

THE HENRY FORD MAGAZINE - JUNE-DECEMBER 2020 | Q&A WITH MARC GREUTHER | BIOMIMICRY | SUSTAINABLE BUSINESS MODELS | INSIDE THE HENRY FORD

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MAGAZINE
JUNE-DECEMBER 2020

**THE
SUSTAINABLE
DESIGN
ISSUE**

WHAT HAPPENS WHEN WE LOOK TO NATURE FOR INSPIRATION?

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COVID-19 PANDEMIC WITH
#WEAREINNOVATIONNATION

LENS OF OPTIMISM:
CURATING THROUGH
DESIGNERS' EYES

THE SUSTAINABLE DESIGN ISSUE



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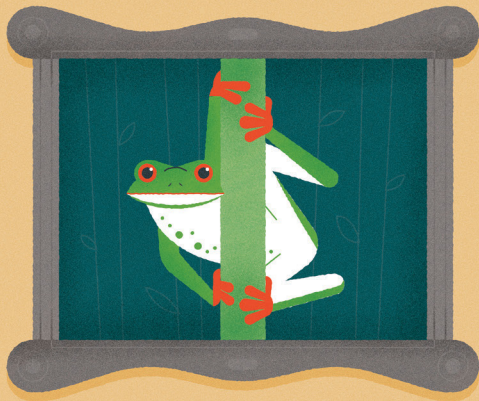
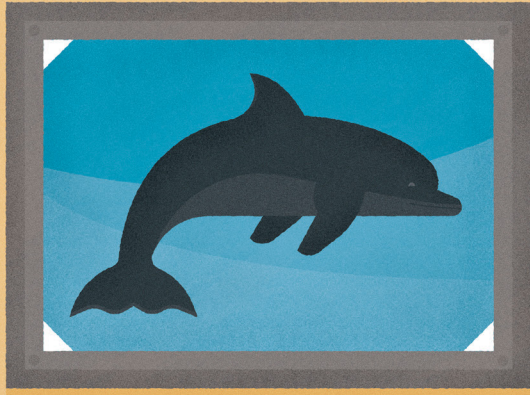
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DIGITAL EDITION
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MAKING MOTHER NATURE OUR MUSE

Biomimicry gives context to why we need to pay closer attention to nature's problem-solving skills

By **Christa Avampato**
Illustrations by **James Round**

In the face of a challenge, a walk is one of the best ways to jump-start imagination and pave a creative path forward. Take that walk in nature, or better yet spend a few days in nature without technology, and research shows our problem-solving abilities soar by as much as 50%.

Inventors and problem solvers need a constant supply of potent inspiration. Books and journal articles, as well as brainstorming with mentors, colleagues and friends, help. However, in many instances our greatest teacher lives right outside our doors. There, we can find knowledge, wisdom, experience and a solid track record of success. Nature has the answers we need to solve every problem — if only we know where to look and how to ask the right questions.

WHAT IS BIOMIMICRY?

Biomimicry is innovation inspired by nature. Whether we're working on a challenge related to product development, process generation, policy creation or organizational design, one of the smartest questions we can ask is: "What would nature do?" Asking this question, and then studying nature to find the answers, is a way to discover new sustainable solutions that solve our design challenges without negatively impacting the planet.

Undoubtedly, biomimicry is best learned by doing. It's a field that requires us to open our eyes, ears and hearts as we roll up our sleeves to dig deep (sometimes literally into the dirt) to understand, interpret and then utilize nature's design principles to solve the challenges we face in our lives.

"Biomimicry applies strategies from the natural world to solve human design challenges," said Alexandra Ralevski, Ph.D., director of AskNature at the Biomimicry Institute based in Missoula, Montana. "This is a field that has the power to radically transform any industry."

AT WORK IN THE WORLD

One of the best ways to illustrate biomimicry's power is to look to some of its most well-known examples.

A trio composed of a marine biologist, mechanical engineer and entrepreneur created the most efficient fans and turbines in the world through inspiration found in humpback whales. On the surface, this may seem like an odd connection. How could humpback whales possibly teach a highly skilled group to build a turbine? It turns out that these whales were experts at the exact function these humans wanted to achieve.

Humpback whales are among the world's most agile animals. Though they can reach 16 meters (52 feet) in length and 40 tons in weight, they can lift a large portion of their bodies up out of the ocean and into the air in an acrobatic feat that leaves whale watchers breathless. A single jump or leap (called a breach) requires humpback whales to expend only 0.075% of their daily energy intake. Not only is the breach a stunning display of athleticism, it's also a remarkably efficient action.

Marine biologist Frank Fish suspected the bumps (called tubercles) on the leading edges of the whale's flippers held the secret to bending the ocean waters to their will. Working with Fish to study this mystery was engineer Phillip Watts: "I had been working in biomechanics and understood the importance of biomimicry, drawing engineering ideas from evolution," shared Watts.

The bumps on a humpback whale's flipper are nature's answer to what makes a wind turbine extra efficient.



Together, Fish and Watts found that humpback whales achieved a rare point of design greatness: The tubercles on their flippers could increase lift while simultaneously reducing drag. A genius combination that gave these magnificent creatures such remarkable agility.

Along with a third collaborator, entrepreneur Stephen Dewar, Fish and Watts decided to model their turbine design on the humpback's flippers. Not surprisingly, their newly fabricated turbines not only produced supreme performance like the whales but were highly efficient. Soon after, the trio's newly formed corporation, WhalePower, became a leading manufacturer of energy-efficient rotating devices for various applications.

"Because nature had done so much work on this [for us]," said Dewar, "we were able to understand what was possible."



“LEARNING ABOUT THE NATURAL WORLD IS ONE THING. LEARNING FROM THE NATURAL WORLD — THAT’S THE SWITCH. THAT’S THE PROFOUND SWITCH.”

— JANINE BENYUS, CO-FOUNDER, BIOMIMICRY INSTITUTE, 2005 TED TALK

FOR THE BIRDS

Transportation aficionados know that Japan's Shinkansen, known as the bullet train, is one of the world's finest examples of efficient and elegant design. What many people don't know is that the Shinkansen has a bird to thank for its performance. Known for its silent diving abilities, the kingfisher can break the water while barely making a sound or a splash to claim its favorite meal — minnows and stickleback fish.

Shinkansen engineers faced a serious structural challenge while designing the bullet train: It created a sonic boom as it emerged from tunnels at high speeds. One of the team's engineers, who had observed the kingfisher's precise diving technique, suggested they mimic the bird's beak shape in the train's design. Voila! The sonic boom disappeared.

The bullet train's unique design also had other unforeseen benefits. Its new nose safely increased travel speeds, lowered fuel consumption and reduced operating costs.

The sleek shape of a certain bird's beak is nature's answer to conquering a bullet train's unwelcome sonic boom.

ONLINE To learn more about biomimicry, visit the Biomimicry Institute's website to view the 20-minute film, *The Promise of Biomimicry* biomimicry.org ►

PUSH THE BOUNDARIES

Building on the success of innovations like the bullet train and WhalePower, biomimicry is finding its way into nearly every industry today.

To promote local agriculture, NexLoop focuses on creating renewable water infrastructure for sustainable food systems. Its main product, AquaWeb, captures, stores and distributes just the right amount of water at just the right time for local food production.

How does it strike this balance? AquaWeb takes its cues from the efficiency of nature, incorporating learnings from multiple organisms: beehives to create structural strength, spider webs to capture water, ice plants to store water and mycelium to distribute water.

Biomimicry also guided the strategy of Nucleário, winner of the Ray C. Anderson Foundation Ray of Hope Prize. Company founders wanted to repopulate the forests of their home country, Brazil, where young tree seedlings face overwhelmingly adverse survival odds. Their roots are choked by grasses while their leaves are devoured by leaf-cutter ants. Of the small handful that reach their first birthday, 95% don't live to see their second. It's these long-shot odds that Nucleário sought to combat.

Like NexLoop, Nucleário combined the designs of several natural models to create its tree seedling pods, from the protective abilities of leaf litter and water accumulation talents of bromeliads (think of a pineapple) to the graceful air dispersal skills of anemocoric seeds.

"Our connection to nature and deep-rooted gratitude for all life inspires and sustains us," said Bruno Rutman Pagnoncelli, CEO and founder, Nucleário. "We look to nature to guide our decisions, from design to raw material selection and everything in between."

Combining the natural models that inspired them, Nucleário's founders have built a planting system that provides protection as well as nutrient and moisture maintenance with less human intervention and tending. Their design is both lightweight and strong, with water chambers that collect and distribute water the same way nature does.



NEW FRONTIERS

"Using nature as a model for sustainability means that we always have a benchmark for our designs," said AskNature's Ralevski. "This benchmarking is critical to determine success and improve our iterations."

A hallmark of nature, and by extension biomimicry, is that there is a progression of continuous improvement over time within the context of a specific situation that could include the geography, environmental circumstances and economic situation in which a design solution must exist and operate.

Biomimicry successes in energy management, transportation and architectural design are spurring design experiments in fields as varied as medicine, materials science, textiles and urban planning. We're also beginning to see social science applications of biomimicry in community organizations, economic development and communication systems.

"Biomimicry's greatest legacy will be more than a stronger fiber or a new drug," said Janine Benyus, co-founder of the Biomimicry Institute. "It will be gratitude and an ardent desire to protect the genius that surrounds us."

A beehive's structure, a spider web's power of attraction and an ice plant's water storage system are nature's answers to creating more sustainable food systems.

WATCH Janine Benyus' TED talks on biomimicry on [youtube.com](https://www.youtube.com) ►



HOOKED BY NATURE

In 1941, Swiss engineer George de Mestral was hunting and noticed his pants were covered with burdock burrs. He wondered how the seedpods could hold on and took to his microscope, examining the burr's "hooks" and how they clung to fabric. After years of research, de Mestral was granted a U.S. patent in 1955 for what became Velcro, his famous hook-and-loop fastener.



DID YOU KNOW? /

The Biomimicry Institute is not the only organization versed in this field of study. Entrepreneur Tom Tyrrell started Great Lakes Biomimicry in Cleveland, Ohio, in 2010 and has created a biomimicry-based economic hot spot, working with educational institutions, such as the University of Akron's Biomimicry Research and Innovation Center.

BEING A BRIDGE

With varied fields of expertise, including scientific knowledge, business planning, design thinking and operations, to name just a few, practitioners of biomimicry serve as the bridge between professional groups, such as scientists, business managers, policymakers, engineers and designers, who are often siloed from one another.

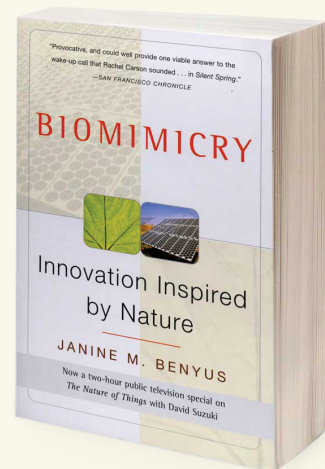
If all the world is an orchestra of voices, those who study biomimicry are the conductors making room for each of them, ensuring that they rise, shine and harmonize together for the benefit of all.

It's impossible to utter a single word about the theory and practice of biomimicry without paying homage to Janine Benyus. A biologist, author, innovation consultant and self-proclaimed "nature nerd," Benyus' groundbreaking book, *Biomimicry: Innovation Inspired by Nature*, has made its way onto bookshelves and into the hearts, hands and minds of problem solvers.

"We're awake now," she said. "And the question is, how do we stay awake to the living world? How do we make the act of asking nature's advice a normal part of everyday inventing?"

To explore this question and bring passionate and multitalented collaborators into community with one another, Benyus co-founded the nonprofit that would become the Biomimicry Institute in Missoula, Montana.

Over a decade later, the organization continues to provide education, support and innovation inspiration for anyone and everyone who wants to bring the study and application of nature's design genius into their work and into their lives.



READ *Biomimicry: Innovation Inspired by Nature* by Janine Benyus ▶

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THE HENRY FORD: A NATIONAL TREASURE AND CULTURAL RESOURCE

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A force for sparking curiosity and inspiring tomorrow's innovators, inventors and entrepreneurs, The Henry Ford fosters learning from hands-on encounters with authentic artifacts. Through its 26 million artifacts, unique venues and resources — Henry Ford Museum of American Innovation®, Greenfield Village®, Ford Rouge Factory Tour, Benson Ford Research Center® and Henry Ford Academy®, as well as online at thf.org and through the TV programs *The Henry Ford's Innovation Nation* and *Did I Mention Invention?* — The Henry Ford helps all individuals to unlock their potential and help shape a better future.

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For more information, visit thf.org.

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now in securing
our future.

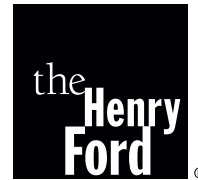
The Henry Ford is facing unprecedented financial challenges because of the COVID-19 impact, which caused a 14-week closure and reduced operations that is expected to last for several months to years. Without donations from people like you, we will struggle to provide the imaginative and inventive programming and experiences for which we are known and loved.

Love The Henry Ford? Please support all that we treasure. Give today thf.org/donate.

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The Henry Ford provides unique educational experiences based on authentic objects, stories and lives from America's traditions of ingenuity, resourcefulness and innovation. Our purpose is to inspire people to learn from these traditions to help shape a better future.



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