the NHGRI Genome Sequencing Program (12/2013); Kew Royal Botanical Gardens (2013).

Help Accelerate the Genomics Research Revolution

The Global Genome Initiative seeks partners to advance its comprehensive collections, research, and training agenda. To fully fund the program, the National Museum of Natural History aims to raise $15 million. Wherever your passions lay, there is a place for you.

Research and Discovery

From field expeditions to scientific publications and ongoing professional development, your gift will foster breakthroughs in this fast-paced field.

Genomic Collections

Fund the acquisition, conservation, and sharing of genome-quality research specimens.

Fellowships and Training

Support the brightest minds—both emerging and established leaders—working in biodiversity genomics.

Programs and Outreach

Strengthen genomics literacy among students, families, teachers, and the public by funding learning opportunities that leverage the National Museum of Natural History's vast reach in the Museum, online, and in communities worldwide.

With your support, we will lay the foundation for non-human genomics research for generations to come. Please contact a member of the National Museum of Natural History's advancement team to learn more, (202) 633-0821 or nhadvancement@si.edu.

Visit GGI online at http://www.mnh.si.edu/ggi.